ELECT

RONIC
esign

All the advantages of electronic measurement of a-c voltages are afforded by the Type A Vacuum Tube Voltmeter, shown here, yet it only occupies 3½" of panel space. Two subminiature tubes in a feedback loop supply a meter bridge circuit of four germanium diodes. Size is 2.80" diam x 4.56", and weight of the unit is only 1 lb.

April 1954

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CIRCLE ED-2 ON READER-SERVICE CARD FOR MORE INFORMATION

Editorial...

Diminishing Returns?

Final statistics on the 1954 IRE Convention and Radio Engineering Show indicate that there were 51 sessions at which 243 papers were presented; 604 exhibits were displayed at the Kingsbridge Armory, and 40,108 people attended the show. At first glance these figures indicate that the entire affair was a huge success . . . but there are a few doubts in our mind.

First of all, is it good to have a technical meeting with as many as 51 sessions and 243 papers? Technical gatherings are supposed to offer engineers an opportunity for a maximum exchange of information. Running seven sessions concurrently, and at three different places made it impossible to attend many sessions because they conflicted with others on related topics. We question the wisdom of having so many sessions and papers.

Secondly, is it effective to have as many as 604 exhibits? Is mere size the criterion for measuring the effectiveness of a show? Shouldn't we be more concerned with what was exhibited, how well were the exhibits presented, and how much information did engineers gain from seeing the exhibits? Assuming that the exhibits were timely and well-planned, it was still a superhuman task to make the trek from the first to the last booth to see what was on display. The sheer press of people made the job physically and mentally exhausting. It is doubtful that after visiting many booths, the average visitor was in condition to absorb much technical or sales information. We question the wisdom of having so many exhibits.

With the Convention and Show growing larger each year, we feel that now is the time for a critical examination of these activities to see whether they are taking the wisest direction, and whether we are reaching the point of diminishing returns.

Engineering Review . . .

Commercial Weather Mapping Radar . . . A C-band airborne weather detection radar designed specifically to meet commercial airline reliability standards is currently planned by the Engineering Products Department of the Radio Corporation of America, Camden, N. J.

Selection of C-band for the equipment was based on results of studies at McGill University and comprehensive experiments and flight tests conducted jointly by United Air Lines and RCA. Results of the tests indicated that C-band radar will penetrate a minimum of 15 miles in 60mph rainfall, using a transmitter power of 75kw. According to the report, this performance cannot be duplicated practically by equipment operating on a higher frequency, and radar operating at frequencies higher than C-band may blank out or present misleading information in areas of moderately heavy rainfall.

Since storm formations cannot always be avoided, the penetration capabilities of C-band radar which enable a pilot to follow paths where there is the least turbulence represent an important factor for further improvement in airline standards. Indications are that the C-band radar, now considered best for airborne weather mapping, can be produced with weight, size, and cost factors comparable with those of other airborne radars.

TV Used to Study Living Cells . . . Living tissues in an animal's body can be studied by a new electronic technique capable of measuring the microscopic constituents of living cells. The method employs a standard TV camera, a microscope, an oscilloscope, a TV receiver or monitor, and auxiliary electronic circuits to study the comparative absorption of substances such as dyes by normal and abnormal cells.

The technique was developed by Dr. C. N. Loeser, assistant professor of anatomy at the Western Reserve University School of Medicine and Mr. Carl Berkley of Allen B. Du Mont Laboratories, Inc., Clifton, N. J.

Tissues to be studied are specially illuminated in the living animal, or, as done by other investigators, are prepared on slides, magnified by the microscope, picked up by the TV camera, and transferred to the oscilloscope. Light from the cells appears on the picture tube as a luminous graph. By noting differences in light pattern, researchers hope to be able to spot abnormal conditions in their early stages. This method might be used to study chemical changes instantaneously as they go on in the living cell.

The electronic techniques used have the following advantages: quantitative rather than qualitative results, increased testing speed, and the ability to test living cells even though they may be moving. Either light emitted or absorbed by the cells may be measured. The method has no potential as a cure.

High-temperature and Stable Transistors . . . Germanium silicon alloy transistors that operate at temperatures up to 350° F have been developed. "Stabilized" germanium and various mixtures of germanium and silicon are being tested by Sylvania Electric Products, Inc., at its Bayside, N. Y., laboratories.

The stabilized germanium was produced by special heat treatment of the germanium in molten potassium cyanamide. It is immune to the effects of moisture, and transistor action does not deteriorate with age.

Manufacture in production quantities of transistors employing the new materials is scheduled to begin later this year.

Automatic Navigation . . . Without any radio or radar contact with the ground, a newly developed four-unit navigational system gives the pilot his position in directly read latitude and longitude. Air speed and magnetic heading, corrected for winds and magnetic variation, are fed into an electromechanical analog computer that computes latitude and longitude read on a servo-operated indicator in the cockpit.

The system also includes two other units: a panel-mounted computer control for initially setting the variation, wind direction and wind force corrections into the computer; and an amplifier which amplifies all the inputs and outputs of the computer.

The pilot initially sets the position of the airport on the indicator. He sets the computer control according to meteorological data and local magnetic variation. The system functions between $\pm 70°$ of latitude for speeds from 70 to 800 knots with an accuracy of 1-1/2% of distance covered.

Developed for the Air Force by the Ford Instrument Company, Division of the Sperry Corporation, Long Island City, N. Y., the system is essentially a miniaturization of this company's shipboard range computers. The system, which is officially designated the Computer Set, Latitude and Longitude, AN/ASN-6, weighs 45 lb compared to the 2540-lb Navy computer.

The 27-tube amplifier is made up of a power supply, five servo amplifiers, and a time standard amplifier. Each unit is mounted on a separate plug-in subassembly chassis for quick servicing. The subassemblies are simultaneously connected both physically and electrically.

All four units in the system are hermetically sealed in an inert gas atmosphere. A new process was developed to seal the alumnium enclosures of the computer, indicator and control, which require no servicing and rare replacement. In this process nickel is plated on aluminium to make a surface which can be sealed hermetically tight to 60,000ft. The amplifier enclosure is sealed with gaskets.

The designers are studying methods of operating the system in the polar regions. After military requirements are met, the system may be marketed commercially. It would be valuable for the airlines in regions without radio beacons, such as the oceans.

Low Temperature Liquid Level Gage . . . The difference in dielectric constants of gases in the liquid and vapor states, respectively, is the principle used in a new electronic device for measuring and controlling the level of certain low temperature liquids. The instrument is designed to be used interchangeably with hydrogen, nitrogen, oxygen, or helium in their low-temperature liquid states merely by changing the sensitivity and range, controls on the associated electronic circuitry.

The sensing element is a vertical cylindrical capacitor, whose capacitance is a function of the height of liquid refrigerant column which is the dielectric. The cylinder is made of monel.

The sensing capacitor forms one element of an a-c bridge whose output indicates and records the capacitance and thus the liquid level. The bridge output also controls a pneumatic valve which admits more liquid to the system when the level falls below a predetermined point. A capacitance change of $10\mu\mu f$ corresponds to full-scale deflection on a scale length of 25″. The instrument has the advantage of no moving parts, but has the disadvantage of requiring electronic circuitry of fairly high sensitivity. The instrument is accurate and linear within 1%.

Developed by W. E. Williams and E. Maxwell of the National Bureau of Standards, Washington 25, D. C. and the Brown Instrument Division of the Minneapolis-Honeywell Regulator Company, the instrument is used in the hydrogen and nitrogen liquefaction installations at the NBS-Atomic Energy Commission Cryogenic Engineering Laboratory at Boulder, Col. Materials used in the device retain their structural characteristics at very low temperatures.

Engineering Review . . .

Transistors in Rural Phone System . . . Transistors may help solve the problem of economically placing many telephone conversations on one rural telephone line for distances as short as five miles. Other systems not using transistors have been able to do this economically only over much longer distances.

An experimental model of the new system, developed by Bell Telephone Laboratories, New York, N. Y., is now being installed in a typical farming community in Georgia. In this system, the transistors will require so little power that the batteries supplying it will be hung on the telephone poles with the transistors. Transistorized amplifiers will amplify the broadband carrier signals, and also, in some cases, the demodulated signals.

Electronic Salesman . . . A new application of electronics to sales demonstrations is offered by the Message Repeater, a machine that talks at the sight of a human being. Photocell-actuated, the compact unit can also direct truck traffic or give safety warnings recorded previously on magnetic tape.

Old messages can be easily erased and replaced by talking a new message into the machine. Messages can be broken down into any number of intervals making up two minutes. Only 6-1/2″ x 5-3/4″ x 5-1/2″ in size, it weighs less than 6 lb.

The Message Repeater can also be actuated by manual or automatic switches, time clocks, etc., in addition to photocells. It can also feed additional loud speakers to augment its built-in speaker. It is manufactured by Michigan Electronics, Inc., Chicago 22, Ill.

Irradiated Insulation . . . Bombardment of polyethylene with high-energy cathode rays from million-volt electron guns has produced an insulation known as "Irrathene" with great heat and chemical resistance over normal polyethylene. The irradiation produces "cross-linking."

Produced experimentally by General Electric's Chemical Division at Pittsfield, Mass., Irrathene retains its form at 300-350°F. It shows resistance to cracking when stressed and in contact with solvents and other chemicals. In the tape and film forms it should aid in the development of small electrical equipment, and in the manufacture of new sterilizable transparent containers for foods and drugs.

While present emphasis is on the film form, fabricated forms of irradiated polyethylene, such as bottles and tubing are being developed.

DIGEST

TIMELY HIGHLIGHTS ON G-E COMPONENTS

Withstands vibration

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

Controls 20 circuits

Compact, lightweight and easy to mount, these G-E cam-operated selector switches help solve many intricate circuit-combination or sequencing problems . . . control from one to 20 circuits, in any operating sequence within the limits of 12 positions . . . operate at altitudes up to 50,000 feet, and in temperatures from 200 F to −70 F. Check Bulletin GEA-4493.

Quickly locates shorts

Minimize the hazards of short circuits quickly, easily with General Electric low-voltage coil testers. These portable units are designed to test coils before assembly in relays, radios, small transformers and instruments. They maintain accurate on-the-spot service for long use. Can also be used to detect open circuits. See Bulletin GEC-964.

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

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

Ultrasonics in Sandpaper Manufacture . . . Ultrasonics and electronics are now used to control one phase in the manufacture of sandpaper. Ultrasonic waves measure the sound-wave energy required to mix a batch of sandpaper adhesive. This energy is proportional to the viscosity of the mix. A computer, fed by the ultrasonic signal, calculates the viscosity information and relays it to an electronic recording-controlling instrument, which is made by Minneapolis-Honeywell Regulator Company, Minneapolis, Minn. This instrument automatically maintains the proper viscosity of the mix. The process is used by the Carborundum Company.

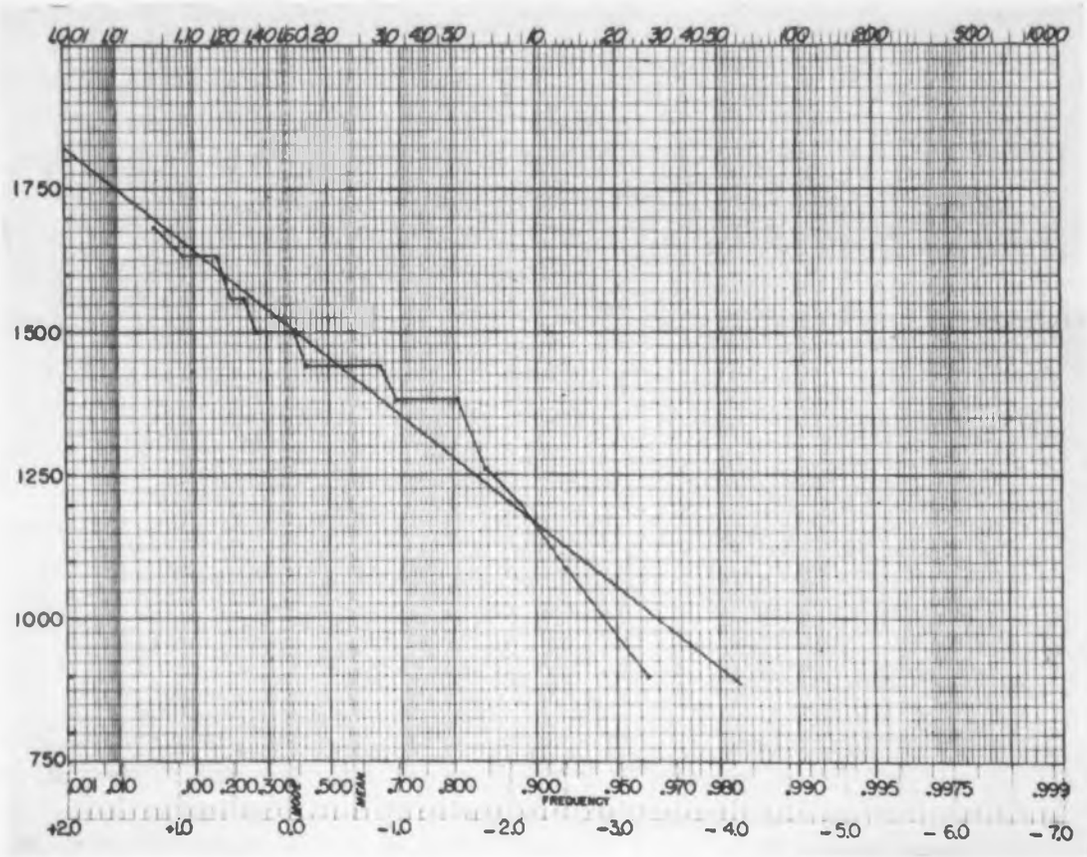
Corrosion-resistant Synthetic Rubber . . . Resistant to strong acids such as fuming nitric and sulfuric acids, a newly developed synthetic rubber is also unaffected by hydrocarbon fuels and lubricants, oxygen, ozone, and sunlight. It also has good electrical insulation qualities.

Known as "KEL-F" fluorocarbon elastomer, it was developed by the Office of the Quartermaster General, Department of the Army, and the M. W. Kellogg Company, subsidiary of Pullman, Incorporated. This synthetic is noninflammable, tough, abrasion and heat resistant, and can be processed and vulcanized on conventional rubber equipment. The KEL-F elastomer is serviceable over the temperature range from −15°F to 400°F. The synthetic may also be used for coating or treating paper, fabric, wood or metal in the conventional manner, either from a water emulsion or solvent system.

A pilot plant is expected to be in production late this year. All available material for some time will be used by the military, but samples will be made available for tests by industry.

WCEMA Scholarship Fund Drive . . . Members of the West Coast Electronic Manufacturers' Association have begun their 1954 Scholarship Fund Drive, which should help solve the problem of attracting more qualified men into the electronics field. Initiated in 1952, the Fund last year distributed $6400 to prospective electronic engineers studying at nine West Coast schools as a result of contributions from 56 electronic firms.

Any firm affiliated with the electronics industry may contribute. Names of all contributors will be publicized at a later date, as well as names of the winning students. To make a donation to the fund, or to obtain copies of an information brochure, write to Mr. Paul Tartak, Tartak Electronics, 2979 North Ontario Street, Burbank, Calif. Checks should be made payable to "WCEMA Scholarship Fund."



Breakdown Voltage of Capacitors

These smallest-value data are plotted on extreme-value probability paper and tend to approximate a downward-sloping line. The proximity of the plotted points to a straight line representing the theoretical curve is an indication of how well the data fits the theory.

Engineering Review . . .

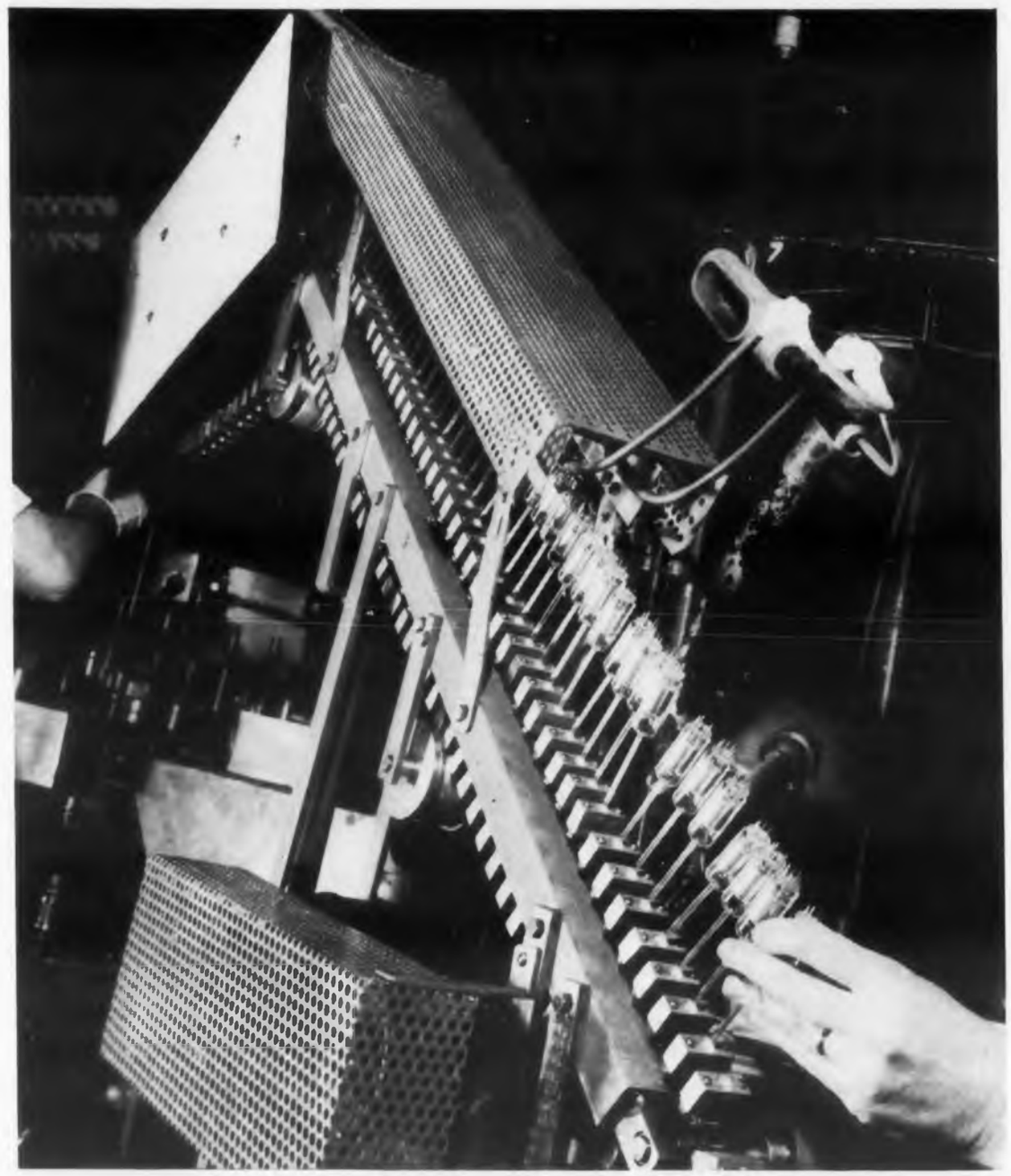
Extreme-Value Techniques For Engineering Problems . . . New statistical methods for evaluating research and development programs at the National Bureau of Standards, Washington 25, D. C., are becoming as much a part of experimental procedure as other forms of applied mathematics. One program, originally sponsored by the National Advisory Committee on Aeronautics, is concerned with the effects of maximum gust velocities on aircraft structures. NBS has been concerned with the mathematical treatment of extreme values and the utilization of these and other data as a means of predicting future performance.

Extreme-value theory can be used also to study the smallest extremes, in which case the steps in applying "smallest-value" theory are very similar to those in the largest values. For example, engineers have long been interested in the problems of predicting the tensile strength of a bar of homogeneous material. One approach is to regard the specimen as made up of many small pieces of very short length. The tensile strength of the entire specimen is obviously limited by the strength of the weakest of these small pieces. The tensile strength, at which the entire specimen will fail, therefore, is a smallest value phenomenon.

Another application of this theory is in studying the breakdown voltage of electrical capacitors. The theory behind the statistical analysis is that every capacitor contains flaws that are conducting particles. The capacitor breaks down at the voltage passed by the weakest particle. This point is a smallest-value phenomenon. A plot of the experimental data from a group of 25 paper capacitors indicates that there are 96 chances out of 100 that the capacitors will fail if voltages up to 1700 are applied. If this maximum voltage is held to 900, the chances of capacitor failure are reduced to 2 in 100.

Electronic Turnpike Tolling . . . Errors in vehicle tolling are avoided in newly developed tolling equipment, which also offers improved auditing and accounting statistics. All terminals and interchanges on the 360-mile Pennsylvania Turnpike will be equipped with the devices in the fall of 1955.

Developed by the International Business Machines Corporation, New York 22, N. Y., the new system is a combination of photocells, specially-designed weighing platforms and toll recorders that both count the number of axles on each car or truck entering the turnpike and weigh these vehicles even while they are being driven up to the toll booth. Even when following bumper to bumper, vehicles may be processed without delay. The system does not require any change in the procedures now followed by drivers using the turnpike.



Preheater Raises Tube Output

This pre-heater was designed to increase receiving tube production. An operator, lower right, places the unsealed tubes on the conveyor belt, which moves each tube through the pre-heater, where its envelope is tempered, to the sealing machine operator. Developed by Sylvania Electric Products, Inc., at their Emporium, Pa., plant, it replaces a slower, circular pre-heater.

Meetings

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

April 21-23: *AIEE Conference on Feedback Control.* Claridge Hotel, Atlantic City, N. J. General Chaiman, A. G. Kegel, Westinghouse Electric Corp., Friendship International Airport, Baltimore, Md.

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

April 28-30: *First West Coast Meeting, Radio Technical Commission for Marine Services.* St. Francis Hotel, San Francisco, Calif. For information contact Robert E. Mayer, 16 California Street, San Francisco 11, Calif.

May 4-6: *1954 Electronic Components Conference.* Department of Interior Auditorium, Washington, D. C. Advance registrations may be made through A. E. Zdobysz, Treasurer, 1954 Electronics Components Symposium, 1 Thomas Circle, Washington, D. C.

May 17-20: *Basic Materials Conference and Exposition:* International Amphitheatre, Chicago, Ill. For information contact Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

May 24-26: *Conference on Telemetering.* Under the joint sponsorship of IRE, AIEE, Institute of Aeronautical Sciences, and the Instrument Society of America. Subject matter will be of wider scope and deeper interest as a result of the considerable amount of telemetering and remote control recently developed. General Chairman, W. J. Mayo-Wells of the Applied Physics Laboratory of Johns Hopkins University. Contact AIEE, 33 West 39 Street, New York 18, N. Y.

June 7-10: *National Plastics Exposition and Technical Conference:* Public Auditorium, Cleveland, Ohio. For information contact E. L. Frantz, Society of the Plastics Industry, Inc., 67 W. 44 Street, New York, N. Y.

June 16-18: *High Vacuum Symposium.* Sponsored by Committee on Vacuum Techniques. Berkeley Carteret Hotel, Asbury Park, N. J. For information write to P. O. Box 1282, Boston, Mass.

June 21-25: *AIEE Summer and Pacific General Meeting.* Los Angeles, Calif. Contact AIEE, 33 West 39 Street, New York 18, N. Y.

June 23-26: *Acoustical Society of America, 25th Anniversary Meeting.* Hotel Statler, New York, N. Y. For information contact W. Waterfall, 57 East 55 Street, New York 22, N. Y.

Engineering Review . . .

Two-color GCA Radarscope . . . By electronically reproducing a map of the terrain on the radarscope in a contrasting color to the "pips" made by approaching planes, the operator of a new Ground Controlled Approach system has an additional means of aiding the pilot in making safer landings. The new gear also features immediate identification of the plane to be controlled. Up to now radar operators seeing the "pips" of a dozen aircraft simultaneously on their screens have had to call for specific maneuvers in order to identify any one of the planes.

Another feature of the radar is a quick-change antenna to permit transmission of a rotating-field radar beam for greater penetration of storms and heavy rainfall.

Developed at the Baltimore plant of the Radio Division of the Bendix Aviation Corporation under contract with the Civil Aeronautics Administration, the radar actually is made up of two systems. One system—airport surveillance radar (ASR-3)—will be used for control of air traffic from 20 up to 50 miles from the airport and the second—precision approach radar (PAR-2)—will come into operation for the final landing approach.

The PAR-2 operator observing a plane approach the airport will know its position in terms of distance, altitude and bearing. He also can note the plane's position with respect to the instrument landing system (ILS) glidepath, which will show on his scope. The ILS glidepath, which operates independently of the radar, is the radio beam used for normal instrument approaches. The PAR-2 system uses the color contrast scope for identifying pips against the map.

The "video map" appearing on the ASR-3 system scope automatically changes in size as the range of the radar "sweep" is altered. The entire system will soon be in use at various airports here and abroad.

Electronic Transmission Line Relay . . . Electronics have again replaced mechanical methods, this time in a new fast transmission line relay. By utilizing only electronic circuits, the designers have eliminated the handicap of mechanical inertia characteristic of presently used electromagnetic relays.

Maximum response time of the unit is one cycle of system frequency (0.0167sec on a 60cy system). Circuit breaker tripping at both ends of the line is initiated within this time after the fault has occurred.

Greater economy in power transmission is the result. Fault-clearing time is reduced, system stability is increased, and greater amounts of power can be transmitted than previously. Because of the type of circuits used, the speed of response to faults is essentially independent of the magnitude or location of the fault as contrasted with the much slower response of electromagnetic relays to low magnitude faults at distant points on the protected line.

Germanium rectifiers and tantalum capacitors are used for compactness. Optimum operation over a broad range of control voltage and ambient temperature is obtained by means of non-linear resistors and thermistors in critical circuits, which would otherwise be adversely affected. Manufactured by the General Electric Company, the equipment was recently installed on a 132kv line of the Appalachian Electric Power Company in Virginia.

Compact British Photo Receiver . . . British designers are matching the efforts of their American counterparts in developing more compact equipment. The new D-700-AM Photographic Receiver with its power supply, does the same job as gear weighing

eight times as much. It weighs 107 lb including supply. The units are shown above.

The unit is used by newspapers, business houses and weather stations to transmit photographs, accounting information or weather maps, respectively, up to 10″ x 10-1/2″ in size in 8-1/2 minutes. A monitor can be connected to the unit to give a simultaneous record on direct recording electrosensitive paper of the picture being received. The paper is used directly for the maps and some business data.

The Receiver is designed for line operation, but an FM/AM conversion unit enables the photo to be transmitted by radio. The manufacturer is Muirhead and Company, Ltd., Beckenham, Kent, England.

Conductive Wax for Batteries . . . An electrieally-conductive wax has been developed to improve intercell connections in dry batteries. Solid at room temperatures, the wax melts into an easily-applied fluid at moderately warm temperatures and cools and sets quickly. Greater production is one result.

The wax could replace solder, carbon-impregnated varnishes, silver paints and similar materials used for intercell connections. It is difficult to solder to certain metals and the fluxes are corroding. The high heat required for soldering is also injurious. Carbon-impregnated materials are poor conductors, while paint-like substances take a long time to dry.

Dr. J. J. Coleman and Sam Kurlandsky, engineers of Burgess Battery Company, were awarded a patent.

Low-level Altimeter . . . Helicopter pilots can measure their altitude accurately as low as two feet with the nonquantized frequency modulation altimeter developed by the National Bureau of Standards, Washington 25, D. C. Present equipment is accurate only to the nearest 10 or 20ft. Operating at 10,000Mc, the new altimeter uses a modified technique for recognizing short-distance information.

Most frequency-modulated altimeters generate high-frequency signals and direct them along a narrow path. When the radiated energy strikes a reflecting surface (like the deck of a ship), it returns to the transmitter-receiver essentially along the same path. Electronic circuits translate into feet the period elapsed between the time the signal left the transmitter and the time it returned to the receiver. Ideally, the transmitter frequency of such an altimeter should be continuously variable. The distance between transmitter and the ground would then be computed from the frequency difference between the received and transmitted signals at the same instant.

Since a continuously varying oscillator of wide range is not practicable, the new altimeter employs a system of displacing a small portion of the transmitted signal in a frequency shifter by a constant amount (about 100cy) and then combining this portion with the received signal. The combined signals are then rectified, amplified, and fed into a counting-averaging mechanism. Since many more impulses are counted by this method in contrast to conventional frequency-modulation altimeters, the average value is changed by small fractional increments instead of integers. Accuracy close to the ground is therefore higher. Three systems using this method were devised.

Coop Graduate Electronic Studies . . . Stanford University, Palo Alto, Cal., and Sylvania Electric Products, Inc. have announced an "Honors Cooperative Program in Electronics" designed to aid outstanding college seniors who are interested in doing graduate work in electrical engineering combined with 35 hours per week of electronics employment, which will be at Sylvania's Mountain View Laboratories, near the university. The program will start September 1 and will have seven men participating initially. Each student selected will receive a full year of graduate work and an M.S. degree in two calendar years. The students will receive a full salary

DESIGN and PRODUCTION NEWS

FOR ELECTRICAL AND ELECTRONIC ENGINEERS

Published by TECHNICAL SERVICE, Chemical Manufacturing Division, The M. W. KELLOGG Company APRIL-MAY 1954

Rectifier Molded in Kel-F® Plastic, Smaller Than a One-inch Cube ... Boasts 100-G Shock Resistance

Unmatched compactness, high electrical efficiency under severe conditions, and exceptional durability are advantages gained by using "Kel-F" trifluorochloroethylene polymer to insulate this double-bridge instrument rectifier. The size of the rectifier belies its 3-ma output from each of two 130-volt rms full-wave bridges. Insulation of the many rectifier wafers and resistors in the unit is enhanced by the exceptionally high electrical resistance of "Kel-F". The high strength and stability of the molded fluorocarbon block also enable it to serve as a mount for parts, since the plastic is unaffected by high thermal and shock loads.

The parts of the rectifier are assembled in a block of injection-molded "Kel-F", which, in turn, is encased in plastic. The unit is made by International Resistance Company, Philadelphia, Pa., to specifications of the Raytheon Manufacturing Company, Waltham, Mass. Rectifier is employed in phase-comparator applications, has many other potential uses.

For further information ask for Application Report E-122

Magnetic Stirring Bars Sealed in Kel-F® to Stop Corrosion and Breakage

A vacuum-tested casing of "Kel-F" permits these metal bars to be used indefinitely to "mix" highly corrosive acids, alkalis, solvents and peroxides—at from minus 200°C to plus 200°C—without corrosion or breakage. The fluorocarbon "skin" cannot crack or chip. Non-porous and non-absorbent, the covering is virtually self-cleaning, can even be sterilized.

Three sizes of stirring bars are now made by the Arthur H. Thomas Company of Philadelphia, Pa., by sealing cylindrical permanent magnets into extruded tubing. Extruded from unplasticized "Kel-F" Grade 300 by the Plax Corporation of Hartford, Conn.

For further information ask for Application Report C-115

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(SEE REVERSE SIDE)

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TRIFLUORO CHLORO ETHYLENE POLYMERS

KEL-F

OILS WAXES GREASES

CONTINUED FROM PRECEDING PAGE

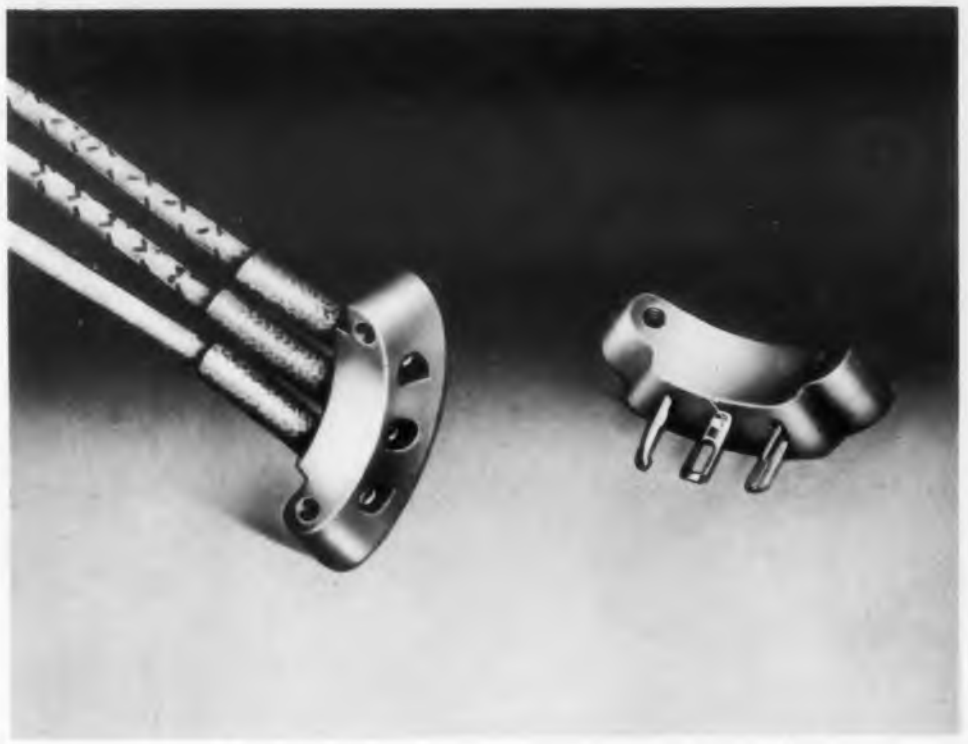
Coil Connector of Kel-F® Boosts Actuator Motor Performance and Output, Simplifies Maintenance

Molding this coil connector for a miniature motor from "Kel-F" made possible the addition of a vital brake clutch, a sharp increase in output and the use of time-saving solderless terminals—without increasing the unit's size.

High insulation resistance of "Kel-F" under thermal cycling, allowed specification of a lighter connector for effective insulation over the temperature range of minus 65°F to 200°F without tracking or shorting. Exposed to high humidity, the plastic's zero water absorption prevents arcing or dissipation. Then non-wetting and smooth surface of the molded connector is fungus-inert.

The connector is injection molded from "Kel-F" unplasticized polymer by the United States Gasket Company of Camden, New Jersey. The Grand Rapids Division of Lear, Incorporated, manufacturers of precision aircraft instruments and electronic systems, uses this connector in a D.C. motor.

For further information ask for Application Report E-123



Molders & Fabricators of the Month

Leading molders, extruders and fabricators specialize in the production of materials and parts made of "Kel-F" . . . each month this column will spotlight several of these companies with their principal services and products.

Brilhart Plastics Corporation
Mineola, N. Y.
Injection, Compression & Transfer Molding
Electrical & Electronic Components
Gaskets, Diaphragms & "O" Rings

Fluoro Plastics, Incorporated
Philadelphia, Pa.
Compression & Transfer Molding
Gaskets & "O" Rings; Valve Seats; Containers
Electrical & Electronic Components

The Garrison Company
Kenilworth, N. J.
Extrusion & Production Machining
Electrical & Electronic Components
Wire Insulation

Penn-Plastics Manufacturing Co.
Glenside, Pa.
Compression & Transfer Molding
Electrical & Electronic Components

Porous Plastic Filter Company
Glen Cove, N. Y.
Porous Filters

Recent Significant Developments in "Kel-F"

Electronic Tube Caps boost performance of high-altitude communications equipment, removing interference from thermal cycling, high humidity.

Asbestos, Glass Fiber, other fillers being successfully incorporated in molded parts in high temperature, corrosive valve service, structural electrical members.

Float Bodies of "Kel-F" and powdered metal incorporated in flowmeter bodies machined of "Kel-F" for smaller, more accurate measuring devices for severe corrosives, liquid or gaseous.

Welding, by "hot gas" method being used in fabrication of corrosion-resistant feed hoppers.

Visit the Kel-F **POLYMER EXHIBIT** *at the Basic Materials Show May 17-20--Chicago, Ill.*

For complete information regarding any item mentioned in DESIGN AND PRODUCTION NEWS, ask for detailed APPLICATION REPORTS, write

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Dunking Radar

Scene from "Ready For Sea", a motion picture depicting the production and testing of this marine radar is available for group showings. Scenes in the 16mm film include testing under extremes of temperature, vibration and salt spray. Bookings can be made through the public relations department, Raytheon Manufacturing Company, Waltham 54, Mass. The motion picture is 13 minutes long.

from Sylvania based on a 40-hour work week and also will be reimbursed for 50% of the tuition fees.

An applicant must be either a senior electrical engineer, physics or mathematics major in the top 10% of his class; an American citizen; able to obtain proper government clearance; desire a career in electronic research or development; and be able to meet the university's admission requirements. More information can be obtained from David W. Currier, Industrial Relations Dept., Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.

◀ CIRCLE ED-300 ON READER-SERVICE CARD

Fig. 2. (right) In this plot of temperature vs. resonant frequency for various d-c control currents in the control winding of the Increductor, a control current of 10ma is shown to have a nearly zero temperature coefficient.

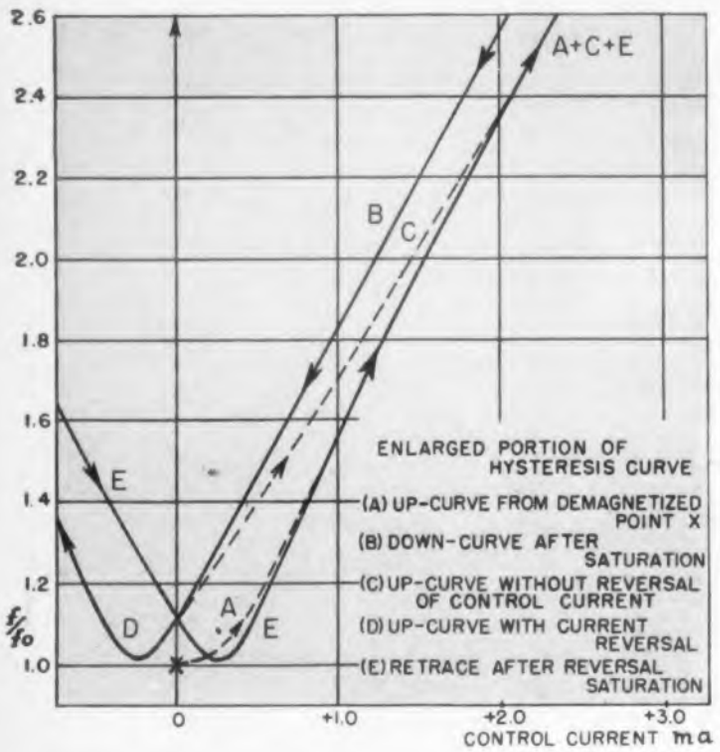
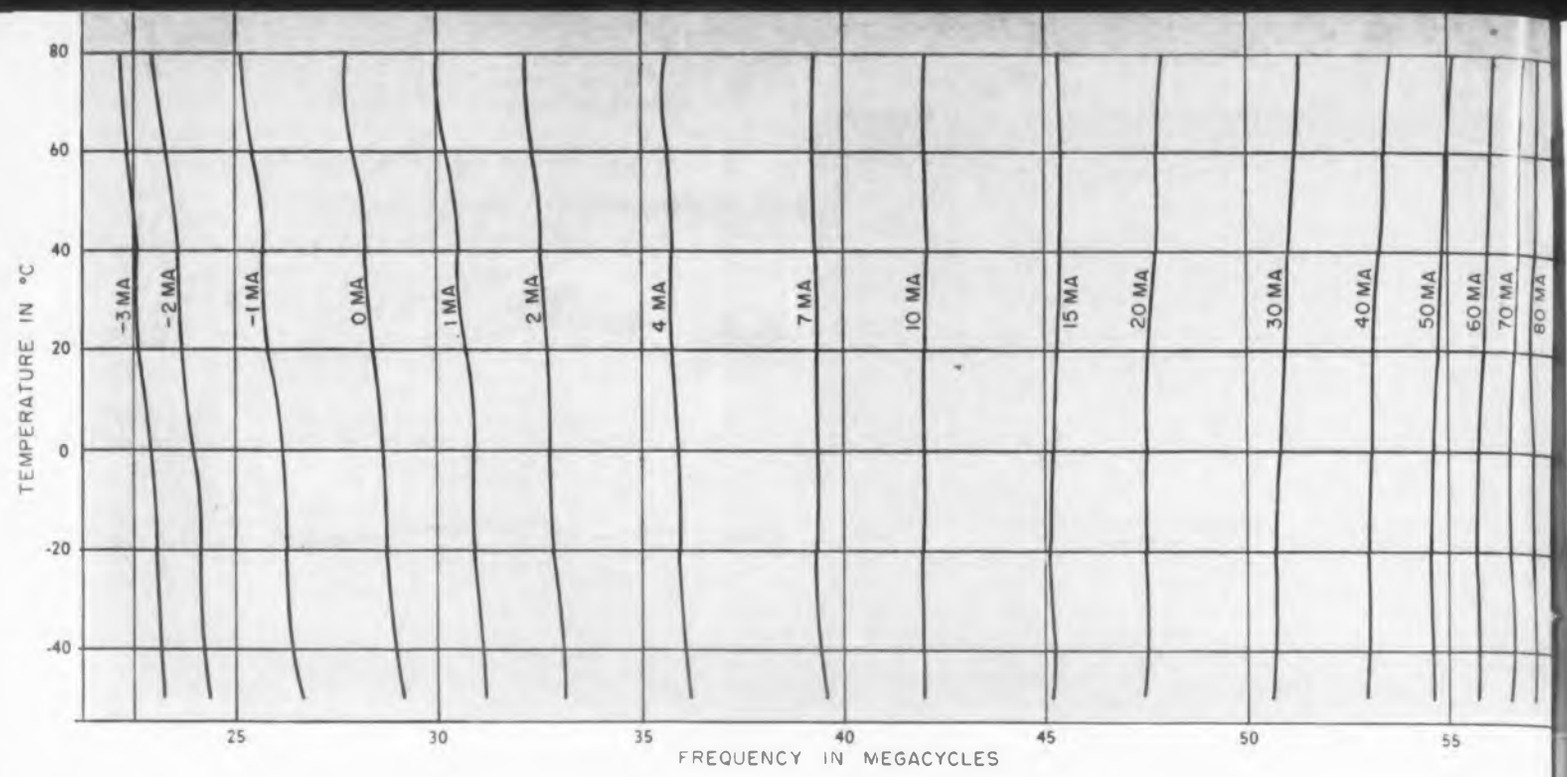


Fig. 1. A curve showing hysteresis effects in the Increductor.



Circuit Design with Controllable Inductors

By Arthur L. Kaufman, Project Engineer

C.G.S. Laboratories, Inc., Stamford, Conn.

THE "Increductor" controllable inductor is based on the phenomenon of decreasing incremental permeability with increasing magnetization of a magnetic core to vary the inductance of its signal winding. This is done by means of a control winding whose current varies the core's magnetic state. The unit is designed so that no inductive or capacitive coupling will exist between the two windings.

In the Increductor a continuous change of permeability over wide ranges is generally the desirable feature. The rate of change of incremental permeability with magnetizing force, or ampere turns, varies with the material used. By choice of proper materials, it has become possible to apply this feature from the sub-audio frequencies to signals in excess of 250Mc.

As in practically all magnetic devices, hysteresis is present. Fig. 1 illustrates its effect in Increductors as a different apparent resonant frequency for the same value of control current depending on the direction in which the point is approached. By the addition of a bias winding, which is similar to the control but usually has fewer turns, it is possible to utilize the frequency range between the residual and coercive flux points without reversing control current. Where hysteresis is undesirable, special circuitry has been developed to markedly reduce its effects, as well as those of inductance shift with temperature.

There is a value of d-c flux at which the temperature coefficient of practically all Increductors is effectively zero from —50°C to 80°C. Fig. 2 illustrates curves showing this behavior where temperature is plotted against resonant frequency for given values of control current. At 10ma the temperature coefficient is nearly zero. In certain narrow-band applications the unit can be designed to operate about this point. In applications where the units are swept, this behavior means that with an increase in ambient operating temperature the unit's inductance will change in such a direction as to increase the frequency range being covered.

Use of Q Map

Of greatest interest to a designer are the Increductor's range and associated values of control current, its values of Q, the region in the frequency spectrum for which the unit is designed and its behavior in a tuned circuit. All this information is concisely described in the "Q map," as shown in Fig. 3. It incorporates a plot of frequency vs inductance on log paper. For every inductance setting of an Increductor there is a certain value of Q at each frequency. If these Q's are measured on a Q-meter, and all points having equal Q's are joined, a family of curves is obtained. Along the inductance axis a nomograph showing values of increasing control current for corresponding values of decreasing signal inductance may be added. Notice that the scale shows a value for demagnetized or f_o state as well as at residual flux.

Due to the effective distributed capacitance of the signal winding, apparent inductance increases with frequency. To avoid this ambiguity, only true inductance is plotted. Distributed capacitance for each unit should be added to the total capacitance for impedance, bandwith and other calculations.

The Q's that are plotted are those as read directly on a Q-meter. Due to the fundamental Q-meter circuit, the Q as read must be multiplied by the ratio

C added to resonate + C distributed)/(C added to resonate) to get the Q corresponding to the definition $Q = f_r/\text{bandwidth}$. This is important where the Increductor is operated with small values of external capacitance and the distributed capacitance becomes significant in comparison.

If lines of constant capacitance operation, as in a parallel tuned circuit, are drawn on this log log graph they have a slope of —1/2. This follows from the expression $f_r = 1/2\pi\sqrt{LC}$. An example is the 200uuf line which shows the related effects of Q and frequency as the inductance changes. This is the line of operation that might be followed by an r-f amplifier or L-C oscillator.

In general, what is desired in both cases is a Q rising directly with frequency. In the former, this keeps the resonant circuit impedance constant for constant gain over the band and, unlike a variable capacitor, offers constant bandwidth as frequency rises. In the latter, the resonant circuit impedance is again kept constant for constant amplitude of oscillation when Q rises directly with frequency.

R-L Wien Bridge Oscillator

In an R-L Wien bridge oscillator, where f is inversely proportional to the first power of inductance, the line of operation is along a slope of —1. Maximum Q may be obtained by operating along the ridge of the Q contours and eventually passing through maximum Q, which has a value of 70+. This line of operation is labelled "A" in Fig. 3.

A line of operation representing a constant parallel resistance across a varying inductance is in the upper right-hand region with a slope of +1. The Q of the unit should be denoted by $Q = R_p\omega L$. A line of operation representing a constant resistance in series with the varying inductance is in the lower left-hand region and also has a slope of +1. Q is then expressed as $Q = \omega L/R_s$. In general by sacrificing range, Q increases, and vice versa.

Since the control winding is inductive, it is generally desirable to operate the Increductor from a high impedance source, such as a *6AQ5*, to avoid loss of high frequency components in the control current signal. For very rapid sweep rates, the stray capacitance of the control winding circuit should be kept to a minimum.

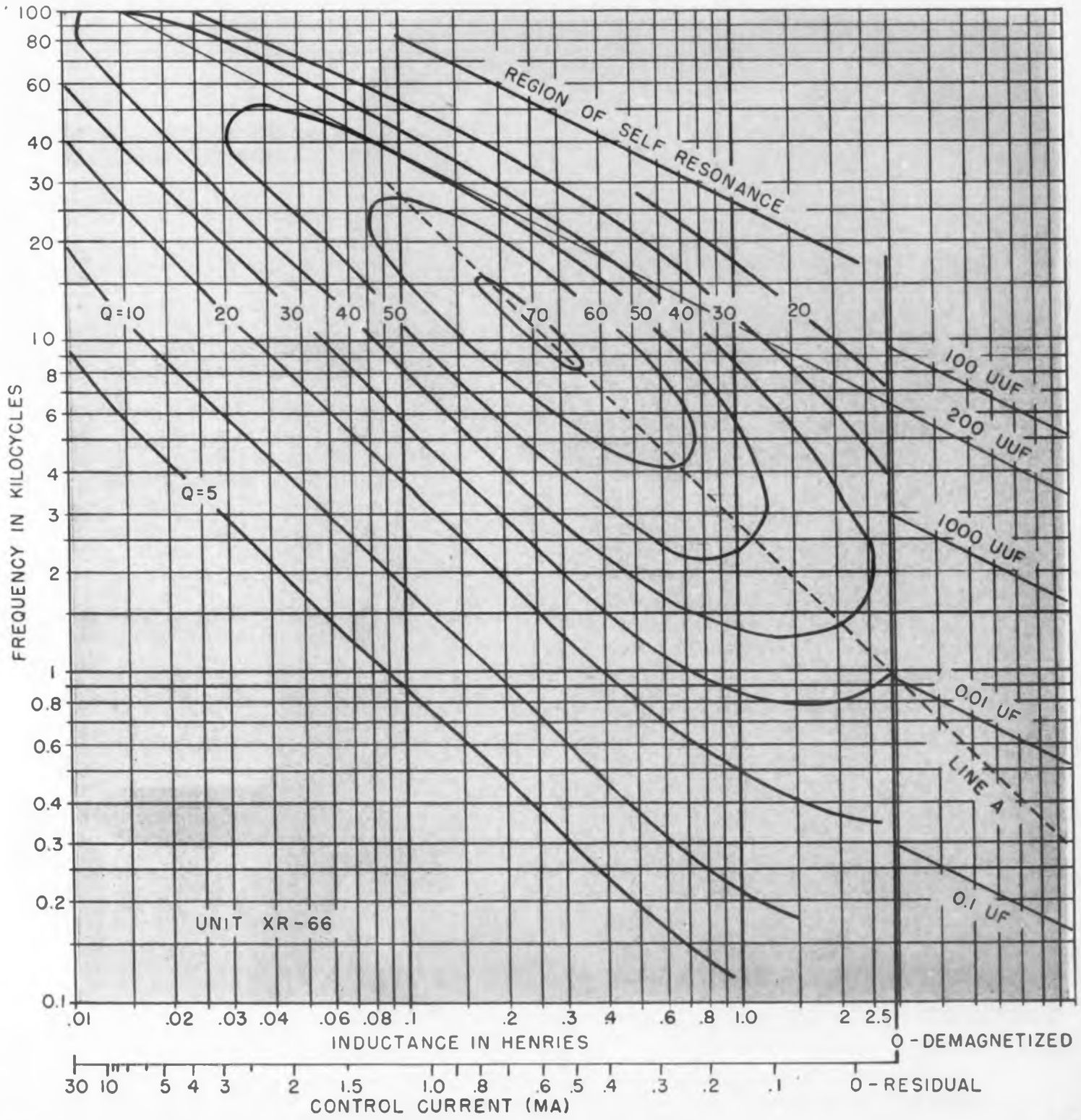
Applications

The Increductor, which has the life and ruggedness of a transformer, lends itself to many applications. These include swept oscillators, automatic frequency control, wide and narrow band fm oscillators, swept receivers of both the TRF and superhet type where several r-f stages and an oscillator stage can be accurately tracked, variable high pass, low pass, band pass, and single side band filters, delay lines, Wien bridge and frequency shift oscillators. Units have been designed to give rapid variations of inductance. A magnetic switch is an example of this, where switching rates in excess of 100kc between two discrete magnetic states have been achieved. Wide band fm oscillators can be built having modulation rates up to several megacycles.

Development to date has produced units having inductance changes of 400 to 1 in the frequency region to 10Mc with reduction in range over 10Mc. At 100Mc frequency shifts of 3 to 1 in tuned circuits have been achieved. Oscillator units have been operated at signal frequencies in excess of 300Mc. Peak Q values of over 200 have been achieved in the frequency region of several kilocycles to 10Mc. Above this range, Q's of 30 to over 100 have been achieved up to 250Mc.

Low-level Increductors require from 0.1mw to 1w or 2w control power for full inductance variation, with typical units requiring 50 to 250mw. One high power inductor delivers over 80w of r-f power with a 2:1 frequency swing and requires 10w of control power.

Fig. 3. Pertinent design information for a particular Increductor can be summarized in a group of curves known as a "Q" Map. An example of a "Q" Map is shown below.



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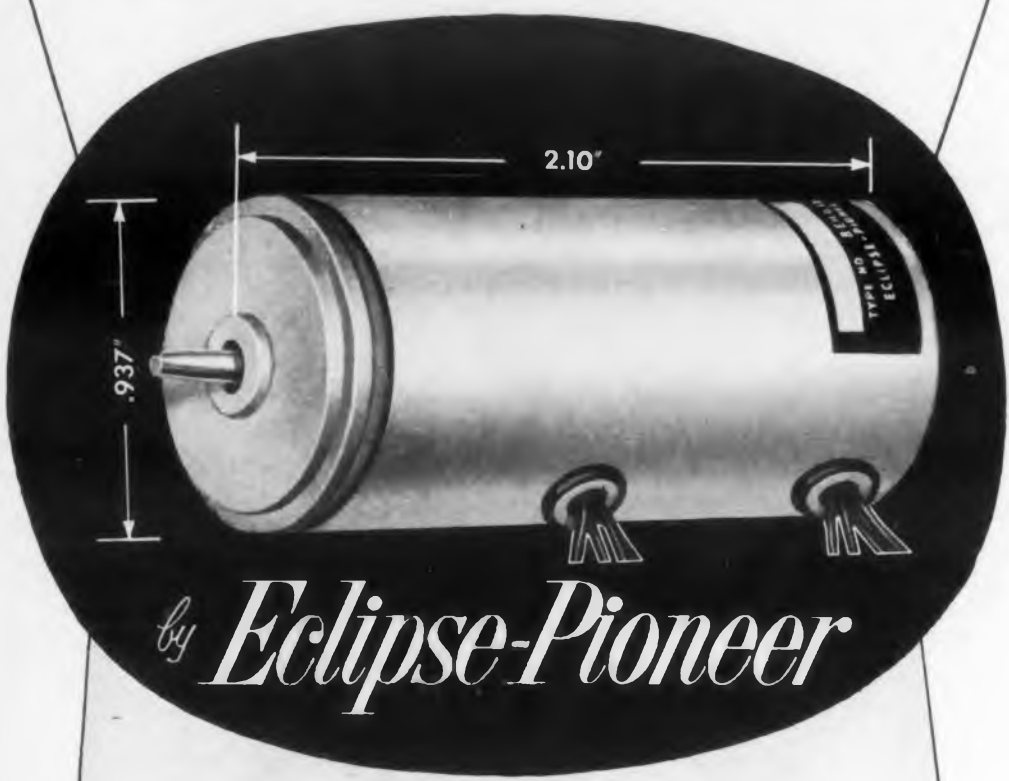

by *Eclipse-Pioneer*

TYPICAL ELECTRICAL CHARACTERISTICS

GENERATOR DATA

Linearity—½ of 1% to 4000 rpm

Output—300 mv/1000 rpm with 18 volt, 400 cycle excitation

Null—10 mv or less

MOTOR DATA

18 or 26 volt, 400 cycle, 2-phase low inertia motor

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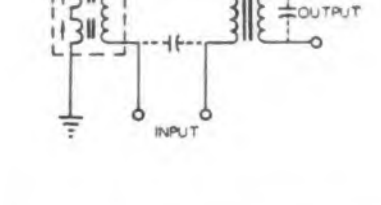
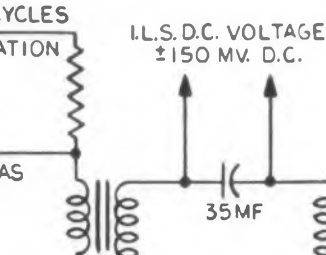
CIRCLE ED-7 ON READER-SERVICE CARD FOR MORE INFORMATION

Low-Distortion Magnetic Modulator

Fig. 1. Biased and unbiased operation of the modulator.



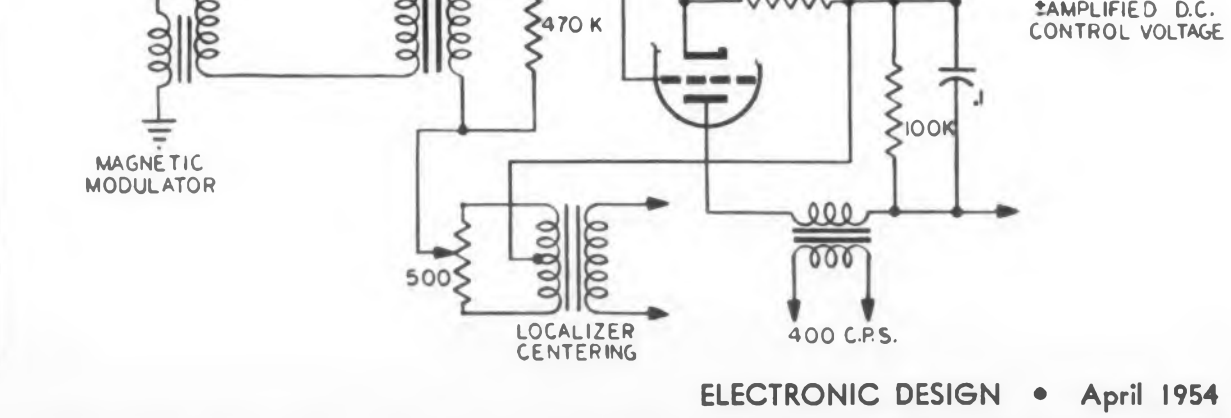


ACCURATE and stable conversion of low-level d-c signals into proportional a-c signals and almost unlimited life are outstanding characteristics of the F5A Series magnetic modulator (above, right). Operating over a range of 60 to 10,000 cps, with a 100kc limit for low-impedance types, the modulators are shockproof and virtually unaffected by temperature and humidity changes.

These low-distortion units can utilize signals from thermocouples, strain gages, telemetering systems and certain computing devices, and can also serve as a variable inductor in sweep oscillators and other tuned circuits. The units are magnetically shielded and hermetically sealed. They respond quickly.

The magnetic modulator operates on the principle that the application of a d-c magnetomotive force to a magnetic circuit excited beyond saturation will result in the generation of an even harmonic flux. If the magnetic circuit is so highly biased that little flux change occurs during the excitation cycle, the

Fig. 2. A circuit diagram showing the modulator feeding a discriminator.



application of the control ampere turns will result in a fundamental frequency flux. For greater stability, second-harmonic operation is recommended.

Fig. 1 shows circuits of the two types of operation. An output coupling transformer with a large step-up ratio provides maximum output voltage into a high-impedance load. The basic output wave, either fundamental or second-harmonic, is not purely sinusoidal. When used with a frequency sensitive device such as a discriminator, the impure waveform presents no problem, and excellent linearity results.

When a pure waveform is necessary, tuning the output transformer with a capacitor, as shown in phantom on the circuit in Fig. 1, will provide adequate filtering. The signal-output winding is wound around two toroidal magnetic cores which are excited in phase opposition so that their no-signal fluxes oppose, giving substantially no output with no input.

Manufactured by Lear, Incorporated, 11916 West Pico Blvd., Los Angeles 64, Calif., the units are offered in single- and dual-channel models with a signal winding resistance of 700 ohms and an impedance of 4000 ohms at 400cps. Units with signal winding resistances of 1, 25, and 3000 ohms can be supplied on order. The excitation winding is of low impedance and requires a normal excitation current of 200ma. Normal signal range is 0-150mv.

With fundamental frequency operation, minimum output does not occur at zero signal input. For the standard models the null is displaced from zero input point by less than 6mv. For special applications, it is possible to provide all models built to better than this standard-production tolerance.

Fig. 2 shows the modulator in a typical application feeding a discriminator. With no signal input, the resulting voltage across the output terminals is zero because the voltages across the load resistors are equal in magnitude and opposite in polarity. Since fundamental frequency output is desired, a d-c bias current is superimposed on the excitation current.

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Panel-Mounted VTVM

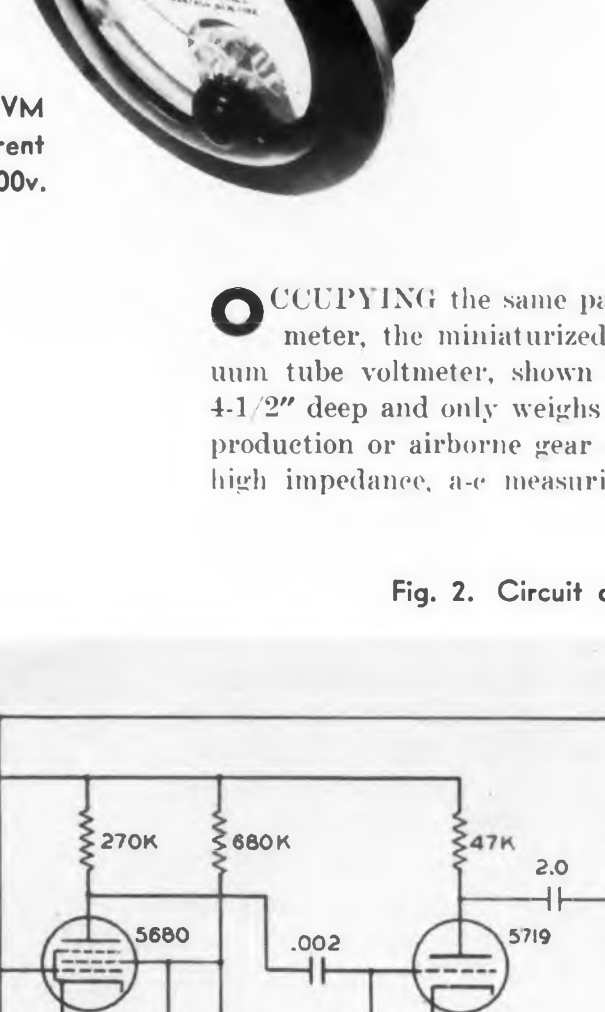


Fig. 1. The Type A VTVM is available in 10 different ranges from 10mv to 300v.

OCCUPYING the same panel space as a 3-1/2" meter, the miniaturized, panel-mounted vacuum tube voltmeter, shown in Figs. 1 and 3, is 4-1/2" deep and only weighs 1 lb. The designer of production or airborne gear can include complete, high impedance, a-c measuring circuits in equip-

Fig. 2. Circuit diagram of the VTVM.

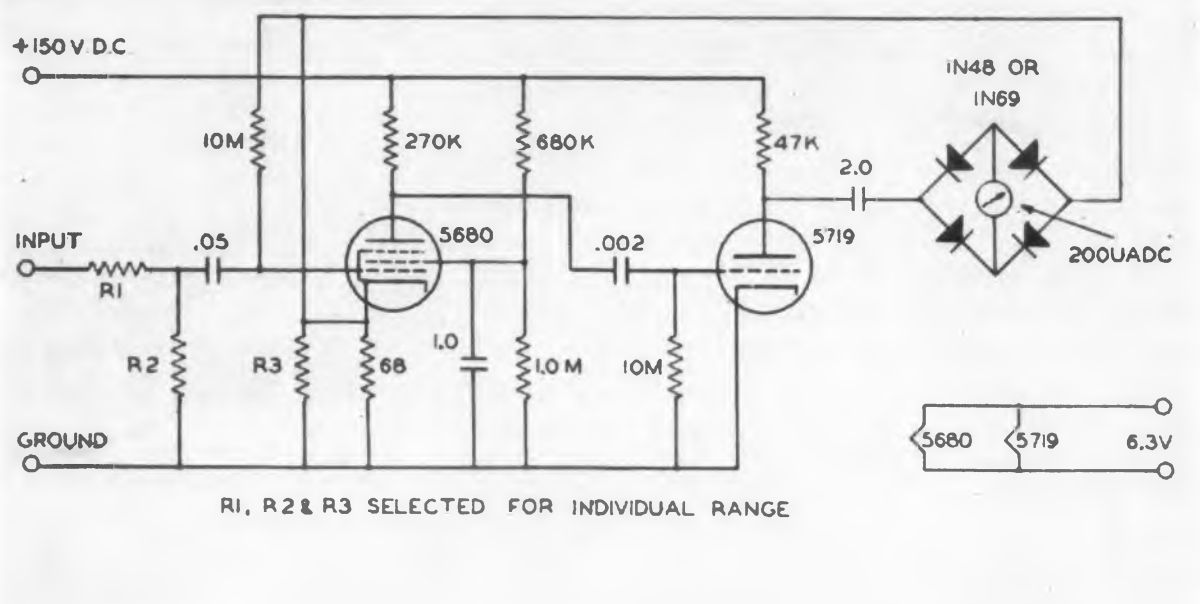


Fig. 3. Exposed view of the VTVM showing its miniaturized construction and terminal board.

ment without requiring external meter test jacks.

Manufactured by Trio Laboratories, Post Office Box 143, Wantagh, N. Y., the Type A Vacuum Tube Voltmeter is available in 10 different ranges from 10mv rms to 300v rms with full-scale sensitivity on single scales. Utilizing the feedback amplifier circuit shown in Fig. 2, the unit uses germanium diodes in the bridge circuit for good linearity and stability, and ruggedized, long-life, subminiature, preferred-type vacuum tubes.

The meters do not include a power supply, but require 6.3v at 0.45amp and 125-200v at 3ma (maximum), which are generally available. Other models are designed with a power supply included. With an input impedance of 1 megohm and an accuracy of 3%, the meter can be used for measurements from 20cy to 50,000cy. Multiple scales and higher input impedances can be specified.

For military applications, the Type A VTVM is produced in a ruggedized version that uses a MIL-M-10304 meter and long-life, hermetically sealed electronic components that will meet applicable government specifications. The D'Arsonval meter movement has a zero left scale and provision for external zero adjustment. All the meters are calibrated for nonmagnetic panels, but meters calibrated for steel panels can be specified. Screw-type terminals are standard, but solder terminals and other special modifications can be specified.

Printed Circuit Connectors

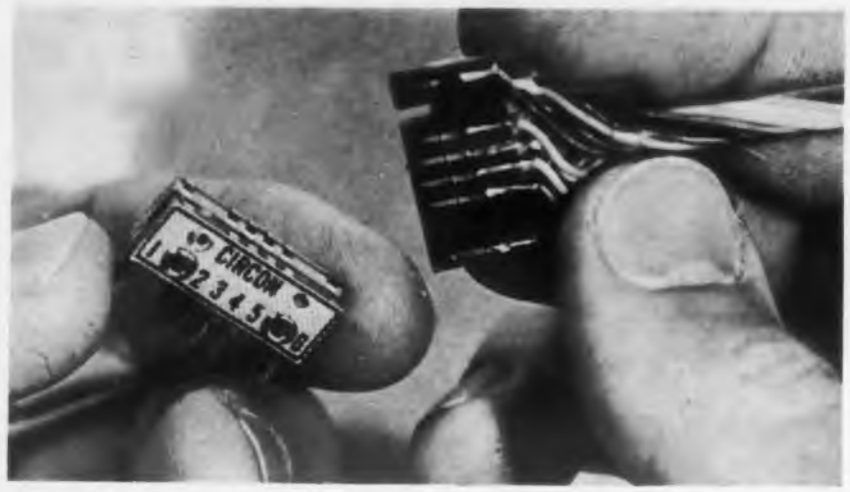


Fig. 1. Cable bunches can be connected to printed circuits through a male Circon connector (right) and the female Circon unit.

SIDE-BY-SIDE, end-to-end, and a wide variety of other types of mounting are possible with "Circon" miniature and subminiature connectors, one of which is shown in Fig. 1. Rectangular in shape, their modular construction permits quick and economical installation of connectors having practically any number of contacts. They are especially suitable for printed circuit applications, at the same time affording ease of connection to non-printed circuitry through mating male connectors, as shown in Fig. 1.

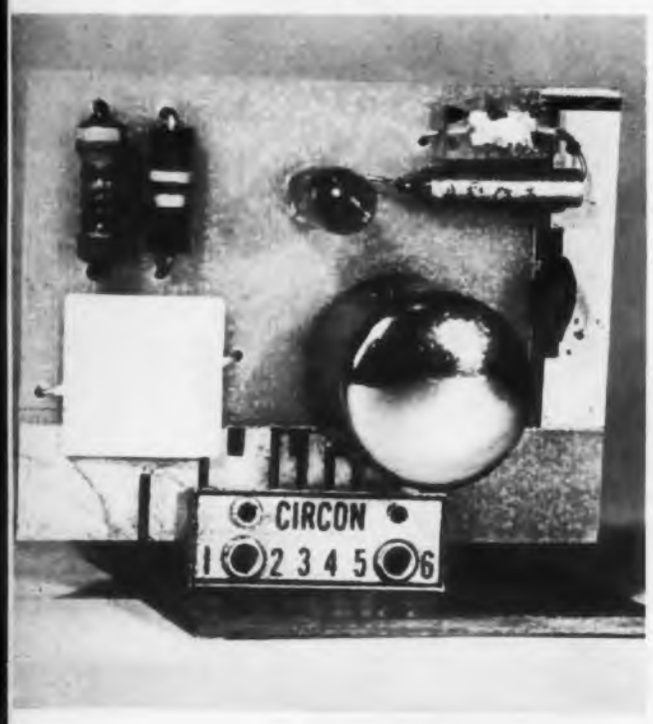
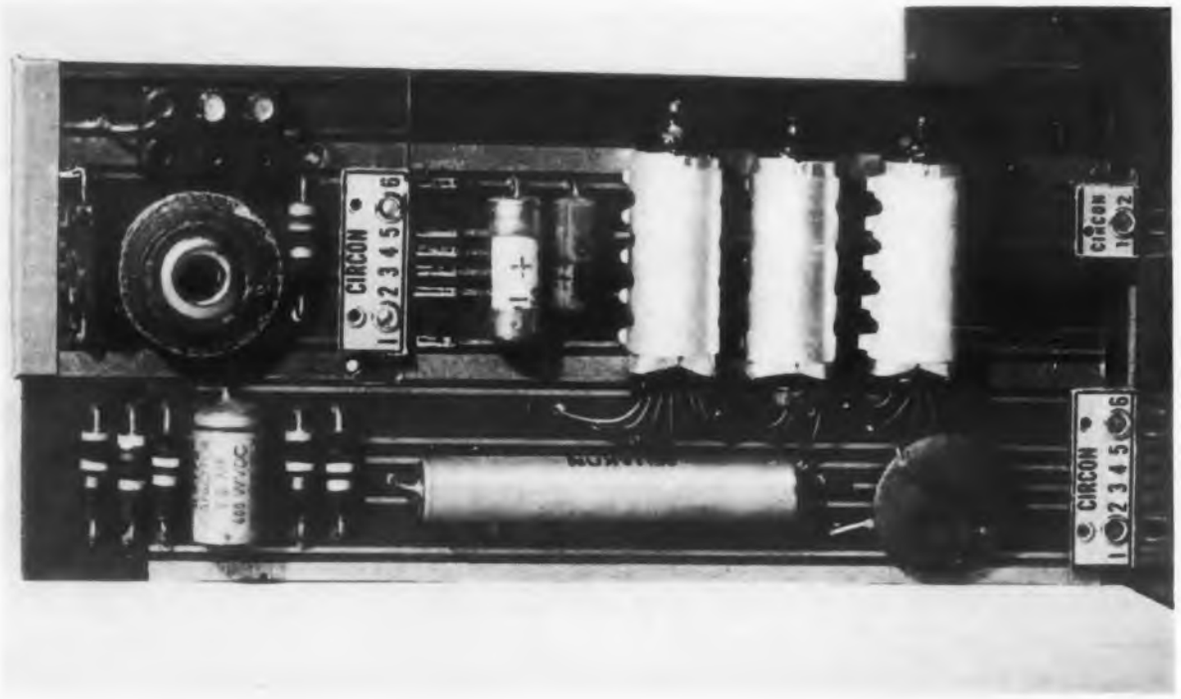


Fig. 2. Two different circuits using Circon connectors. The left illustration shows how these connectors are strong enough to physically support a small circuit. Two sizes of the connectors are employed to connect three circuits below.



The contact of the female connector is a ribbon of gold-plated nickel silver backed with a supporting layer of specially developed elastomer. The compressive load formed by the edge of the printed circuit upon being inserted into the female connector maintains a low-resistance contact providing increased protection against humidity, breakdown, corona and leakage under high altitude or adverse environmental conditions. Sliding insertion wipes the contacts on mating.

The Circon series consists of 32 models, 16 each in miniature and subminiature types in basic modules of 2, 4, 6 and 12 contacts. The miniature type is rated at 500v d-c at sea level between contacts and between contacts and mounting sleeves. Its current rating is 2amp per contact. The subminiature type is rated at 300v d-c between contacts. Its current rating is 1amp per contact.

A typical miniature series 12-contact female connector with 5/64″ contact spacing is 1/4″ x 7/16″ x 1-25/64″ in size. A subminiature series 12-contact female connector with 3/64″ contact spacing is 1/4″ x 5/16″ x 55/64″ in size.

Available in three gages to accommodate 1/32″, 3/64″ and 1/16″ thick printed circuits, they are made by Circon Component Company, 17544 Raymer Street, Northridge, Calif. The connectors can be used with circuits printed on ceramic and other body materials as well as plastic laminates. On printed circuits of small size, the female connector will often provide adequate mechanical support to the circuit as well as electrical connection, as shown in Fig. 2. Various mounting arrangements are shown in Fig. 3.

The subminiature connector is mounted with No. 0 machine screws through the metal sleeve provided. The miniature type is mounted with No. 4 machine screws or the equivalent. The polarizing pin in the female connectors also permits mechanical locking of a printed circuit or male connector into the female connector simply by replacing the normal polarizing slot in the printed circuit with a round hole. A pin can then be inserted in the hole.

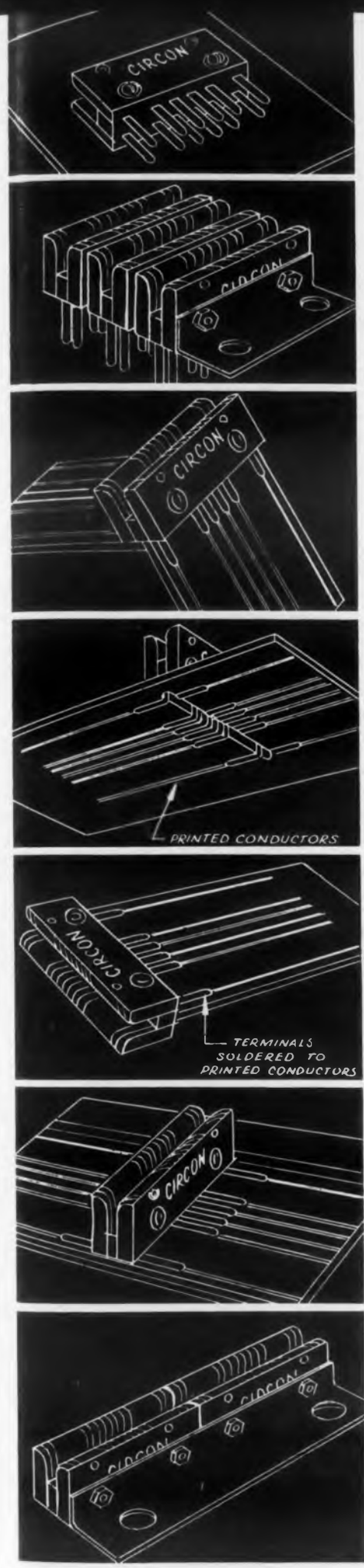


Fig. 3. Various mounting arrangements for Circon connectors enabling printed circuits to be mounted in parallel, perpendicular to each other, end-to-end, or in tandem for utmost flexibility.

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

Color TV Receiver Tubes

ESPECIALLY developed for application in color TV receivers and transmitters, the five new tube types shown on these pages also have many uses in black-and-white TV receivers and other types of communication equipment. Covering a wide range of functions, they provide designers with greater flexibility in circuit design and higher levels of operating efficiency for color TV equipment. The tubes are products of Radio Corporation of America, RCA Victor Div., Harrison, N. J.

The *6BY6*, a pentagrid amplifier tube, is intended as a gated amplifier in TV receivers, but may also be used as a combined sync separator and sync clipper. The *6BY6* has separate base-pin terminals for grids No. 1 and 3. Each of these grids has a sharp-cutoff characteristic and can be used independently as a control electrode. This characteristic aids in good sync clipping and noise cancellation with low values of input signals.

A miniature dual purpose type, the *6AN8* is a medium-mu triode—sharp cutoff pentode. The high transconductance pentode may be used as an i-f amplifier, video amplifier, AGC amplifier and as a reactance tube. Characterized by a high zero-bias plate current, the triode is recommended for low-frequency oscillator, sync-separator, sync-clipper and phase-splitter circuits.

The *6BD4* is a low-current beam, sharp-cutoff triode designed for voltage regulation of high-voltage, low-current, d-c power supplies. It has a maximum d-c plate-voltage rating of 20,000v, a maximum d-c plate current of 1.5ma and a maximum plate dissipation rating of 20w. A shunt voltage-regulator circuit utilizing the *6BD4* is shown in Fig. 2.

The *3A3* is a glass-octal type, half-wave vacuum rectifier with an indirectly heated cathode. Designed as a rectifier of high-voltage pulses produced in scanning systems of color TV sets, it is rated to withstand a maximum peak inverse plate voltage of 30,000v and can supply a maximum peak plate current of 80ma and a maximum average of 1.5ma.

The *6AU4-GT* is a half-wave vacuum rectifier of the glass-octal type for damper-diode service in color TV receivers and in black-and-white receivers having picture tubes with 90° deflection. Rated to withstand a maximum peak inverse plate voltage of 4,500v, the tube has a maximum peak plate current of 1,050ma.

Fig. 1. Five tube types specifically designed for color TV receivers are shown on these pages.

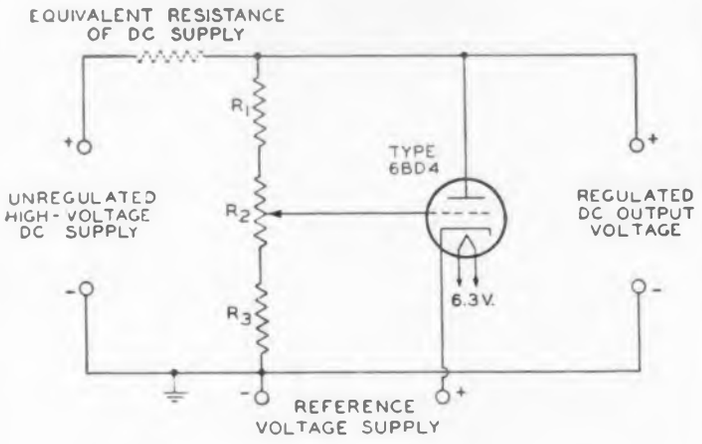
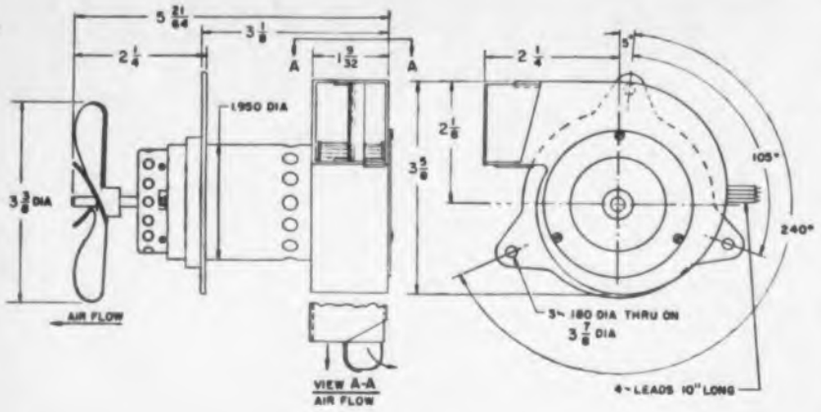
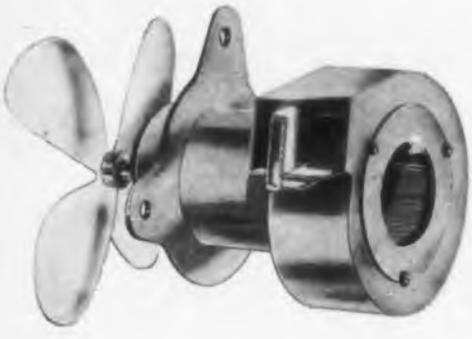


Fig. 2. A shunt voltage-regulator circuit using the 6BD4, a low-current beam, sharp-cutoff triode.

TWO WAY COOLING WITH ADAPTABLE AIR FLOW DIRECTION



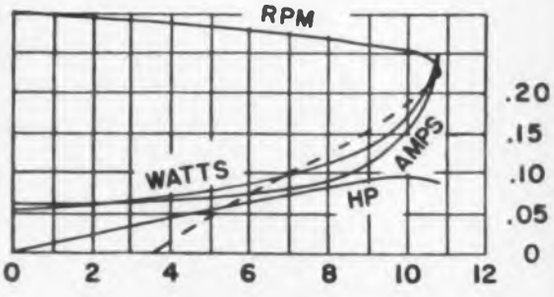
This motor is specially designed for use where space is at a premium. It has 3 point mounting and can be mounted in any position. Its two way cooling direction, a propeller fan at one end and centrifugal blower at the other, makes for maximum cooling in all directions. The vent on the centrifugal blower can be designed so the air can be deflected in any direction desired.



TYPE A15ABF-1
115 Volt—400 cycle Blower delivering 50 CFM (free air) at 8500 RPM. Propeller fan delivering approx. 300 CFM (free air) at 8500 RPM

PERFORMANCE CHARACTERISTICS A15ABF—1

AMPS	WATTS INPUT	RPM
3.0	300	12000
2.5	250	10000
2.0	200	8000
1.5	150	6000
1.0	100	4000
0.5	50	2000
0	0	0



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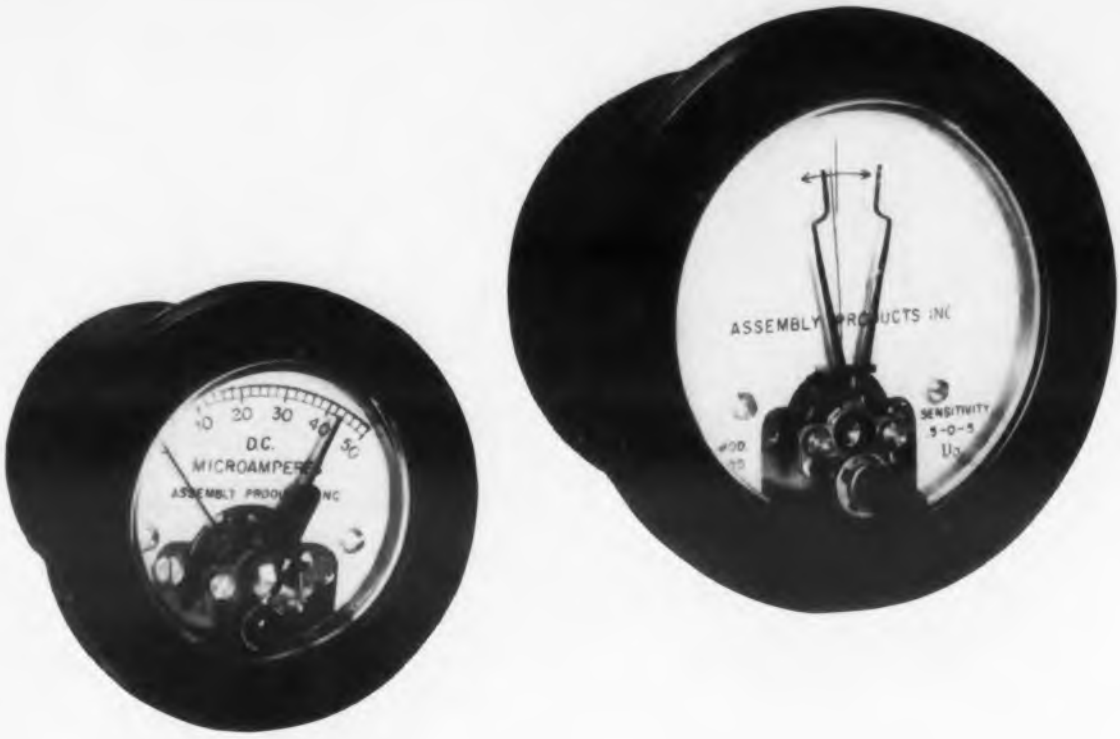
West Coast Factory 2233 Federal Ave., Los Angeles 64, Cal.

Send for Sub-Fractional Horsepower Motor and Application Folder and Engineering Assistance Form Number ED-04

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



Ruggedized Contact Meter Relays

MANY control functions, especially in industrial automation, may be served by these ruggedized and sealed contact relays, which also give a meter indication. Offered in two models shown above, their contacts can be made to close with either increasing (high limit) current, decreasing (low limit) current, or both, and are made adjustable or fixed.

Employing a d'Arsonval movement, the units are made in all the usual d-c and a-c voltage and current ranges. As illustrated in the exploded view in Fig. 1, these relays have one contact mounted on the indicating pointer of the "moving and locking coils" and the other on a separately pivoted pointer, which can be made adjustable over the entire scale arc. Spring mounting breaks the contacts when current in the moving and locking coils is interrupted. The tiny contacts, shown oversize in Fig. 1, are platinum-iridium tipped and will make and break up to 15,000,000 times before wearing out and requiring replacement.

Instead of the conventional "Alnico" horseshoe magnet surrounding the coil, the magnet is the core. Despite its small size, the magnet is still strong enough to be used in the 0-20 μamp, 0-5mv ranges. The complete movement—coils, contact pointer assembly, hairsprings, cushion jewel assembly, cast bracket assembly, and magnet—weighs only 0.8 oz, making for easier shockproofing. The movement is so small that slave relays can be mounted in the same case, as shown in the exposed case illustrated in Fig. 2.

Manufactured by Assembly Products, Inc., 35 N. Main Street, Chagrin Falls 17, Ohio, the relays comply with Specification MIL-R-5757-B for relays and Specification MIL-M-10304 for meters. To meet these specifications, they must stand a 50G shock and vibration of 10-55cps, 0.03" amplitude.

The units are normally used at 5-25ma d-c, 75-125v, although samples have been successfully operated at 300ma. Suggested applications are as bearing overheating protectors when operating off thermocouples, for automatic speed control, warning and control units in radiation measuring equipment, automatic switching for standby equipment, and for over-voltage protection.

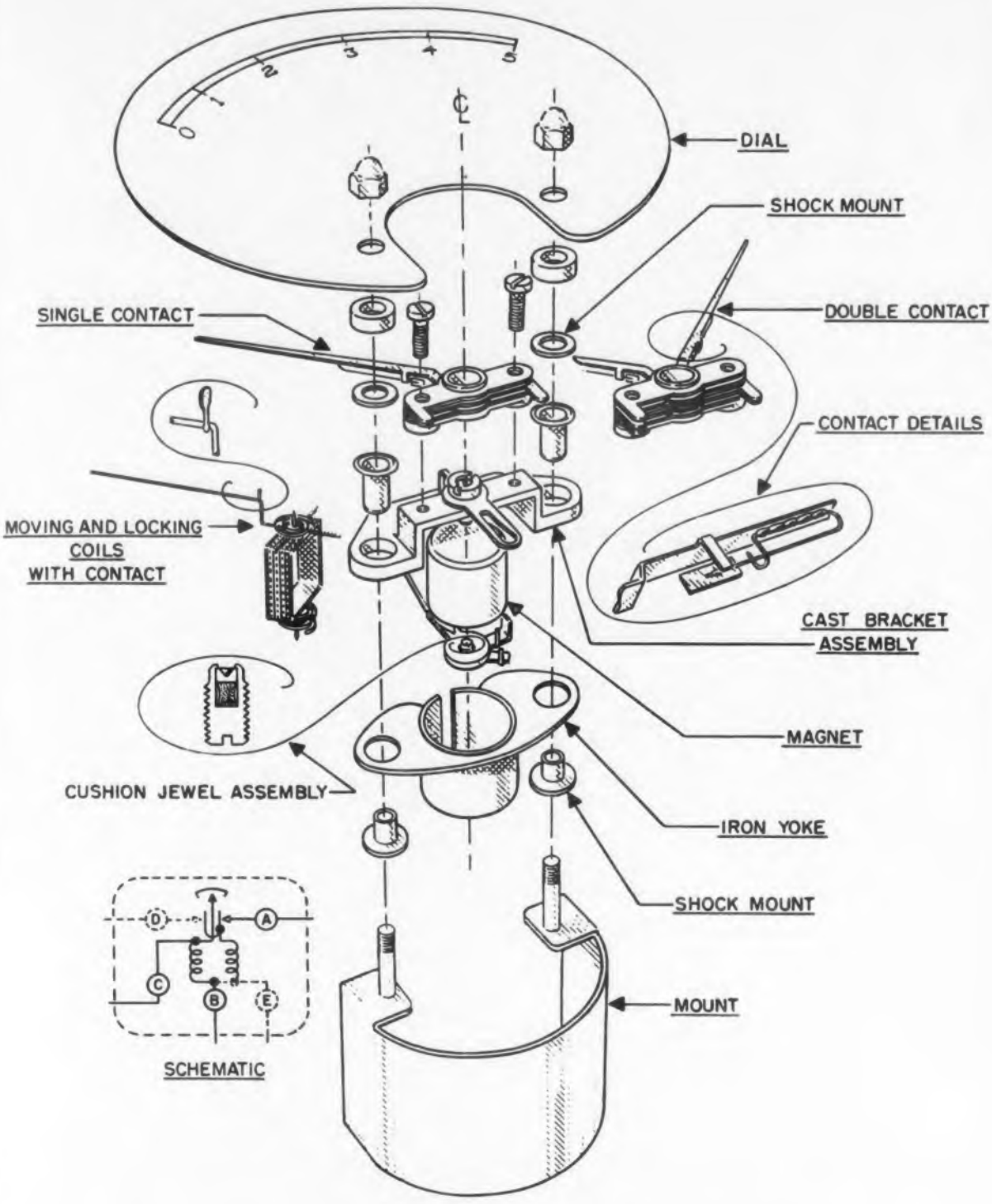


Fig. 1 (above). Exploded view of the contact meter relay movement.

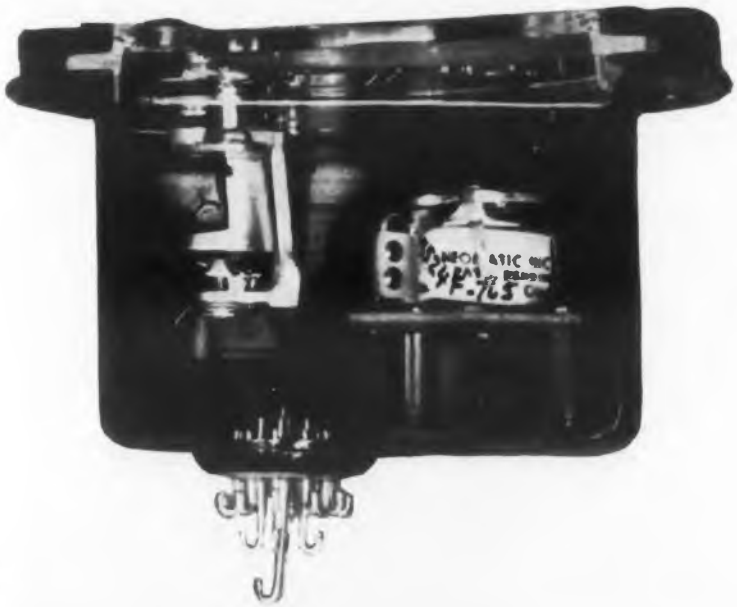
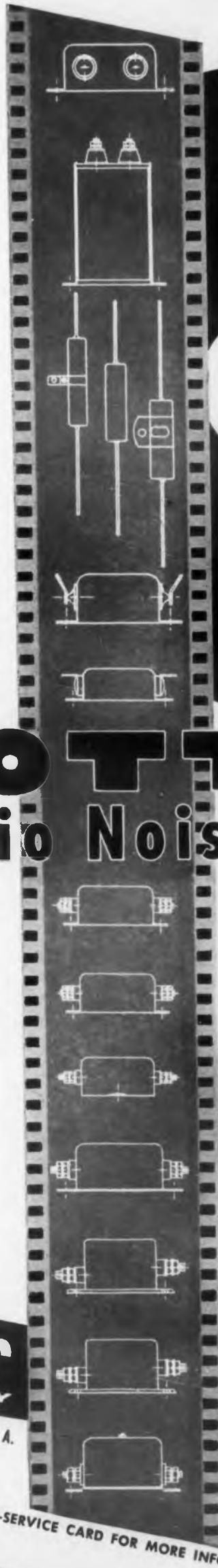


Fig. 2. A cutaway view of the relay case showing how a slave relay can be mounted in the same case because the movement is so small.



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

R vs T of Resistance Materials

R. G. Lindstrom

Engr. Standards Department

Capehart-Farnsworth Company

Fort Wayne, Ind.

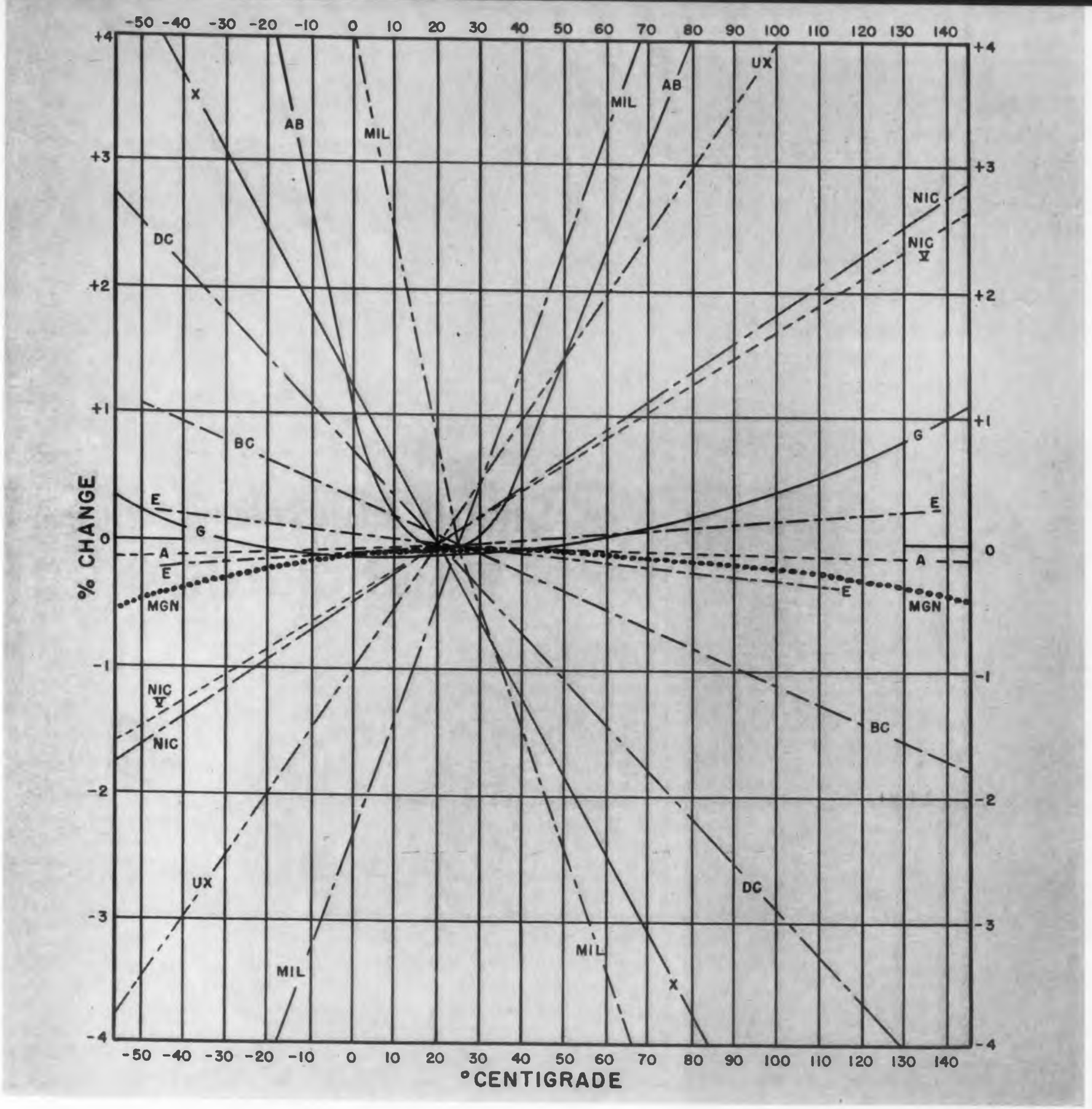
SELECTION of the proper resistance material to use in equipment operating over a wide temperature range should be facilitated by this graph of the average or nominal change of resistance (percent change) with temperature of many common materials. There are a number of other materials that could have been incorporated, but the ones considered will indicate the general range of values.

For the composition and film type resistors, the temperature coefficients vary with the basic resistance values, therefore, as a general average, 100,000 ohms was selected as an average base value.

Where the only resistance available for a particular material was not 100,000 ohms, the variation is noted in the "Remarks" column of the Key. The curve limits do not indicate the operating temperature range limits of the materials considered.

The information from which these curves were derived has come from a number of sources—primarily manufacturers' literature, specifications, special reports, and the *Tables of Critical Values*. The manufacturers' names or trade marks given do not necessarily indicate that it was the only source used, but merely is being used as identification to better describe the particular form of resistance material. The one exception is the Allen-Bradley material, whose composition is widely known for its particular characteristics.

◀ CIRCLE ED-14 ON READER-SERVICE CARD



This graph of percent change in resistance vs temperature change for 12 common resistance materials will aid the designer in the selection of resistance materials that will stay within his tolerance requirements for equipment required to operate over a wide temperature range. A key to the abbreviations used is given below.

Key Chart

Symbol	Material		Remarks
A	Advance or Equiv.	Wire	
AB	Allen-Bradley	Composition	
BC	Boro-Carbon	Deposited Film	
DC	Deposited Carbon	Film	1 Megohm
E	Evanohm or Equiv.	Wire	Variation may be plus or minus
G	Corning-Glass	Film	10,000 Ohms

Key Chart

Symbol	Material		Remarks
MGN	Manganin	Wire	
MIL	Mil-R-11	Composition	Military Spec. Limits
NIC	Nichrome or Equiv.	Wire	
NIC V	Nichrome V or Equiv.	Wire	
UX	Nobleloy	Metal Film	Low Resistance Values (1000)
X	Nobleloy	Metal Film	500K to 1 Megohm

Fig. 1. Diameters of these brakes range from 1-13/16" to 4-1/4"; lengths from 1-3/8" to 2-9/32".

Small Electric Brakes and Clutches

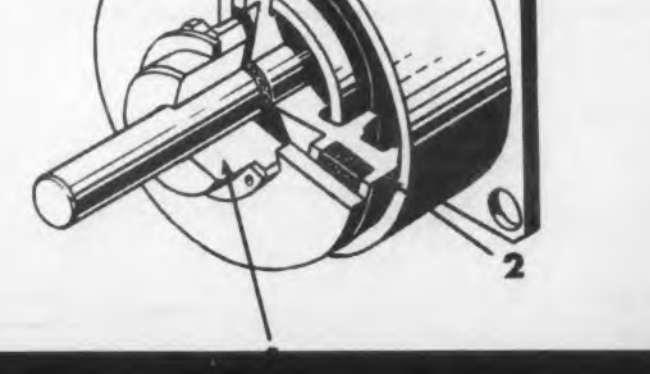


Fig. 2. Electric brake. 1—stationary field; 2—armature; 3—replaceable friction surface; 4—splined armature hub.

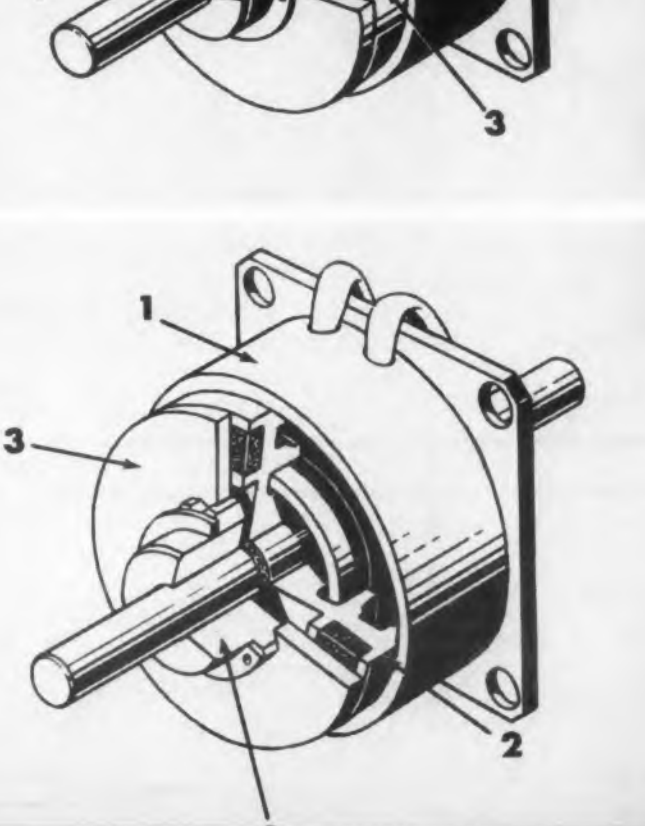


Fig. 3. Electric clutch-coupling. 1—stationary field; 2—rotor; 3—armature; 4—armature hub.

SMALL electric brakes, clutches, and clutch couplings of a new design offer many applications for designers of servo mechanisms, computers, fire controls, remote control gear instruments, and automatic machinery. Easily controlled, these units can serve many starting, stopping, indexing, rapid cycling, synchronizing, torque limiting and jogging needs.

The brakes, illustrated in Fig. 1, have only two parts: a rotating armature and a stationary field with replaceable face, as shown in Fig. 2. The clutches and clutch-couplings have only three parts: a stationary field, rotor, and armature, as shown in Fig. 3. The units are operated by means of an electromagnetically produced magnetic field which attracts the armature to the stationary field section in the brake, or to another rotor in the clutch. Fig. 4 shows the

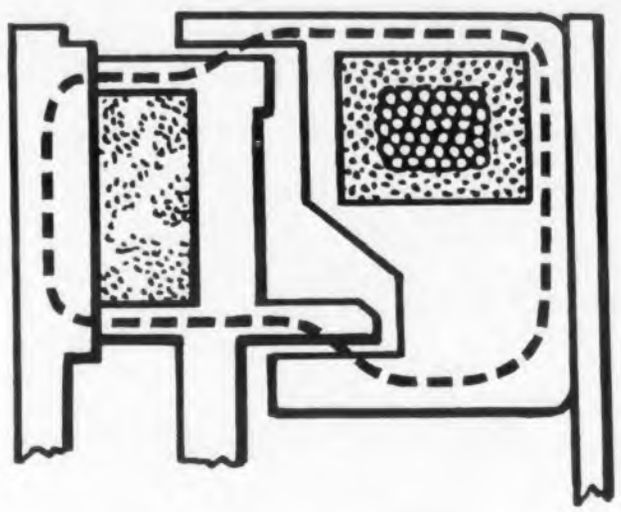


Fig. 4. Flux path through armature on left and clutch rotor on right. The brake flux pattern is similar, except that a stationary field and replaceable face attract the armature for fast stopping.

flux path for the units, which are produced by Warner Brake and Clutch Company, Beliot, Wis.

With special controls, a response time in the order of milliseconds is possible. Torque build-up is always smooth until "lock-in," after which there is no creeping or slipping. Lost motion is practically eliminated. The units are controlled either by a pushbutton, or automatically by limit switches, relays, electric eyes, or other electric or electronic methods. Voltage is easily adjusted by means of rheostats, giving a wide selection of acceleration and deceleration rates.

The units never need adjustment since wear is automatically compensated for until the faces require replacement, a simple but rarely needed repair. Torque ratings are 8, 60, and 240 in-lb; with rated speeds of 10,000, 7200 and 4500 rpm, respectively.

All models operate on 6, 12, 28, 40 or 90v, and require 6 to 15w. Designed for split shaft applications, the clutch-couplings are available in two styles, with flange mounted and bearing mounted fields.

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These rugged, compact transformers have been designed in close cooperation with organizations directly concerned with the development of standards for aircraft communication, guided missile and related equipment. They are engineered to meet future, as well as current requirements for 400 cycle power supplies.

POWER TRANSFORMERS (All primaries 105/115/125 V., 380-1000 cycles)

HIGH VOLTAGE A.C. Volts	SECONDARY D.C. Ma.	RECTIFIER FILAMENT Volts	RECTIFIER FILAMENT Amps.	OTHER FILAMENTS Volts	OTHER FILAMENTS Amps.	CATALOG NUMBER
270-0-270	55	5.0	2	6.3 CT	2	4PHC-55
335-0-335	70	5.0	2	6.3 CT	3	4PHC-70
375-0-375	120	5.0	3	6.3 CT	4	4PHC-120
440-0-440	165	5.0	3	6.3	7.5	4PHC-165
				6.3	3	
				6.3	3	
				6.3	0.6	
450-0-450	200	5.0	2	6.3	4	4PHC-200A
				6.3	4	
				6.3	0.6	
550-370-75-0-75-370-550	300	5.0	6	6.3 CT	5	4PHR-300
				6.3 CT	1	

FILTER REACTORS

INDUCTANCE (henries)	MAXIMUM D.C. Ma.	D.C. RESISTANCE (ohms)	INSULATION VOLTS RMS	CATALOG NUMBER
2.0	55	160	2,500	4RH-255
2.0	70	240	2,500	4RH-270
2.0	120	105	2,500	4RH-2120
2.0	165	80	2,500	4RH-2165
2.0	200	77	2,500	4RH-2200
2.0	300	49	2,500	4RH-2300

FILAMENT TRANSFORMERS (All primaries 105/115/125 V., 380-1000 cycles)

SEC. VOLTS	SEC. AMPS.	INSULATION VOLTS RMS	CATALOG NUMBER
6.3 CT	3	2,500	4FH-63
6.3 CT	5.5	2,500	4FH-65
6.3 CT	10	2,500	4FH-610
6.3 CT	20	2,500	4FH-620

Write for Chicago Bulletin #32 listing more complete specifications on these units, specially designed for 400 cycle, high-temperature operation.

CHICAGO *the World's Toughest Transformers*

CHICAGO STANDARD TRANSFORMER CORP.

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

Fig. 1. These capacitors retain their properties to 1000Mc and above.

High Capacity Ceramic Capacitors

HIGH capacity for a given size, as well as excellent high temperature and high frequency performance are outstanding features of a new line of ceramic capacitors designed for broadcasting, communications and industrial applications. Available in four models in many ratings, these lightweight, easily-mounted units should find wide usage in airborne, shipboard, or other mobile equipment.

Three of the four models are shown in Fig 1. The HPB type, the smallest one, is primarily intended for oil operation, which gives it very high power and voltage-across-connections ratings. Featuring a new ceramic developed by French engineers, these space-saving components are presently imported and will shortly be made here by Aerovox Corporation, 740 Belleville Ave., New Bedford, Mass., the marketing agent.

Outer surfaces of the capacitors are fired enamel, while the inner surfaces are metallized with silver. The heavy connections have silver-plated conduction surfaces. The dielectric retains its properties at frequencies above 1000Mc, and may be used at higher frequencies limited mainly by the inductance of the connections to the units.

Design of the capacitor reduces to a minimum the self-inductance of the terminals. The effective frequency limit depends on the method of mounting. The connections stand up to 20 lb axial pull for 10sec for the larger HPA and HPB types.

Maximum working temperature without derating is 105°C. The capacitors are rated at an ambient temperature of 45°C. For an ambient temperature of 20°C, the maximum power ratings are increased by 25%, and if the ambient temperature is 60°C, the indicated power ratings are decreased by 30%.

For those applications where a minimum change in capacitance is necessary, capacitors with a dielectric temperature coefficient of -30×10^{-6} are available. The extreme variation using this dielectric for a 30°C temperature rise is only 0.22%. Thousands of these capacitors have proven themselves overseas under extreme climatic conditions.

The capacitors come in by-pass types of high capacitance value for by-pass and blocking applications where reasonable variations of capacitance and greater loss factor are permissible.

Dynamically Compensated D-C Power Supplies

INEXPENSIVE and dynamically compensated, the Type RP series of d-c power supplies feature a special load compensation control to provide high stability. By means of this adjustment the user is able to set the regulated supply voltage to either increase or decrease slightly with load, or remain completely constant. Increasing voltage compensates for the drop in leads while decreasing provides a negative internal impedance which stops regeneration through the unit and thereby eliminates one cause of motorboating in multi-stage, high-gain amplifiers.

Compactly housed and portable, one of the models is illustrated in Fig. 1. The unit is manufactured by Millivac Instrument Corporation, 444 Second Street, Schenectady 6, N. Y.

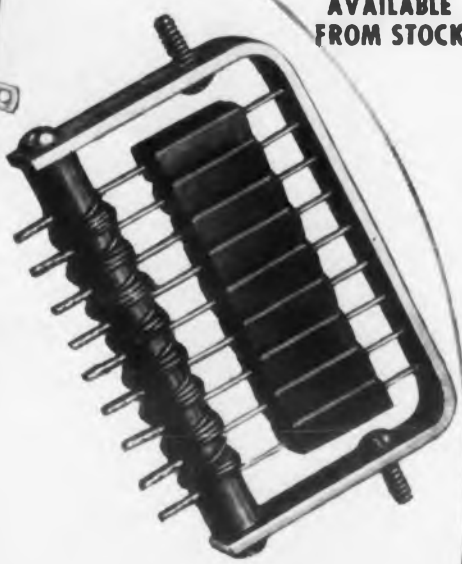
The special feedback circuit in these supplies neutralizes the slight regulator errors inherent in all gas regulator reference-tubes and aids in handling line voltage fluctuations up to ±10%. This degenerative control is factory-adjusted, and need not be touched under normal conditions. Ripple is below 10mv.

There are four models in the RP series. All provide heater power outputs of 6.3v, 2amp, 60cy. Model RP-41 has a nominal rating of 250v, 0-50ma, with a limit of 1ma at 400v. Model RP-42 has double the current output of Model RP-41 at the same voltages, respectively. Model RP-43 has a nominal rating of 400v, 0-50ma, with a limit of 1ma at 575v. Model RP-44 has double the current output of Model RP-43 at the same voltages, respectively.

Fig. 1. The Series RP power supply. The load compensation control is centered just below the meters. The output characteristics of each model are printed on the panel, with rated values in a box.

Encapsulated Type 380

Open Type 380
AVAILABLE FROM STOCK



Delay Lines

...STOCK TYPES FOR QUICK DELIVERIES

...SAMPLES AND "SPECIALS" TO EXACT SPECIFICATIONS

As engineering specialists in both wire winding and electronic equipment assemblies, Shallcross offers complete facilities for the design and large-scale production of delay lines in a variety of open and encapsulated styles for both highly critical as well as commercial uses.

Typical applications include use as compensating delays for color television, in signal delays for TV synchronizing signal generators, and in wideband distributed-type amplifiers.

Now available for prompt delivery is the Shallcross open-type 380 described below. This is a typical lumped parameter delay line using silvered mica capacitors conforming to JAN Style CM-15, Characteristic E. Many other types can be readily designed for specific applications. Quick delivery of prototypes! Send your specifications for prompt consideration by Shallcross engineers. SHALLCROSS MFG. CO., 526 Pusey Avenue, Collingdale, Pa.

SHALLCROSS TYPE 380 DELAY LINE

SIZE: Open Type: 2¼" x 1½" x 5/16"
Encapsulated Type: 2¼" x 1" x 1"

ELECTRICAL CHARACTERISTICS:
Maximum pulse voltage: ± 100 volts
Rise time: 0.04 microseconds
Total delay: 0.3 ± 0.03 microseconds
Impedance: 500 ohms
Cut-off frequency: 8.5 megacycles

Shallcross

Our 25th Year 1929 1954

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

Thin Gage Metals In Electronics

Herbert Schwartz

Sales Manager,

American Silver Company, Inc.,

Flushing, New York

MINIATURIZATION of components in electronics and other fields has created a small industry devoted to custom rolling of metals to extremely thin gages and high precision tolerances. The designer aware of the capabilities of this industry can not only improve present equipment, but can adapt or initiate future designs with these facts in mind.

Metals are being rolled to thicknesses down to 0.0005", to tolerances as close as ±0.0001", and in widths from 1/8" to 8". These precisions contrast sharply with accepted commercial rolling mill toleraces of ±10% in thickness for heavy gages and ±20% for material much thicker than 0.0005".

Not only does this new industry work to tolerances and thicknesses that most commercial rolling mills can not produce, but it handles quantities—particularly if wanted in a short time—that were not accepted for rolling previously. Quantities as low as one pound are rolled, an important fact for the small

Table 1. Tolerances to which various thicknesses of beryllium copper alloys can be rolled.

Thickness (in inches)	Commercial Tolerance	1/2 Commercial Tolerance	1/3 Commercial Tolerance
.004 and under	± .0004	± .0002	± .00013
over .004 to .006 incl.	± .0006	± .0003	± .0002
" .006 to .009 "	± .0008	± .0004	± .00026
" .009 to .013 "	± .001	± .0005	± .00033
" .013 to .017 "	± .0013	± .00065	± .00043
" .017 to .021 "	± .0015	± .00075	± .0005
" .021 to .026 "	± .002	± .001	± .00066
" .026 to .037 "	± .0025	± .00125	± .00083
" .037 to .050 "	± .003	± .0015	± .001
" .050 to .073 "	± .0035	± .00175	± .00116
" .073 to .130 "	± .004	± .002	± .00133
" .130 to .188 "	± .0045	± .00225	± .0015

manufacturer, the manufacturer who will produce a limited number of a particular item, or the experimental designer. The experienced metallurgists of these custom rolling mills are available to designers, and they have suggested many cost-saving uses.

Gage tolerances for these custom rolled metals as close as ±0.0002″ are held for thicknesses from 0.010″ to 0.006″. Tolerances as close as ±0.0001″ are held for thicknesses below 0.006″. For each of the metals listed in Table 3, there is a range of thickness tolerances for a given gage thickness. An example of these ranges is given in Table 1, where the tolerances for various thicknesses of beryllium copper alloys are given. Similar tables are available for the other metals processed by the industry.

Where the metal involved is either scarce or expensive, the need for precision thickness tolerances becomes more important. The precious metals, beryllium copper, molybdenum, tantalum, titanium, and the magnetic, high resistance or low expansion alloys are metals that fall into this category. For these metals, the savings in metal resulting from precision rolling usually more than pay for the extra charge for this rolling.

The use of thin metal or clad metal strips can save in grinding, lapping or electroplating operations. A new use for precision-rolled phosphor bronze is as a commutator on printed circuits. Silver strip is widely used as contact material. Instead of precision grinding and lapping certain parts used in subminiature components, the parts are now blanked from precision-rolled metal, at great savings.

Some companies have changed their production methods to take advantage of the new steel microshims. For example, where once parts were machined to within 0.001″ tolerance by expensive precision grinding, the same parts are now produced to commercial tolerances, and the manufacturers make up the difference with microshims in increments of 0.0002″ with a tolerance of ±0.0001″. High accuracy is thus obtained with considerable cost savings.

Fig. 1. Three forms in which clad metals are available: overlaid on one or both sides (top); inlay (middle); edge clad (bottom).

Clad Metals

Composite metals (clad metals) are playing an important role in the electronics industry. Clad metals possess properties not found in a single metal. Where electrical conductivity coupled with high strength and magnetic properties is required, copper clad on steel or silver clad on steel would be specified. Clad metals also result in economy—for contacts, silver clad on copper replaces solid silver. In addition, the use of clad metals effects labor savings, since each operation involves working with two or more metals at the same time. Table 2 gives the various combinations of clad metals available, and Fig. 1. shows the various forms in which one metal can be attached to another. One processer offers clad metal combinations in total overall thicknesses down to 0.001″, with overlay thickness down to 0.00001″ and in widths up to 4″.

Clad metal strip has been used in applications where electroplating proves difficult, impossible or uneconomical. In the manufacture of flexible waveguides, for example, it is cheaper to fabricate the flexible tubing members from extremely thin silver clad brass strip rather than to attempt to electroplate the finished lengths of tubing. Only a light overlay of precious metal is required, a common thickness for this application being 0.0003″.

Table 2. Some of the most common combinations of metals making up clad metals.

Non-Precious to Non-Precious	Phosphor Bronze-on-Copper Stainless Steel-on-Copper Brass-on-Steel Copper-on-Beryllium Copper Copper-on-Steel Nickel-on-Steel
Precious to Non-Precious	Silver-on-Beryllium Copper Silver-on-Copper Gold-on-Copper Gold-on-Nickel Silver-on-Monel Silver-on-Phosphor Bronze Silver-on-Steel
Precious to Precious	Palladium-on-Silver Platinum-on-Silver
Thermostat Metals	For appliance, automotive, room thermostat, circuit breaker and other industrial uses.

Table 3. Properties and uses for various custom-rolled, thin-gage metals.

Metal	Paper-thin metal properties important in electronic applications.	Major uses in the electronic, instrumentation, aviation and allied fields.
Aluminum	Lightweight, corrosion-resistant, flexible, good electrical conductor, non-magnetic. Easily worked.	Electrolytic capacitors and condensers. Tube shields. Radar trailing equipment. Microwave reflectors. Indicators of all types. Waveguide material.
Beryllium Copper Alloys	High strength, high electrical conductivity and excellent resistance to corrosion and wear. Non-magnetic; easy to harden; easy to work—can be readily blanked, formed or deep drawn before hardening.	Mechanical and current-carrying springs. Electrical contacts, switch parts, circuit breakers. Diaphragms, bellows, and other pressure responsive units for regulator equipment. Wire terminals for electronic computors. Bearings, bushings.
Copper	Corrosion-resistant. Excellent electrical and thermal conductivity. Easily worked.	Electrical connectors, switches and wiring devices. Waveguide material. Printed circuits. Meter parts and signal devices.
High Nickel Alloys	Resistant to corrosion and wear. High thermal conductivity: retains strength at elevated temperatures.	Vacuum tube components. Magnetic cores, magnetic shields and components. High precision instrument transformers. Telemetering devices, thermo-switches and temperature control instrument components. Circuit breakers, voltage regulators, relays. X-Ray tube components.
Nickel Silver	Tough and highly resistant to corrosion and fatigue. Highly malleable and ductile.	Diaphragms, springs. Contact material on commutators for low-current purposes. Trim. Hardware.
Phosphor Bronze	High tensile and yield strength, good ductility, resiliency, high fatigue strength, wear resistance, and good bearing qualities.	Magnetic cores for potentiometers used as transmitters in servo systems. High strength springs and fastenings. Electrical contacts, sliding contacts in printed circuits. Diaphragms, bellows.
Stainless Steel	High corrosion and heat resistance at elevated temperatures. Exceptionally ductile—readily fabricated.	Corrosion-resistant springs and stampings. Non-magnetic components. Switch parts. X-Ray tube components. Diaphragms and bellows. Instrument and gauge parts. Name plates and instrument paneling.
Tantalum	Extremely non-magnetic. Malleable, ductile and corrosion resistant, with tensile strengths comparable to cold rolled steel. High melting point; low thermal expansion.	Electronic tube components—anodes, grids, etc. Electronic controls, amplifiers, condensers, oscillators, capacitors. Components for telephone equipment, timing devices, signal and alarm systems.
Titanium	Extremely strong, yet lightweight. Excellent corrosion resistance and ability to withstand high temperatures.	High-precision instrument parts. Metering equipment components.

precision electronic instruments by DeJUR

Model R-210

The DeJUR 2½"
RUGGEDIZED
Round Panel Meter

★ Exceptional resistance to shock and vibration.

★ Internal shock mounts are symmetrical for uniform lateral and horizontal excursion.

★ Unique external shock mount at flange cushions scale window, supplements internal shock-proofing.

★ Special shock mount rubber provides high dielectric strength, good low temperature characteristics, resistance to corrosion due to heat.

★ Hermetically sealed window and terminals are soldered to a one-piece drawn steel housing for positive immersion and weather resistance.

★ Qualified under spec. MIL M-10304 SIG. C.

★ Prototype to production on short notice.

For further information write DeJUR-Amsco Corporation, Dept EDR-4, 45-01 Northern Boulevard, Long Island City 1, New York.

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45-01 NORTHERN BLVD., L.I.C. 1, N. Y.

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

Fig. 2. The plug-in unit and its "Amphenol" base. The guide pins insure correct polarization.

Plug-in Diode Units

Fig. 1. A Diode Plug-in unit. The dimensions marked are for the 12-diode model. All the diodes can be readily tested in an easily constructed test set-up.

GROUPS of germanium diodes can be conveniently mounted in a new easily-serviced plug-in unit for such applications as computers, mixers, and other circuits using diodes. Manufactured in three sizes to accommodate either 8, 12, or 16 diodes, the unit, shown in Fig. 1, is dust proof and moisture resistant. Nonstandard units to accommodate any number

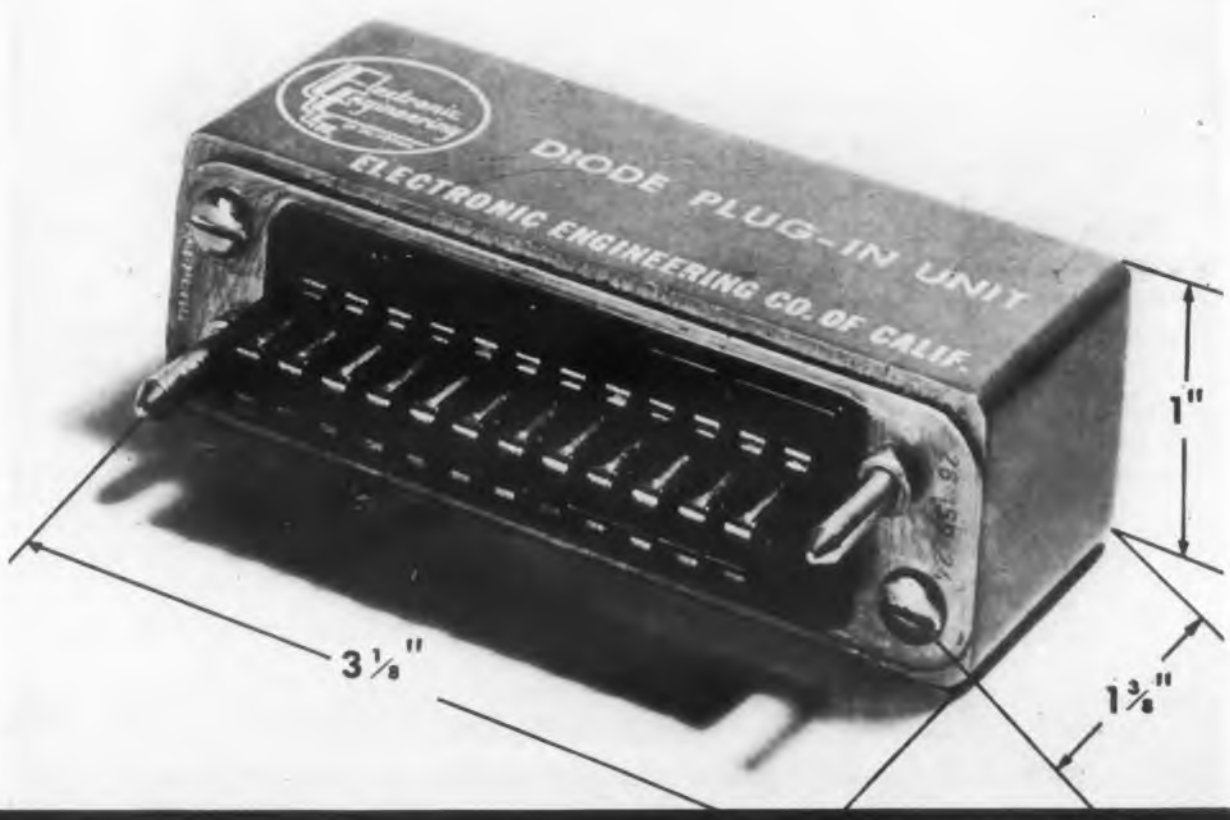

Fig. 3. By removing the two round head screws shown in Fig. 1, the components are quickly exposed for servicing. The cover is made of cast aluminum.

of diodes can be furnished to specification.

The new unit can be used to package clippers, limiters, d-c restorers, modulators or demodulators, second detectors, ring circuits, bridge circuits, rectifiers and diode gates. It also has many possibilities for packaging items used in fire control equipment. Components other than diodes may be included, if they are small enough. The electrical specifications for the units meet those of the packaged diodes.

Forward and backward resistance of each diode can be quickly and readily tested in easily constructed testing arrangements, reducing "down time" for the equipment. The unit is manufactured by Electronic Engineering Company of California, 180 South Alvarado Street, Los Angeles, Calif. The cover is made of cast aluminum with a baked gray enamel finish, as shown in Fig. 3.

Construction of the plug-in unit is such that the plug to which the diodes are soldered, as shown in Fig. 3, can be readily removed by loosening two screws. Correct polarization of the germanium diodes is assured by means of guide pins which prevent the plug from being inserted incorrectly in a circuit, as shown in Fig. 2. The type of "Amphenol" socket required with this unit is also shown in Fig. 2.

Width and seated height for all models are 1" and 1 3/8", respectively. The lengths of the 8-diode, 12-diode and 16-diode units are 2-7/16", 3-1/8" and 3 3/16", respectively.

for the most exacting DC regulation!

a super-precision POWER SUPPLY

MODEL
D3-300-E

DRESSEN- BARNES
MULTIPLE POWER SUPPLY

FOR EXTREMELY CLOSE REGULATION, despite drastic load or line variations, the Dressen-Barnes Model D3-300-E provides unsurpassed performance. Actually four power supplies in one, it is suitable for a wide variety of applications. Designed and manufactured by Dressen-Barnes — long noted for efficient, high-performance DC power supplies—the Model D3-300-E Super-Precision Power Supply is the culmination of extensive research. The condensed specifications below, which cover but two of the four outputs, illustrate how this equipment can ensure precision results.

RATED AT:	Zero to 300 V. DC, at 300 MA.
REGULATION:	From no load to full load: .003 V. load variation (or .001%).
RIPPLE:	Only 100 Microvolts.
TRANSIENT RESPONSE:	.01 Milliseconds.
OUTPUT IMPEDANCE:	0.01 ohm.

(Input is 117 V. AC, single phase, ±10%, from 50 to 800 c.p.s.; dimensions are: 8¾" H, 19" W, 18" D; Net Wt.: 82 lb., Ship. Wt.: 122 lb.)

FOR INFORMATION SHEET, WRITE TO:

DRESSEN-BARNES Corp.

250 N. Vinedo Ave., Pasadena 8, Calif.
'phones: SYcamore 3-0691 and RYan 1-7041

PIONEERS IN HIGH VOLTAGE DC POWER SUPPLIES

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

High Drain Alkaline Batteries

LONGER life and improved high current drain characteristics upon initial discharge are outstanding features of the small rechargeable battery shown in Fig. 1. It is an alkaline-silver-zinc cell known as the "Blue-Point Silvercel" and it retains its charge while stored.

Manufactured by Yardney Electric Corporation, 105 Chambers Street, New York 7, N. Y., the batteries can be used in underwater ordnance, guided missiles, portable gear and for aircraft applications. They are available in 1/2, 1, 3, 5, 15, 20, 40, 60 and 100 ampere-hour capacities.

Life expectancy may run as high as 125 complete cycles. The new cells do not show a small drop at the beginning of each high-rate discharge, as illustrated in the graph in Fig. 2.

The Blue-Point Silvercel gains its improved characteristics from a new type of electrode construction, a new electrolytic, and improved separator materials that include ion exchange compounds to inhibit shorting between plates and thereby increase battery life.

Fig. 1 (right). This Blue-Point Silvercel alkaline battery is available in sizes from 1/2 to 100 ampere-hours.

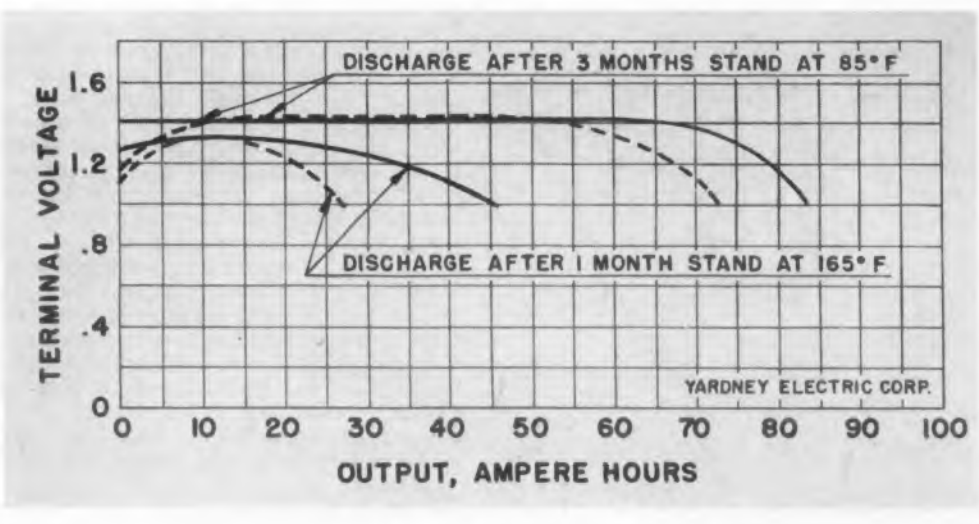

Fig. 2. A terminal voltage vs output comparison of the Silvercel (solid line) with an ordinary alkaline battery (broken line).

Fig. 1. The printed circuit high-pass filter removed from its enclosure.

Printed Circuit High Pass Filter

TELEVISION receivers designers can incorporate a new compact, printed, high, pass filter in their set designs to suppress interference which occurs at frequencies of 54Mc and below. Shown in Fig. 1, the printed circuit unit is a product of Photocircuit Corporation, New Street, Glen Cove, N. Y.

The filter unit, whose circuit is shown in Fig. 2, consists of three sections: a middle "T" section designed from constant 4K formulas with an impedance of 300 ohms and a cutoff frequency of 54Mc; and two "M"-derived terminating end sections designed for severe attentuation at 43Mc and to terminate the filter with an input and output of 300 ohms each.

The filter is mounted in a metal container with two terminal strips representing input and output connections. The filter is grounded internally to the container. The circuit is printed on both sides of a transparent insulating sheet.

The preferred manner of connection is to insert the unit as close to the antenna connection as possible. The metal case is grounded by attaching it directly to the chassis of the set or by a short lead between case and chassis. The designer should try various grounding points.

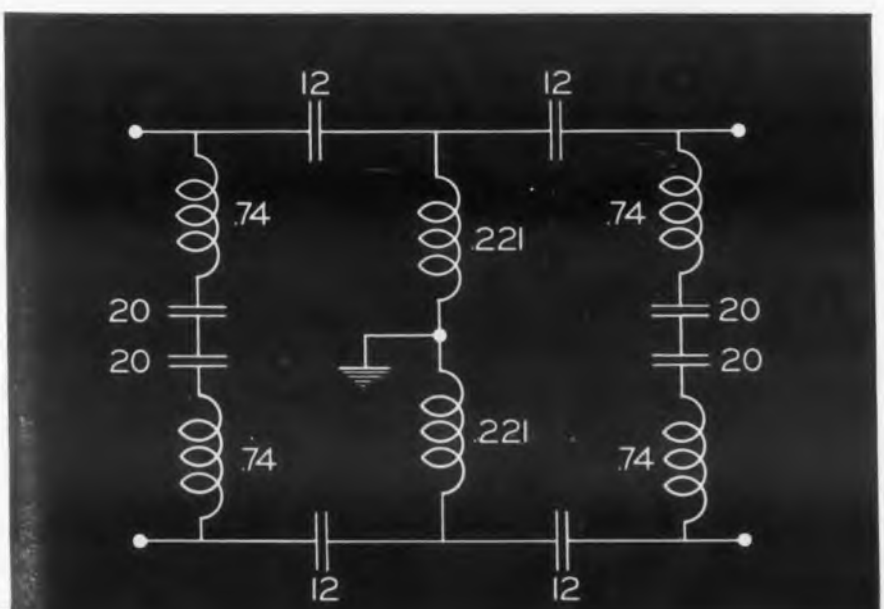

Fig. 2. Circuit diagram of the filter. Capacitances are in micromicrofarads and coils in microhenries.

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- **Built-in centering device.**
- **Flexible nylon adjusting shaft eliminates breakage.**
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Ft. Wayne 8, Indiana
Irv. M. Cochrane Co.
408 So. Alvarado St., Los Angeles, Calif.

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

New Products . . .

Compact Pulsescope

Weighs 22 lb

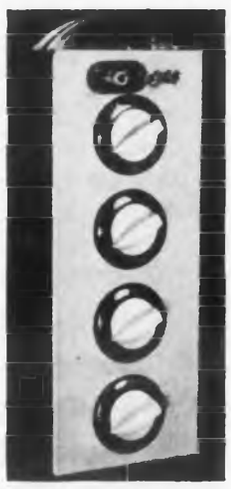
This Pulsescope features instantaneous direct-reading d-c calibration of either positive or negative going signals. The unit has a vertical amplifier sensitivity of 0.2v rms/inch, a response from d-c to 5Mc within 3db or pulse rise of .1μsec and internal intensity modulated markers of 1, 10, 100 or 1000μsec.

Repetitive or trigger sweep is variable from 5cy to 500kc with a five-fold sweep expansion. Sweep, marker and d-c calibrating voltages available externally. Operates from 50 to 400cy at 115v a-c. It is 8-1/2" x 6-3/4" x 13-3/4" in size and weighs 22 lb. Waterman Products Company, Dept. ED, Philadelphia, Pa.

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

Decade Resistance Box

High Accuracy, Low Cost



This Decade Resistance Box has a range of 0 to 11 megohms in 1000 ohms steps, four decades. With it, the user can increase or decrease the resistance in a circuit to determine the amount needed for best operation.

Accurate to $\pm 1\%$, the low-cost unit should have wide application for work with grid resistors, plate resistors, and lead and lag networks. Inherently stable deposited carbon resistors are used throughout. The box measures 10" x 4" x 2-1/2" high. Stuart F. Louchheim Co., Dept. ED, 1229 N. Broad St., Philadelphia 22, Pa.

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

D-C Amplifier

Output Linear Within 0.01%

The Model 3501 DC Amplifier was designed for special-purpose computer circuits where accuracy is of the utmost importance. The output is linear within $\pm 0.01\%$ of maximum output up to ± 140v for loads as low as 10,000 ohms and up to ± 100v for loads as low as 5000 ohms. Output ripple is less than 0.50mv rms and the normal 24-hour drift for a temperature rise from 10°C to 60°C is less than 0.5mv after a 15-minute warmup.

The normal open-loop gain exceeds 10^5. Fixed gains may be obtained accurate to $\pm 0.01\%$. The plug-in chassis may be mounted wherever convenient, since there are no operating controls on the chassis. The Ralph M. Parsons Company, Dept. ED, 135 West Dayton St., Pasadena 2, Calif.

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

Signal Generator

Constant Amplitude Unit

The Type 190 Constant Amplitude Signal Generator generates sine waves in the 350kc to 50Mc range. Output amplitude varies less than 2% from 350kc to 30Mc, and less than 4% from 30Mc to 50Mc. Frequency is continuously variable in six ranges, with frequency indication accurate to 2%. Output amplitude is continuously variable from 4mv to 10v peak-to-peak in 10 ranges.

Output impedance of the unit is 52 ohms. Weight is 24 lb. Tektronix, Inc., Dept. ED, P. O. Box 831, Portland 7, Ore.

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

High-Permeability Cores

Made in Sizes to 20″ O.D.

These Permeron nickel-iron cores are available in a wide range of sizes up to 20″ O.D. for torodial windings. They feature high permeability and steep hysteresis curves. I-T-E Circuit Breaker Co., Mechanical Rectifier Division, Dept. ED, 19 and Hamilton Streets, Philadelphia 30, Pa.

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

Multi-Range Meter

Automatic Overload Protection

This Multi-range Type 430 Meter features an automatic overload cut-out. A red button on the front panel pops up whenever any one of the 29 a-c or d-c voltage ranges or the six d-c current ranges is overloaded. Pressing the button down returns the meter to service. The unit has a single range switch and is accurate to 1-1/2% and 2-1/2% for d-c and a-c measurements, respectively. Sensitivity is 20,000 ohms per volt. Current ranges are 50μamp to 10amp. Resistances are measured from 0 to 20 megohms. Dimensions are 8-1/4″ x 5-7/8″ x 3-1/8″. Weight is 3 lb. 8 oz. Compagnie Generale de Metrologie, Annecy, France.

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

Line Cord Sets

Thermoplastic Insulated

These "US-YR-CORD" line cords are supplied with molded or attached plugs, molded and attached connectors, molded crotches, harnesses and other special types of construction.

The cords are thermoplastic insulated and Underwriters' Laboratories approved. U. S. Wire & Cable Corp., Dept. ED, Progress & Monroe Streets, Union, New Jersey.

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

New Products . . .

Square-Wave Generator

With Rise Time of 0.02μsec

The Model HF-101 is a wide-range square-wave generator covering a frequency range of 5cy to 5Mc. Frequencies still lower and higher can be obtained by the use of an external capacitor. Waveform symmetry is adjustable.

Output impedances of 75 ohms and 500 ohms are provided. Rise time is approximately 0.02μsec. The power supply is regulated, and a standby switch and indicator are incorporated for convenience of operation. Linear Equipment Laboratories, Dept. ED, Brightwater Pl., Massapequa, L. I., N. Y.

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

Permanent Magnet Motor

Miniature, 1/400hp Design

The Type PM-47 miniature permanent magnet motor is suggested for application to small fans, blowers, and other similar lightweight and light load applications. It is rated at 1/400hp with an operating rotor speed of 10,500 rpm. Designed for continuous duty, it draws 0.18amp at 27v d-c, and has a total weight of 5 oz.

Dimensions are 1-13/16" long x 1-1/8"diam, and the 1/8"diam shaft has an extension length of 1-1/16". Other lengths, and special arrangements including splines, keyways, gears, etc., can be provided where required. Electrical connections can be provided in a number of arrangements to suit application requirements (an integral lead type is illustrated). Dalmotor Co., Dept. ED, 1375 Clay St., Santa Clara, Calif.

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

Electronic Motor Control

Operates by Magnetic Tape Recorder

This electronic Variable Speed Motor Control System can be operated remotely or by memory with magnetic tape recorders, offering design possibilities for automation. The system handles motors up to 3hp. Besides many standard models, special designs can be specified. Servospeed Division, Dept. ED, Electro-Devices, Inc., 4 Godwin Ave., Paterson, N. J.

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

Digital Computer

General-Purpose, Low-Cost Design

The "Circle Computer" is a low-cost, small size, electronic digital computer especially suited to the needs of the research laboratory or engineering firm. Easily operated, it is built up from small logical units which are each built on a separate chassis.

Overall dimensions are 3' x 4' x 6'. The computer

contains 700 vacuum tubes and consumes 3-1/2kw for a 110v single phase power source. A magnetic drum rotating at 59rps is employed as the memory element. Its capacity is 1024 words, with each word consisting of 40 binary digits plus two sign digits, equivalent to 12 decimal digits, plus sign. The multiplication time is 45millisec.

All controls necessary for operation appear on the operator's console. A complete installation consists of the computer, control console, and two electric typewriters with associated punch and reader. Input is by means of a typewriter or a punched paper tape reader; for output, the computer may operate a typewriter, a paper tape punch, or both. Circle Computer Division, Nuclear Development Associates, Inc., Dept. ED, 80 Grand St., White Plains, N. Y.

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

Teflon-Rulon Sample Kit

For Design Experimentation

For experimental uses, this sample kit contains specimen shapes of both Teflon and Rulon weighing about a pound altogether. Contents of the kit vary from box to box, but always consist of at least four inches of Rulon rod, a machined piece of Rulon, extruded Teflon rod (including one piece 12″ long and one at least 1″ in diameter), extruded Teflon tubing, small Teflon molded and machined samples, and Teflon spaghetti tubing. Dixon Corporation, Dept. ED, Bristol, R. I.

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

Single Crystal Germanium

High Homogeneity

Single crystal germanium is available from this company in commercial quantities in the resistivity ranges and conductvity types required for the manufacture of semiconductor devices.

The crystals, which are produced by special refining and doping methods, are free of bounderies, dendrites, lineage flaws, and banding or striation patterns. They are homogeneous in electrical as well as crystal properties. Semi Metals Company of America, Dept. ED, 2417 Federal Street, Philadelphia 1, Pa.

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

Regulated High-Voltage Supply

Output from 700 to 2020v D-C

This moderately priced Model RE-2002 Power Supply delivers from 0 to 25ma over an output range of 700 to 2020v d-c. The voltage is accurate to within ±2%. Full load regulation is maintained for line voltage fluctuations from 105 to 125v. It can operate down to 50cy.

The use of a balanced, two-stage, high-gain feedback amplifier yields a stability ratio of 10^6, and an internal impedance under 0.5 ohm at d-c. Ripple is under 0.5mv peak to peak. This unit is especially useful for klystron applications.

Either the positive or the negative side may be grounded. All controls are on the front panel. Only standard-type tubes, all commonly available, are used. Mounted on a standard 8-3/4″ rack panel, the unit is 10 1/2″ deep. Northeast Scientific Company, Dept. ED, 1 Gray Street, Cambridge 38, Mass.

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

Unit Amplifier

For Audio and Ultrasonic Frequencies

The Type 1206-B Unit Amplifier is a high-quality general-purpose laboratory instrument. With a maximum output of 3w, it is adequate for driving many low-power transducers. Because less than 1v input is required for full output, it can operate directly from the output of many electro-acoustic and electro-mechanical devices, such as sound-level and vibration meters, to amplify their outputs for such purposes as operating graphic recorders.

The frequency range extends from below 10cy to about 250kc, so that both low-frequency and high-frequency signals can be handled. Outputs from random-noise and other low power generators and oscillators can also be amplified.

Harmonic distortion into a load of 600 ohms is less than 1% at 2w output, and less than 2% at 3w, from 20cy to 40kc. The amplifier is designed to operate from the Type 1203-A Unit Power Supply which can be attached to form a single rigid assembly. General Radio Co., Dept., ED, 275 Massachusetts Ave., Cambridge 39, Mass.

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

Slideback Voltmeter

For Absolute or Relative Measurements

The Slideback Voltmeter is designed for precision measurement of voltages on an absolute or relative basis. For ratios of 300v, dials are direct reading to six places. For absolute readings, a standard cell is encased with each unit to permit adjustment of voltages to an absolute value. For relative readings, the voltmeter may be connected to a prime source and used to adjust other voltages to a ratio of the prime source or to determine the ratio between two voltages.

The indicator permits sensitivities of 0.2ma. The voltmeter should have many applications in research and development, as well as in testing and in field calibration of equipment. Cal-Tronics Corp., Dept. ED, 11307 Hindry Ave., Los Angeles 45, Calif.

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

New Products . . .

Induction Motors
Have Offset Driveshafts

An adaptation of the Series 500 Induction Motors makes it possible to mount these small fractional-hp units in hard-to-reach places. A redesigned gear box brings the final shaft out of the gear housing at any one of five different locations (including the standard power takeoff in the center of the system).

Shaft speeds available in the motors range from one revolution in three days, to a top speed of 600 rpm. The motors are synchronous or non-synchronous motors operating on a-c only. Standard takeoff shaft length is 1", but shafts up to 2-1/2" long can be supplied. Various torques are available. The offset drive can be built into reversing motors, and non-synchronous motors can be ganged to produce a single unit of heavier load capacity. Gleason-Avery Co., Dept ED, Auburn, N. Y.

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

Power Supply Regulator
Has Low Output Impedance

The "Super-Regulator" converts ordinary power supplies to provide extremely low output impedance and ripple. Stable high gain amplifiers and pentode series passing tubes make the regulator immune to variations of the power supply preceding it. Etched circuit construction is utilized throughout, and there are no electrolytic capacitors in the operating circuitry.

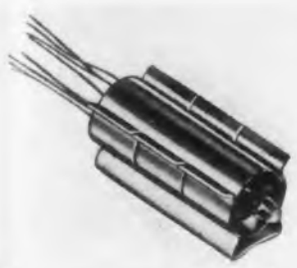
The regulator can be used for either positive or negative output voltage. Terminals are provided for connecting a Model 122 Chopper Stabilizer to give absolute long-time stability to the output voltage.

Voltage range is 200-350v; current range is 0.450ma. Load regulation for full load current change is 0.01%; line regulation for 10% line voltage change is 0.03%. Hum and noise output, measured over 1Mc is 50mv or less. Voltage stability is 0.2%. Kalbfell Laboratories, Inc., Dept. ED, P. O. Box 1578, 1090 Morena Blvd., San Diego 10, Calif.

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

Subminiature Tube Holder

Withstands Rough Applications



This subminiature Tube Holder is made of cadmium-plated spring steel with a silver-plated brass tube shield. It provides a space-saving, economical, and convenient means for firm holding in fixed positions in relation to a mounting surface. Subminiature tubes held by the holder withstand high shock and vibration of mobile electronics, such as in guided missiles. Electronic equipment using this type holder has withstood tests of 10cps to 500cps from 5G to 20G for 8 hours without resonance.

The design provides: ready removability of the tube from the holder in the event that replacement of the component is necessary; efficient conduction of heat away from the component to the body on which the holder is mounted; and automatic adaptation to thermally caused dimensional changes. These component holders are available in the following sizes: 0.175″, 0.195″, 0.235″, 0.260″, 0.312″, 0.375″, 0.391″, 0.400″, 0.562″, 0.670″, 0.750″, 1.00″, and 1.12″ ID, lengths to 2″. Atlas E-E Corp., Dept. ED, Bedford Airport, Bedford, Mass.

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

Electric Furnaces

Provide Close Control

The "Dyna-Trol" line consists of over 40 standard industrial furnace models, with special models also available. The furnaces (with up to 2000°F or 2300°F temperature ranges) will reproduce any time-temperature curve within ±3F°. This accuracy has permitted them to be used for calibration and instrumentation.

The furnaces have infinite zone control from 8% to 100% of input, providing for accurate equalization of vertical zone temperatures at any time-temperature curve. Once the furnace has reached desired level, it can be maintained at ±3°F. The furnaces are equipped with "Cyber-Tac" temperature controllers to indicate, or to hold, or cut off temperatures to ±2% of full scale temperature reading. L and L Manufacturing Co., Dept. ED, Chester 43, Pa.

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

The Digitester $1185.00

Telecomputing's new digital instrument

measures resistance, voltage and current with push-button speed

The versatile Digitester serves as a combination digital volt-ohm-milliampere meter, gives you 0.1% accuracy and .8 second speed. In addition, readout is in decimal numbers instead of analog form.

Wide measuring ranges are an important advantage of the Digitester. You can measure up to 10 megohms, 1000 volts, or 1 ampere. Maximum accuracies (lowest scales) are ±.01 ohms; ±.00001 volts; ± .01 microamperes.

Operation does not involve any manual adjusting or balancing. You simply press a panel button to get decimal readout.

A digital ohm meter called the Digitohm is also available at $985.00. It measures resistance with the same speed, accuracy and wide range as the Digitester.

Specifications on the Digitester and Digitohm will be sent you upon request. Please address inquiries to Preston W. Simms, Dept. ED-4.

TELECOMPUTING CORPORATION

BURBANK, CALIFORNIA • Washington, D. C.

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

New Products . . .

Direct Reading Counter

Has Five Divisions Per Digit

The unit wheel of this counter has five divisions per digit which, combined with the white indicator line etched on the cover, makes for easy, accurate reading. The counter will operate at speeds up to 1500rpm, giving a count reading of 150,000 increments per minute because of the graduations on the unit wheel. Mounting is done through four mounting holes in the base of the frame.

Applications for this counter include directional or navigational instruments where there is a requirement for a servo-driven indicator to register increments of measurement. The unit is rustproof throughout. Figures are 3/16" high x 9/64" wide. Durant Manufacturing Co., Dept. ED, 1993 N. Buffum St., Milwaukee 1, Wis.

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

Miniature Connectors

Bayonet Locking Type

Completely weatherproof when connected, Series "B" bayonet locking miniature electrical connectors are particularly suitable for airborne and electronic equipment, or power applications, where space and weight are important considerations.

Quick engagement and disengagement of plug and receptacle are effected by the bayonet locking coupling. Weatherproof sealing is accomplished at the plug cable opening by a threaded gland nut expanding an internal synthetic rubber gasket. Polarization of contacts is provided by keyways in the shells.

Contacts are gold plated over silver. Molded insert bodies are mineral filled melamine. Connectors are available with insert arrangements containing 12, 14, or 24 contacts. Mounting flanges on receptacle shells have four 1/8" diam holes. Voltage breakdown between contacts at sea level is 2600v d-c, at 60,000 ft is 1100v d-c. Winchester Electronics, Inc., Dept. F, Glenbrook, Conn.

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

This Motor
Runs on Only
75 MILLIONTHS
of a watt

What's this to you?
Just this—

Perhaps RAM can *also* help YOU when you need a component to do a job electrically, electro-mechanically or electronically.

This small, versatile, highly flexible factory specializes in special-purpose devices designed, developed and manufactured to your order — either short runs or production quantities.

When you need this kind of help—CONTACT

Servicing the Air Force, Navy and civilian industry, in some cases the seemingly impossible has been accomplished to save our customers thousands of dollars.

Send for new Brochure K54—illustrating devices that have solved problems for others.

RAM METER, INC.

Founded 1936

1108 Hilton Road
Ferndale
DETROIT 20, MICHIGAN
Telephone Lincoln 4-7220

CIRCLE ED-58 ON READER-SERVICE CARD

Coaxial Connector Kits

Offered in Three Types

"RF" Coaxial Connector Kits each consist of a heavy plastic compartmented case with 18 connectors and a functional wiring diagram. The kits serve as portable "parts cribs" to save time and labor on experimental and prototype work.

Kit No. 1 contains Type "BNC" connectors for use on small coaxial cables. Kit No. 2 contains Type "UHF" connectors for use in non-constant impedance applications.

Kit No. 3 contains several Type "N" connectors which are designed for use on microwave applications. Schweber Electronics, Dept. ED, 122 Herrick Rd., Mineola, L. I., N. Y.

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

Varistor Kits

For Experimental Applications

These two "Thyrite" varistor kits provide a variety of miniature disk-type and rod-type varistors for experimental applications in electronics, communications, power control, and allied industries. "Thyrite" is a non-linear resistance material which has been used for many years in this firm's lightning arrestors and which is also valuable for the solving of many circuit problems.

Kit No. 1 (Cat. No. 108L338G1) contains 12 miniature disk-type varistors, two each of six ratings. Kit No. 2 (Cat. No. 108L338G2) contains 10 rod-type varistors, two each of five ratings. All varistors are color coded with connecting leads. Both kits contain data tables of physical and electrical properties and log-log volt-ampere characteristics graphs. Distribution Transformer Dept., General Electric Co., Dept. ED, Schenectady 5, N. Y.

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

UNRELIABILITY IS NOT FUNNY

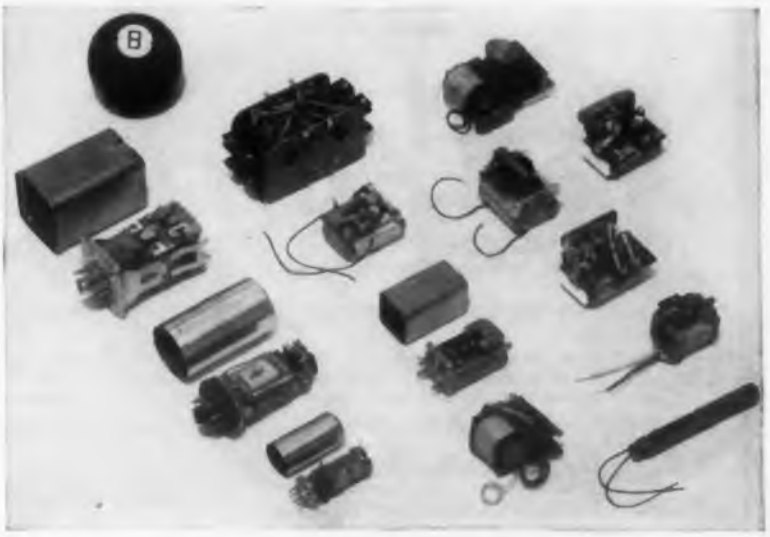
A competitor has taken us to task.* Because we are delighted to find somebody *else* willing to come out and admit just who he is and what he's up to, we'd like to answer him candidly, even though it seems he's missed our point quite a bit.

He implies we treat *unreliability* as a joke, and our customers as naive to expect anything better. To straighten him out:

— what we think is *funny* is the way some customers distill the story of what they want to accomplish into pure mathematics and formal specifications and *then* expect reliability;

— what we think is *pathetic* is the way an unreliable relay disappoints a member of that growing body of good customers who are naive enough to let their hair down, skip the formalities, and tell us what they are after. So little do we like this that we just announced (in the January ad which teed off our friend) respectively our fifth and sixth design attempt to do one particular job right.

It may be that our friend mistakes willingness to talk turkey in turkey-talk with mere frivolity, but that's a small crime. His ad is good and worth reading.



At all events, here are 13 relays (not counting the eight ball) which we now have in various stages of development, only three of which have had their first shiver under public scrutiny.

6 exist by reason of dissatisfaction with reliability of existing products.

7 exist by reason of a frontier which, 'though it may be neither new nor romantic, we think can be cracked. Their nature is briefly indicated just in case anyone else wants to get into the argument.

If you can't tell which is which, don't be surprised. As we said, only three are ready to talk about. But even so there's no harm in letting us know if you're interested in things indicated above or anything else, for that matter.

DC POLAR RELAYS

- Multi-circuit heavy current switch.
- DPDT or SPDT three-position non-mechanically centered.
- SPDT very high speed telegraph or information repeater.
- DPDT or SPDT low cost.
- SPDT miniature three-position.

DC NEUTRAL RELAYS

- Sensitive high current SPST.
- Very sensitive and precise miniature.
- Low cost DPDT.
- SPDT midget low cost.

AC RELAYS

- 400 cycle (non-rectifier).
- Constant voltage temperature compensated high overload rated.
- Tuned (resonant) (1200-2800 cps).
- Self-synchronous aperiodic motor for pulse counting (0-60 cps).

* See page 88, Scientific American, March 1954 He isn't really a competitor, he makes meter-movement relays which are a couple of orders more sensitive than anything we make, and have different limitations Ours are often used between such types and the load to give maximum protection to delicate contacts

SIGMA

SIGMA INSTRUMENTS, INC.

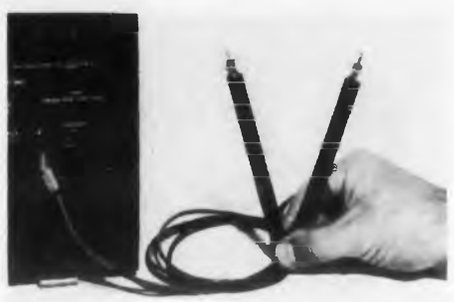
91 PEARL ST., SO. BRAINTREE, BOSTON 85, MASS.

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

New Products . . .

Test Leads

Have Lucite Handles



These No. 304 test leads are intended for use with standard voltmeters, multimeters, vacuum tube voltmeters, and similar equipment. They have Lucite handles 5" long x 3/8"diam which withstand the roughest conditions and furnish reliable protection against high voltages. The ends are fitted with small threaded chucks which take phonograph-needle test tips. Needles can be inserted with either blunt or sharp points outward.

The handles are colored red and black respectively and carry 45" lengths of kinkless, flexible leads with molded right-angle phone tip plugs. Insuline Corporation of America, Dept. ED, 3602 35th Ave., Long Island City, N. Y.

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

K-Band Test Horns

Cover 12,400-40,000Mc Range

When used as test receiving antennas, these precision-cast K-Band Test Horns serve such purposes as location of r-f leakage and approximate gain checks on microwave antennas. Employed as transmitting horns, they can be applied in antenna pattern measurements, illumination of parabolic reflectors or lens arrays, and for termination of high power systems into space. The horns have been developed in a series covering the frequency range from 12,400Mc to 40,000Mc.

Horns are precision cast in one piece and insure minimum deviation from the extremely close tolerances demanded at K-band frequencies. They also feature low vswr and low secondary lobes over the entire range. Type No. 68503 covers a 12,400-18,000Mc range; Type No. 68052, 18,000-26,500Mc; and Type No. 68501, 26,500-40,000Mc. Airtron, Inc., Dept. A, Linden, N. J.

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

Time Delay Relays

Hermetically Sealed Units

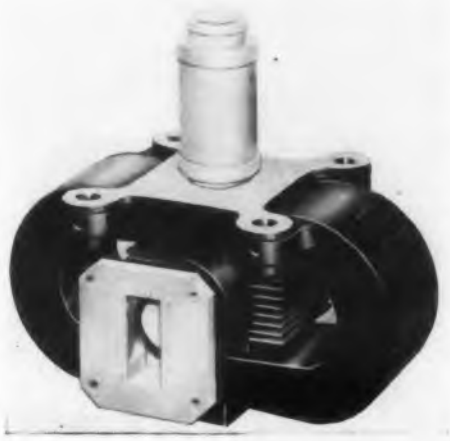
A line of hermetically sealed Time Delay Relays can be supplied for 50cy, 60cy, or 400cy a-c, or governed, or standard d-c motors. Designed to take up a minimum of space, the relays feature high accuracy and low power consumption.

The units are enclosed in a lightweight aluminum hermetic housing with 2-1/2" diam. The basic length for a single switch unit is 2-15/16"; governed or filtered motors, special or extra switches increase this dimension slightly. Three-stud or flange mounting is available. Electrical connection can be made with a glass seal header or an AN connector. The A. W. Haydon Co., Dept. ED, 232 North Elm Street, Waterbury, Conn.

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

Magnetron

Wide Temperature Range

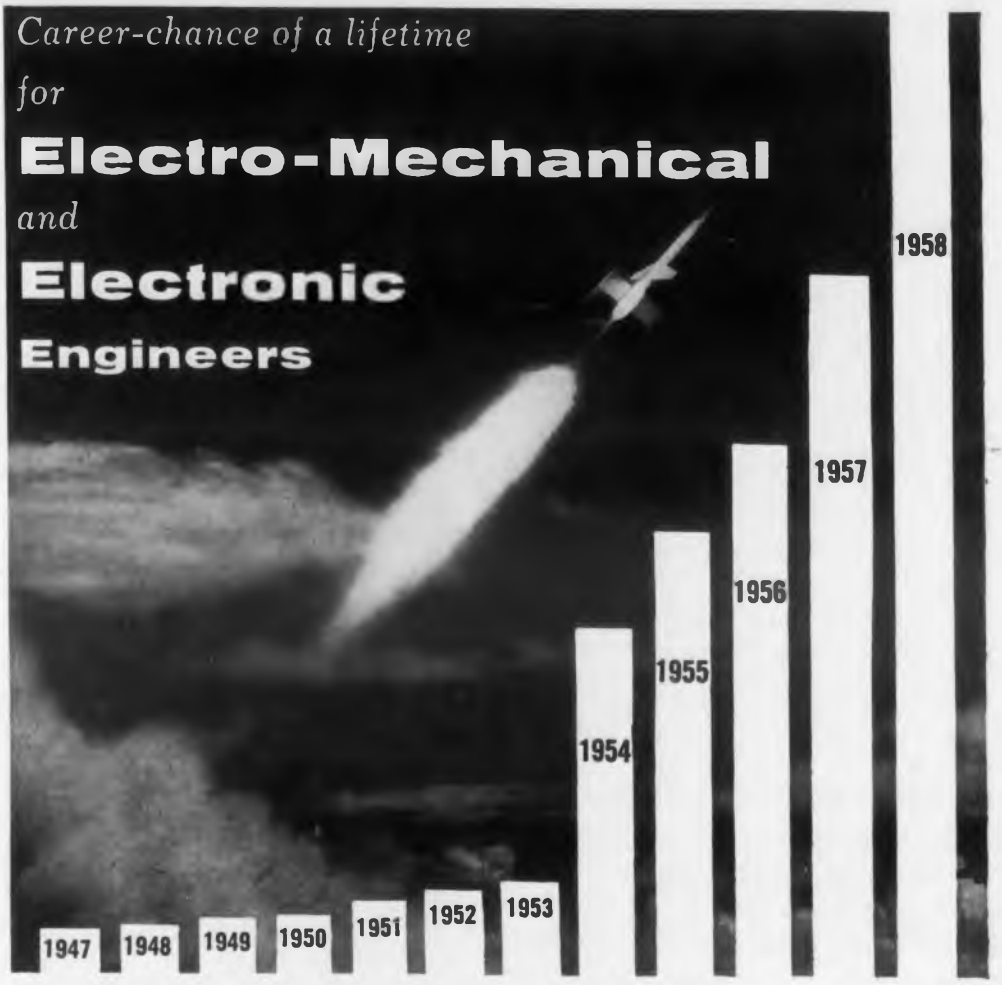


The redesigned Type *4J52* Magnetron incorporates a number of improvements while retaining physical and electrical interchangeability. For improved stability and life under all conditions, particularly with long pulses, the oxide-coated cathode has been replaced by the new Philips dispenser-type cathode; this cathode is fabricated from tungsten impregnated with barium aluminate and operates over a wider temperature range than the previous model.

A bifilar winding heater is used, reducing tube noise. All of the glass in the tube has been replaced by ceramic, allowing the tube to be baked out at considerably higher temperature, insuring gas-free operation throughout life in addition to increasing mechanical strength.

The anode is of the strap-vane type, highly reliable under steep pulse conditions. The waveguide output transformer of the tube has been designed for the center of anticipated load conditions. Microwave Associates, Inc., Dept. ED, 22 Cummington St., Boston 15, Mass.

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



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- Outstanding career opportunity comes rarely in a man's life. But such an opportunity exists now for Electro-Mechanical and Electronic Engineers in Lockheed's Missile Systems Division.
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The openings are for

ELECTRO-MECHANICAL ENGINEERS
with circuit or servomechanisms experience (aircraft or missile experience preferred)

ELECTRONIC ENGINEERS
experienced in any or all of the following fields: Micro-Wave Techniques, Electronic Components, Circuit Design, Flight Instrumentation

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my name

my field of engineering

my street address

my city and state

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

New Products . . .

Glass-Braid-Lacquered Wire

With Silicone Rubber Insulation

"Sil-X" Wire, designed to meet temperature extremes, is a UL-approved glass-braid-lacquered wire with G-E SE-460 silicone rubber insulation. It retains its flexibiliy at —60°F and maintains its strong physical and electrical properties as high as 400°F. Other advantages include high resistance to flex cracking, low dielectric constant, and an insulation that is fungus resistant.

Six sizes of the wire have been approved for use in lighting fixtures up to 200°C, and for radio and TV hookup wire at temperatures up to 150°C. It is recommended for use in oil and gas fired furnace control equipment and will be approved by Underwriters' Laboratories for use on devices or in appliances up to 200°C where the application demands that temperature rating; but the consumer must apply for approval. Essex Wire Corp., Dept. ED, Ft. Wayne, Ind.

CIRCLE ED-71 ON READER-SERVICE CARD

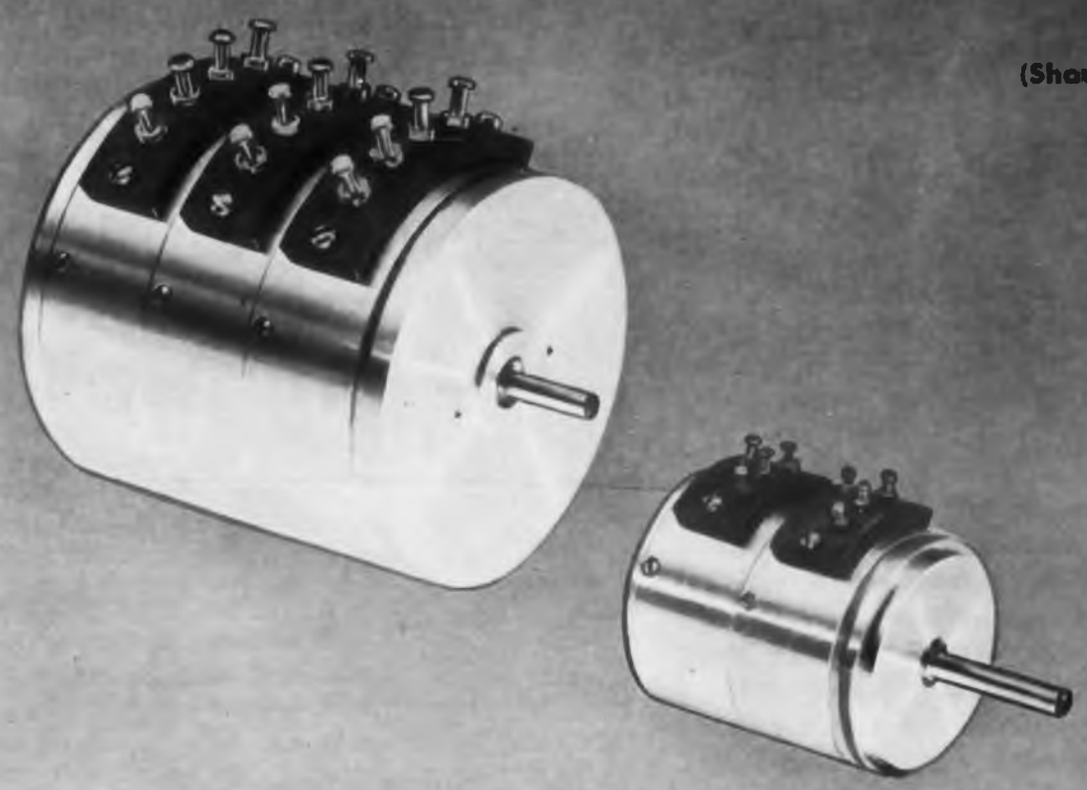
Metal Nameplate

Can Be Numbered in Typewriter

"Speedy-Cals" are easily fastened to curved as well as flat surfaces without the need for drilling holes. They permanently adhere to such surfaces as porcelain, glass, bakelite, wood, and metal, and they will not crack, peel, chip, or tarnish. These units can be numbered in a typewriter, if desired.

The nameplates are available in many colors, such as gold, red, yellow, green, blue, black, and many other shades, including clear aluminum. They meet most all applicable specifications for commercial as well as government work. Made for nameplates, trademarks, circuit diagrams, terminal diagrams, and many other uses, they are only 0.003" foil, laminated with a transparent bonding material. North Shore Nameplate Co., Dept. ED, Bank of Manhattan Bldg., Bayside, L. I., N. Y.

CIRCLE ED-72 ON READER-SERVICE CARD



(Shown actual size)

POTENTIOMETERS

all your precision potentiometer needs

TYPE 754—2" linear potentiometer—Resistance range from 800 ohms to 100,000 ohms. High linearity (±0.15% standard). Internal clamp rings permit ganging up to 8 cups on single shaft without increasing over-all diameter. AIA standard 2" servo mount. Depth is 1" with .594" added for each cup section ganged. Gold-plated terminals are easier to solder and have better resistance to corrosion.

TYPE 741—1⅛" linear potentiometer—Internal clamp rings permit ganging up to 5 cups on a single shaft without increasing the over-all diameter. Resistance range 500 to 25,000 ohms; linearity ±0.5% standard. Electrical angle 350°. Only 1⅛" in diameter and ⅛" long; starting torque is 0.25 oz.-in. The simplified slip ring construction and a one-piece paliney wiper give longer life and lower noise.

● ***Available immediately in sample quantities.*** Look to Fairchild for assistance in solving all your precision potentiometer problems. Fairchild has, or can make, a potentiometer to fit any requirement. For information write: *Fairchild Camera & Instrument Corp., Potentiometer Division, 225 Park Avenue, Hicksville, L. I., N. Y., Dept. 140-45N1.*

FAIRCHILD
PRECISION POTENTIOMETERS

ORE INFORMATION

Polyester Resin

High Heat and Chemical Resistance

A polyester resin, AR493, with superior chemical and heat resistance, has been added to this firm's basic line of polyester resins. The high heat resistance makes it valuable for use in electrical applications. The AR493 glass cloth laminates may have maximum continuous operating temperatures as high as 150°C, intermittent temperatures as high as 250°C.

The corrosion resistance, high strength, and light weight of the plastic, when reinforced with glass fibers, offer a practically unlimited number of fabricating applications. Chemical Materials Department, General Electric Co., Dept. ED, Pittsfield, Mass.

CIRCLE ED-74 ON READER-SERVICE CARD

Metal Strip

Coated With Silver Brazing Alloy

"Braze-Clad" is a metal strip (ferrous or nonferrous) clad on one or both sides with layers of silver brazing alloy of any specified thickness or melting range. To join metals, the strip is placed along the area to be joined, much like an adhesive is placed along the flap of an envelope, and heat is applied. The strip is available in coils or straight lengths in widths up to 4", and in thicknesses from 0.003" to 1/4".

Typical applications are joints in electronic tube assemblies, small instrument parts, timing devices, signal and alarm systems, and telephone equipment. The metal base in the strip anchors the silver brazing alloy so that it "flows" but remains in place and keeps its uniform thickness during the heating cycle. The result is a uniformly controlled, sound joint, with no voids, pockets, or oxide islands. Blind joints and joints of long cross-section can be made readily.

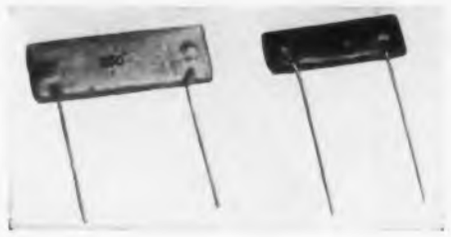
The strip can be blanked, stamped and drawn. It can simplify assembly by making such preplacements as rings, washers, or special shapes unnecessary. Industrial Division, American Silver Co., Inc., Dept. ED, 36-07 Prince St., Flushing 54, N. Y.

CIRCLE ED-75 ON READER-SERVICE CARD

New Products...

Wire-Wound Resistors

Withstand Humidity, Temperature



"Econ-Ohm" resistors are individually wound with high grade resistance wires on non-hygroscopic ceramic cores to which are attached tinned copper leads in such a way that stresses put on them in any way will not injure the resistance wire. The resistance wire junction to the terminals is embedded in solder and provides a secure, permanent connection. The units are then coated with a newly developed silicone cement which makes resistors completely impervious to moisture and capable of withstanding 90-95% relative humidity for extended periods of time.

Resistors may be operated at full watt rating and at a temperature not exceeding 275°C. Standard ratings are 3w, 5w, 7w, 10w, 15w, and 20w, with respective sizes of 1-3/16" x 1/2", 1-5/8" x 9/16", 2" x 9/16", 2" x 3/4", 2-1/2" x 3/4" and 3" x 3/4". Tru-Ohm Products, Division of Model Engineering & Mfg. Company, Inc., Dept. ED, 2800 N. Milwaukee Ave., Chicago 18, Ill.

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

Midget Torque Screwdriver

Prevents Thread Stripping

The Model J Midget Torque Screwdriver is factory preset to the desired torque requirement. Torque adjustment screws make it possible to adjust the screwdriver to exact torque. The tool is manufactured with an interchangeable handle and can be supplied with a jeweler's finger guide (as illustrated) or with a knurled type. It has many applications in the assembly of small mechanisms, switches, relays, potentiometers, indicators, etc.

The screwdriver has a 3/4" maximum diameter. Taking all responsibility from the assembler, it stops automatically at the required torque. There is no friction clutch, because there is positive locking and unlocking. The type of screwdriver it requires may be specified. Overload Control Co., Dept. ED, 260-11 Langston Ave., Glen Oaks, L. I., N. Y.

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

INTRODUCING THE NEW MODEL "U"

- Choice of 12 alternative blower performance curves.
- All-angle, resilient, sleeve-bearing, NEMA rated, G.E. motor, nylon insulated.
- Integral electrical, airflow interlock switch, air velocity type.
- Ready fitted with inlet and outlet clamps and adaptors.

The new MODEL "U" line of UTILITY blowers are specially designed for electronic, instrument and light industrial application. They are compact and move large volumes of air in relation to their size and weight. Handy mounting arrangements as well as integral ducting connectors are a designers delight. Motors are 1-phase, dual voltage, capacitor start.

ROTRON MFG. CO., INC.
7 Schoonmaker Lane, Woodstock, N. Y.

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

POLYSTYRENE FILM CAPACITORS

The ideal capacitors for use in integrating or memory circuits and as coupling capacitors for very high-impedance grid circuits. Close control of processing and materials provides these desirable characteristics:

Capacitance tolerance: ±0.2%
drift not over 100 parts/million/degree C.
Insulation resistance: one million
megohms × mfd. at 60° C.
Dielectric absorption: not over 0.05%
maximum recovery voltage after 1/3 sec. discharge.
Stability: capacitance change not over
0.5% per year.
Operating temperature: —55°C to +80°C maximum.

Because of the unique nature of these capacitors, each application is specially handled. Tell us your physical and electrical requirements; we'll quote on the units that suit them best. Capacitances available—0.01 to 10 mfd.

TOBE DEUTSCHMANN CORPORATION
NORWOOD, MASSACHUSETTS

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

Circular Connectors
Polarized, Shielded Type

Polarizing in these two series of connectors is accomplished by means of a keyway in the receptacle and a key on the plug. Units are kept mated against vibration by a simple, positive locking device. Both mating and locking can be effected by feel alone; there is no need to check these actions visually. Pin contacts are protected against breakage by an enclosing shell made of aluminum with an Iridite finish to permit its use as a shield.

One series is equipped with 1 to 4 contacts and is available with VR 4/2 AB1 receptacles, VP 4/2 BC1 plugs, and VS 4/16C4 hoods. Shell OD is 1/2". The other series comes with 5 to 9 contacts, the shell OD being 23/32". Contacts on both series are silver plated and gold flashed for maximum conductivity and corrosion resistance. Viking Electric, Dept. ED, 1061 Ingraham St., Los Angeles 17, Calif.

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

Miniature Inductors
In Wide Range of Values

These units are particularly suited for use as inductor elements in tuned circuits and filter networks and as chokes in receiving, telemetering, and navigational systems. They are also ideal for chokes in low power sections of transmitters where a compact, stable, and durable inductor is required.

The design provides large values of inductance in a small space. High Q is provided due to use of high permeability Ferroxcube 3C cores. The structure is inherently self-shielding, and the core design completely encloses and protects the winding. Inductances available range from 2.2mh to 220mh. Nominal tolerance is ±10% ±one turn. Unit weight is 1/2 oz. The inductors may be mounted on terminal boards by their own leads. Mico Instrument Co., Dept. ED. 80 Trowbridge St., Cambridge 38, Mass.

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

The LFE OSCILLOSCOPE *Model 401 FEATURES:*

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

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

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

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

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

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

For complete information and specifications write:

LABORATORY for ELECTRONICS, INC.
75-5 Pitts Street · Boston 14, Mass.

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

New Products . . .

Miniature Relay

Withstands 10G's up to 500cps

The "PW" is a sensitive, miniature, d-c actuated, hermetically sealed relay with ruggedized, balanced armature construction that withstands 10G's vibration up to 500cps during operation. Dimensions are 0.765" x 1.656" above chassis, and weight 1-1/16 oz.

A high permeability, low residual nickel-iron magnetic structure gives high sensitivity and contact pressure. Contact arrangement is 1 Form C (spdt). Contacts are 3/32"diam pure silver, rated at 2amps 28v d-c or 115v 60cy a-c non-inductive load.

These rugged, compact relays have coils with resistances ranging from 100 ohms to 16,000 ohms; actuation, current or voltage; and operating power, 25 mw to 1.5w. Potter & Brumfield, Inc., Dept. ED, Princeton, Ind.

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

Pressure Transmitter

Rugged, Potentiometer Type

The Model GPT Pressure Transmitter, in which the potentiometer is isolated from the actuating pressure, is available in pressure ranges of 12 psi to 80psi. Although designed primarily as an absolute pressure instrument, gage and differential pressure types which can be operated by both atmospheric and fluid pressures are also available.

In the instrument, a pressure-sensitive bellows moves the brushes of one or two precision potentiometers. Output is linear with pressure (1.0% of full scale).

Potentiometer windings and brushes are of precious metal alloys for noise-free output and long life. Resistances between 2000 ohms and 15,000 ohms can be furnished; however, 5000 ohms and 10,000 ohms are standard. Current rating is 7.0ma for standard units.

Applications include use in aircraft and missile control circuits involving ram and static pressure measurements, air computers, altitude measurement, air speed measurement, pressure telemetering,, and industrial control applications. Genisco, Inc., Dept. ED, 2233 Federal Ave., Los Angeles 64, Calif.

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

Single-Phone Headset

For Monitoring Applications

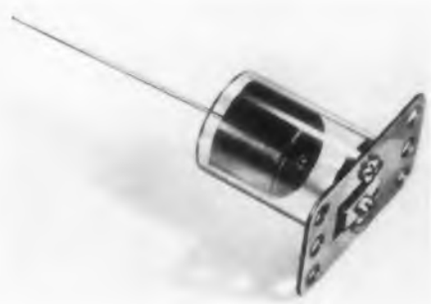
Weighing only 1/2 oz, the "Earset" is a single-phone headset that is held on the ear by a flat plastic frame shaped like a large comma. The center part of the "comma" is a sensitive hearing aid type receiver. The clamp design eliminates head band pressure and will fit any head shape or ear size, right or left.

The "earset" can be used for transcription, radio monitoring, multiple listening, and many other hearing applications. Its frequency response runs from 50cy to 4000cy and gives comfortable listening at 0.3mw input. Telex, Inc., Dept. KP, Telex Park, St. Paul, Minn.

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

Air-Damp Dashpot

For Control Mechanisms, Switchgear



Weighing less than 1/2 oz, this precision air-damp dashpot is for use as a system stabilizer in control mechanisms and switchgear. It has already been used extensively on "Regohm" voltage regulators in military and industrial applications.

Possessing the reliability of springs, the unit can be used where simple airvanes are inadequate, oil seal devices insufficiently reliable, or magnetic damping too heavy. It is made of low expansion glass cylinders and graphitized-carbon pistons, ground and fitted to tolerances closer than 0.002". It is furnished with a metal plate for easy mounting and will operate in any position at temperatures from —75° to +150°C. Damping constant is adjustable up to 0.06 pound-sec/inch; maximum tension force is 4 pounds at sea level; compression force is limited only by the strength of the materials used.

Static and sliding friction is less than 0.2. The air load can be easily adjusted with a screwdriver. The standard piston has 5/8"diam. Maximum stroke is 1/2". Other sizes can be made to order. Electric Regulator Co., Dept. ED, Norwalk, Conn.

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

New Products . . .

Trimmer Capacitor

Fits Any U-H-F Receiver

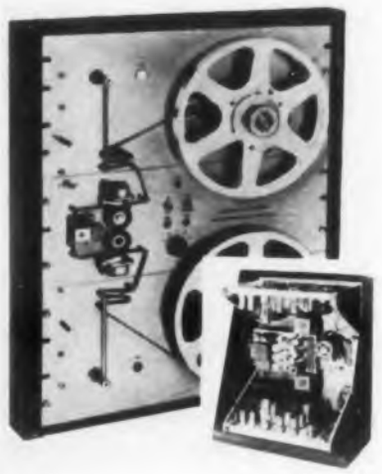
The Model VC3-G "Mighty Midget" Piston-Type Variable Trimmer Capacitor has a 1" overall length at maximum capacitance. The capacitance range is 1.0mmfd. Temperature coefficient of capacitance is 2×10^{-3}mmfd 0°/C. This unit has a universal mounting design which fits any u-h-f receiver.

"Q" rating is over 1000 at 1Mc. Dielectric strength is 1000v d-c at sea level pressure, and 500v d-c at 3.4" hg. Minimum insulation resistance is 10,000 megohms. A silver band fused to the exterior of the drawn glass tube serves as a stationary electrode. JFD Mfg. Co., Inc., Dept. ED. 1601 16th Ave., Brooklyn 4, N. Y.

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

Digital Tape Handlers

Fast Starts, Stops, Speeds



Model 902 Digital Tape Handlers have start and stop times of 5millisec and tape speeds up to 60psi. Extension of available tape width up to 5/8" permits up to eight channels of information to be recorded simultaneously. Another feature is complete interchangeability of tape from one machine to another; tapes recorded on one tape handler can be played back on another.

A variety of tape width and speed combinations is available. Choice of 30/15ips and 60/15ips dual speeds, with 1/4", 1/2", and 5/8" tape provides high versatility. The 60ips handlers use 8" reels with 1200' capacity; the 30ips handlers use 10-1/2" reels with 2400' of tape. All models are equipped with standard NAB hubs. Versions are available for handling teletype tape.

Standard 19" rack mounting is used. Power requirements are 400w at 115v, 60cy. Potter Instrument Co., Inc., Dept. ED, 115 Cutter Mill Rd., Great Neck, N. Y.

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

DUAL-TRACE APPLICATIONS

The Tektronix Type 535 Oscilloscope and Type 53C Dual-Trace Plug-In Preamplifier make a combination superior to a dual-beam oscilloscope in most applications. Because both waveforms appear on the same time base, accurate time comparisons are assured. Flexibility provided by independent positioning, sensitivity, and polarity inversion controls makes almost any sort of waveform comparison easy. The one exception is the observation or recording of two simultaneous transients of less than a millisecond duration. For this a dual-beam instrument is more practical.

Two typical dual-trace applications with the Type 535 and Type 53C are the comparisons of amplifier grid and plate voltage waveforms, and network input and output waveforms.

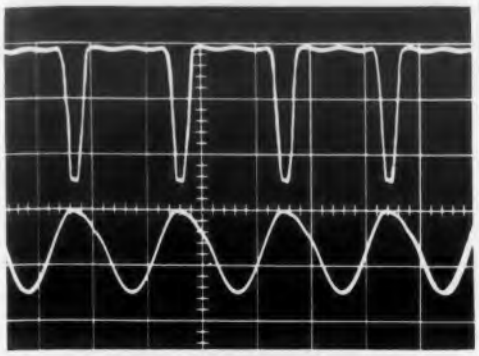
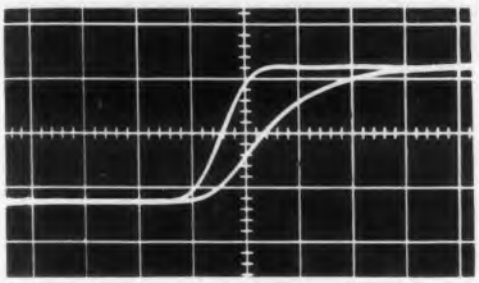


Plate and grid voltage waveforms of a class C amplifier working into a resistive load. Traces may be brought together for closer comparison.



Output of an RC network superimposed on the input pulse. Both waveforms appear on the same 0.04 μsec/cm sweep, accurately measuring the risetime deterioration caused by passage through the network.

MAIN OSCILLOSCOPE FEATURES

600,000,000 to 1 Sweep Range — 0.02 μsec/cm to 12 sec/cm, continuously variable. Calibrated — 0.02 μsec/cm to 5 sec/cm, accurate within 3%.

10 KV Accelerating Potential — Brighter display at low repetition rates.

Flexible Sweep Delay — 1 μsec to 0.1 sec, jitter-free, incremental accuracy within 0.2% of full scale.

Type 535 Oscilloscope — $1300 plus price of desired plug-in units.

DUAL-TRACE PLUG-IN PREAMPLIFIER

Type 53C Specifications

Two Identical Amplifier Channels

Frequency Response — DC to 8.5 mc.
Risetime — 0.04 μsec.
Sensitivity — 0.05 v/cm to 20 v/cm calibrated, continuously variable to 50 v/cm.

Electronic Switching

Triggered — actuates alternate sweeps.
Free-running rate — 100 kc, approximately.

Type 53C Dual-Trace Unit — $275.

OTHER PLUG-IN PREAMPLIFIERS

Type 53A Wide-Band DC Unit — $85.
Type 53B Wide-Band High-Gain Unit — $125.
Type 53D High-Gain Differential Unit — $145.

Prices f.o.b. Portland (Beaverton), Oregon.
Please write for complete specifications.

Tektronix, Inc.
P.O. Box 831W, Portland 7, Ore.
Cable: TEKTRONIX

CIRCLE ED-99 ON READER-SERVICE CARD

High Voltage Power Supply

Hermetically Sealed Unit

This power supply is rated at 6000v ±5% with an output current of 100μamp. It is also provided with a d-c output voltage tap at 600v and is designed for an a-c input of 100-200v, 380-420cy, single phase. The unit is especially adopted for airborne applications.

The supply is designed to operate over a temperature range of −55° to +85°C. It is hermetically sealed and is potted with an epoxy resin. It is the first in a series of airborne high-voltage power supplies developed by this firm; similar units can be built to customers' specifications. Perkin Engineering Corp., Dept. ED, 345 Kansas St., El Segundo, Calif.

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

Helical Potentiometer

100-300,000 ohms, ±0.5% unit

The Type 745 10-turn helical type potentiometer is available for precision government and commercial applications such as speed computers and guided missile controls. It has a resistance range of 100 ohms to 300,000 ohms (±0.5%), and a linearity tolerance of ±0.025% for 5000 ohms and over, and ±0.05% under 5000 ohms.

The unit meets electrolysis and humidity, high altitude, vibration, load life, and temperature cycling tests under JAN-R-19; shock, sand and dust, salt spray, and high temperature under MIL-E-5400, and fungus resistance tests under MIL-E-5272A. Electrical noise level is low and does not vary with life. Terminals are gold-plated.

The potentiometer has a 2″diam at the servo flange. Length from front of flange to end of case is 2-5/32″ maximum. It dissipates 5w at 40°C and has a starting torque of 1 oz-in at ambient. Mechanical and electrical rotation is 3600° +2°, −0°. Weight is 7 oz. Potentiometer Division, Fairchild Camera & Instrument Corp., Dept. ED, 225 Park Ave., Hicksville, L. I., N. Y.

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

R-B-M Relays

FOR EVERY ELECTRONIC APPLICATION

Meeting Commercial and Government Requirements

OPEN TYPE. Circuit switching — power and dynamotor loads — plate circuit — low capacitance.

HERMETICALLY SEALED. Stud or bushing mounting — solder or plug-in headers — circuit switching — power — low loss applications.

TRANSPARENT PLASTIC COVER. Most R-B-M relays now available in low cost transparent plastic cover.

OTHER PRODUCTS: Motor starting relays and overload protectors for refrigeration, appliance and general purpose motors. Industrial contactors and across-the-line starters. NEMA size 1 and smaller. Low cost general purpose relays. Low voltage D.C. manual and magnetic devices.

Write Dept. L-4 for ASR Bulletin.

R-B-M DIVISION
ESSEX WIRE CORPORATION
Logansport, Indiana

Controls for Electronic, Refrigeration, Industrial, Appliance, Communication and Automotive Industries

RBM

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

New Products . . .

Volt-Ohm-Milliamp Meter

Reads in Decimal Numbers

The "Digitester" serves as a combination volt-ohm-milliampere meter with an accuracy of 0.1% and an 0.8sec speed. Readout is in decimal numbers instead of analog form. With the instrument, readings can be made up to 10meg in seven ranges, 1000v in six ranges, and 1amp in six ranges. Maximum accuracies (lowest scale) are ±0.01 ohms, ±0.00001v, and ±0.01μamp.

Operation does not require manual adjusting or balancing; decimal readout is obtained simply by pressing a panel button. No accessories or external references are necessary. Dimensions are 21-1/2" x 10-1/2" x 15" deep, in cabinet; the unit may be removed from the cabinet for mounting in a standard relay rack. Telecomputing Corp., Dept. ED, 133 E. Santa Anita Ave., Burbank, Calif.

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

High Resistance Bridge

Accurate to Better Than 0.25%

The Model 601 Bridge covers a range from 100,000 ohms to 100Meg, and measures resistances to an accuracy of better than 0.25%. The circuit is a simple Wheatstone bridge network with the unknown and a 10-turn "Helipot" in adjacent legs. Bridge unbalance voltage is amplified by a vacuum tube voltmeter and fed to a null indicatiag panel microammeter. The circuit is such that the meter cannot be damaged by severe unbalanced conditions. At balance, resistance values correspond to "Helipot" dial settings multiplied by appropriate factor of 10.

The instrument is for general-purpose resistance measurements, as well as for the laboratory for production testing of resistors. It is basically a-c operated but contains a long-life 45v B battery for the bridge voltages to provide greater stability. Shasta Division, Beckman Instruments, Inc., Dept. ED, P. O. Box 296, Sta. A, Richmond, Calif.

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

Fixed-Pad Attenuators

For 0-1000Mc Range

Two fixed pad attenuators for the 0-1000Mc range, the "HFA-50" and "HFA-75", have impedances of 52.5 ohms and 75 ohms respectively. These attenuators have a maximum vswr of 1.2 up to 1000Mc. Nominal attenuation is 3db, 6db, 10db, or 20db for both units, and accuracy is better than 1/2db.

BNC connectors are used so that the pads can be incorporated into most equipment and test set-ups without the need for auxiliary adapters. Applied Research, Inc., Dept. ED, 163 07 Depot Rd., Flushing 58, N. Y.

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

Wire-Wound Resistor

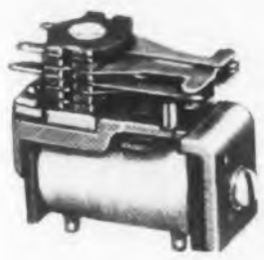
Rugged, Subminiature Design

The "NM-2" subminiature Wire-Wound Resistor provides values up to 60,000 ohms —0.1%. Known as "The Runt", it measures only 1/4" x 1/4". The unit features hermetic sealing and withstands the most rugged environmental conditions. Eastern Precision Resistor Corp., Dept. ED, 130-11 90th Ave., Richmond Hill 18, L. I., N. Y.

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

Telephone Type Relay

Functions Under Severe Conditions



The "Series 80" Midget Telephone Type Relay is a sensitive, compact, multiple-contact relay with vibration and shock-proof characteristics. It is designed to meet rigid government specifications. Coil windings are rated for d-c voltages up to 115v. Contacts are palladium and rated at 3amps non-inductive load at 24v d-c or 115v 60cy. On special order, they can be supplied with silver contacts rated at 5amps.

The relays are available in open form, for surface mounting, or in hermetically sealed containers. The "s614" type, the smallest of the sealed types, measures 1-5/8" x 1-1/32" x 1-21/32". Signal Engineering & Mfg. Co., Dept. ED, Long Branch, New Jersey.

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

New Products . . .

Computing Differential

Accurate, Sensitive Unit

The 1/8" differential is the latest addition to this firm's line of single spider gear units. It is designed to meet highest military and commercial standards, and it mechanically adds and subtracts with extreme accuracy.

The differential can operate over a wide environmental range. It weighs less than 1 oz, and performs in a working circle of 1" max diam. Breakaway torque at no-load is 0.01 oz-in. The unit is made of stainless steel throughout to ensure low wear and high corrosion resistance. Ford Instrument Company, Division of The Sperry Corp., Dept. ED, 31-10 Thomson Ave., Long Island City 1, N. Y.

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

Sealed Capacitors

With 4800 Hour Time Constant

"Stabelex D" capacitors are hermetically sealed units with a time constant in excess of 4800 hours, low absorption, high insulation resistance, low power factor, and other valuable characteristics. Now available in quantity, they have already been used for some time in a variety of special equipments including electronic computers, calculators, and spectrographs.

The capacitors are offered in a full selection of values, as well as case sizes for upright or inverted mounting, including types for mounting where space is extremely limited. Operating temperature ranges from −80° to +75°C. Capacity tolerances available are from ±10% to ±1%. Change in capacity from room temperature to +75°C is only −0.4%. Industrial Condenser Corp., Dept. E-13, 3243 N. California Ave., Chicago 18, Ill.

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

Deposited Carbon Resistors

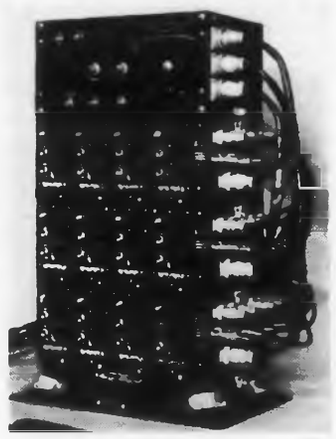
Sealed in Steatite

A line of hermetically sealed deposited carbon resistors is offered in ratings from 0.25w to 2w. The resistors are completely sealed in steatite housings, assuring positive protection against moisture. Also available are resin coated types made to MIL-R-10509A, glass enclosed and helium filled high stability types, and high frequency rod and disc units. Mepco, Inc., Dept. ED, Morristown, N. J.

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

Amplifier System

Unitized, Multi-Channel Design



Amplifier System "D" now offers extended carrier-amplifier range and increased data capacity. Both linear-integrating and carrier amplifier units may be used in any combination up to a maximum of 12 to permit simultaneous use of self-generating and externally-excited pickups. Physical phenomena in the 0-5000cps range may be amplified and system output coupled to any recording oscillograph equipped with galvanometers of matched characteristics.

The system may be used with such transducers as: capacitance, inductance, reluctance, resistance, Piezoelectric, and photoelectric, as well as types developed in the laboratory for specific instrumentation requirements. A single oscillograph record may thus contain indications of strain, pressure, acceleration, vibratory displacement, and velocity.

Rugged, lightweight construction and wide temperature operating range (−10° to +40°C ambient) permit use under varied conditions, including laboratory, field, and flight-test applications. The single-channel amplifier units plug into stacking, four-channel capacity cases, with all input, output, and power connections made automatically upon insertion to eliminate intricate wiring. Consolidated Engineering Corp., Dept. ED, Pasadena 15, Calif.

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

New Products . . .

Turret Terminal Connectors

For No. 14 AWG Wire

"Series 14T" connectors are designed for No. 14 AWG wire with turret terminals. They feature a disengagement force of only 3 oz minimum and 8 oz maximum per contact. Telescoping barriers around each contact provide extra-long creepage paths for high voltage applications.

The turret-type socket and pin contacts (available in 7, 10, 15, 18, and 20 contacts) are of spring-temper phosphor bronze and brass respectively, and come assembled in a floating, non-rotating arrangement which insures self-alignment of each contact. Contacts are silver plated. Three insulating materials, and aluminum hoods with cable clamps, are available. DeJur-Amsco Corp., Dept. ED, 45-01 Northern Blvd., Long Island City, N. Y.

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

Thermal Delay Relays

With Periods from 5-300sec

These lightweight thermal delay relays are valuable for a wide range of industrial, aeronautical, mobile, and marine applications where quiet, maintenance-free delay control of an electrical circuit is desired. They are available with heater input of 5w in 6.3v, 26.5v, and 117v a-c/d-c, with time delays of 5sec to 300sec at 25°C; they also can be adapted to any control requirement not covered by existing types.

Contact rating is 3amp at 150v d-c or 250v a-c for relays with periods up to 75sec; for relays with delays of 105sec or more, contact rating is 3amp at 450v a-c/d-c. Contacts are silver, spst, either normally open or normally closed. The base is a standard receiving type intermediate 8-pin octal base. The heater terminates in pins 2 and 3; the contacts in pins 5 and 7. Maximum overall height is 3.250". For a range from −60° to +80°C, there is a slight variation in timing from room temperature timing. Sheldon Electric Co., Dept. ED, Irvington 11, N. J.

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

Servo Accelerometers

For Linear or Angular Measurements

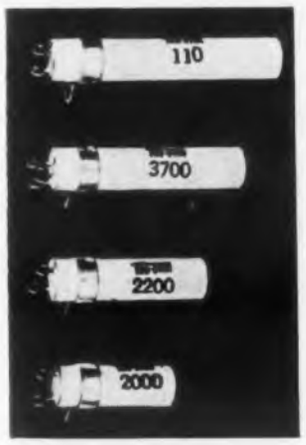
A family of precision accelerometers measures either linear or angular acceleration to four significant figures. Based on Navy developments, each instrument incorporates a vest pocket servo system which automatically generates a current to counterbalance torque arising from acceleration. The voltage output of 10v or more per G is proportional to acceleration within approximately 0.1% over the entire operating range, and goes precisely through zero at zero acceleration without drift or hysteresis. Error due to friction has been measured as approximately 0.0002G.

The accelerometers are rugged instruments suitable for airborne use. Laboratory uses include employment as standards for checking and calibrating other transducers. Donner Scientific Co., Dept. ED, 2829 7th St., Berkeley 10, Calif.

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

Resistors

For Top of Chassis Mounting



"Stan-Ohm" resistance units are made for top of chassis mounting, which removes a high heat source from the area of critical components. Their integrally mounted bracket aids in the conduction of heat to the chassis, which in turn radiates it.

The resistors are wound with high grade resistance wire on a flat ceramic core, allowing the use of heavier gage wire. The junction of the resistance wire and the tie points is imbedded in solder and results in a permanently secure connection.

The wound core is coated with silicone cement and inserted into a ceramic tube which is then filled with silica and sealed with silicone cement, excluding moisture from the winding. The resistors are supplied in ratings of 10w, 15w, 20w, and 25w, with respective heights of 1-1/2", 2", 2-1/2", and 3"; all units are 19/32"diam to fit in 5/8" chassis cut-out. They can be supplied in straight resistance values or with up to two taps. Tru-Ohm Products, Division of Model Engineering & Mfg. Company, Inc., Dept. ED, 2800 N. Milwaukee Ave., Chicago 18, Ill.

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

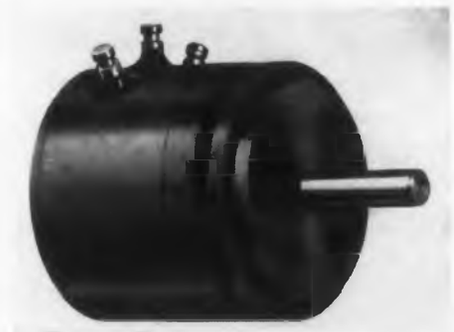
New Products . . .

Wire Wound Resistors
Ceramic Insulated Units

"Cer-Ohm" high voltage ceramic insulated, low cost, wire wound resistors are fabricated with 2w, 3w, 5w, 7w, 10w, 15w, and 20w ratings, in resistance ranges from 10-500 ohms in the 2w size, to 10-15,000 ohms in the 20w size. These low cost units are produced with standard 5% and 10% tolerances, but can be made to closer tolerances with special characteristics when specified. They are designed to fill the gap between expensive wire wound resistors and vitreous enameled units. Bradford Components, Inc., Dept. ED, 33-35 Bishop Street, Bradford, Pa.

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

Low Torque "Helipots"
Combine Small Size, High Precision



An improved version of the series "T" miniature "Helipots" features low torque, small size, and high precision. All-metal housing and lids provide dimensional stability, ruggedness, and maximum heat dissipation. Maximum operating temperature has been raised to 105°C ambient.

Power rating has been increased to 1.2w at 40°C ambient. While standard linearity tolerance remains ±0.5%, best practical linearity tolerance is now ±0.2%. Shaft diameter has been increased to 1/8" to provide greater strength and permit machining of flats and slots. Standard electrical rotation has been increased to 354°; 360° electrical rotation or mechanical stops are available on special order. Resistance range is as low as 10 ohms and as high as 100,000 ohms.

The units are available for bushing or servo mounting. Diameter is 7/8", and weight 0.6 oz. Up to five sections of the "T" series may be ganged on a common shaft at the factory, and as many as nine taps provided per section, each electrically welded to a selected single-turn of resistance winding—without shorting out adjacent turns. Helipot Corp., Dept. ED, 916 Meridian Ave., South Pasadena, Calif.

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

Pick 'DIAMOND H' RELAYS

FOR HIGHER

VIBRATION RESISTANCE

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

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

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

THE HART MANUFACTURING COMPANY

210 Bartholomew Ave., Hartford, Conn.

CIRCLE ED-137 ON READER-SERVICE CARD FOR MORE INFORMATION

- 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, 4-3/4"
- 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-138 ON READER-SERVICE CARD FOR MORE INFORMATION

Germanium Diodes

Hermetically Sealed

This firm's germanium diodes are being hermetically sealed at no increase in cost. Three JAN types (1N69, 1N70, and 1N81) and some commercial computer types are now available in production quantities; other commercial types will be available soon.

All features of the firm's plastic case diodes have been preserved in the new units. As in the past, the platinum-rhuthenium whisker is welded to the germanium pellet. The hermetic seal is metal-to-ceramic; gas tight ceramic cases with metallized ends permit solder seal to nickel pins. The diodes exceed the requirements of JAN humidity specifications. General Electric Company, Dept. ED, Syracuse, N. Y.

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

Mercury Switch

With Low Loading Characteristics

This switch is an spdt magnetically actuated mercury type. As a small, moving magnet approaches the armature within the switch, the electrodes are moved in and out of the mercury; no mechanical friction is involved, providing practically unlimited life.

The switch is hermetically sealed. All contacts are visible. Contacts are not subject to oxidation, open arcing, pitting, or sticking; chemical combination between the mercury and the gas within the tube is impossible.

The design provides exceptionally low loading requirements, making for high accuracy when the switch is used as a position indicating and limit switch in conjunction with precision equipment. Standard operating ranges are from 12v at 0.25amp, to 120v at 1amp. Tube dimensions are 1-1/2"diam x 2-1/2" long, with standard cap 3/4"diam x 1/2" long. Other types and sizes can be made to specification. Hamlin, Inc., Dept. ED, E-13, 1316 Sherman Ave., Evanston, Ill.

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

Eliminate Corrosion from Electrical Contacts with...

RHODIUM PLATING

Rhodium plating is finding increased use by electronic design engineers where hard, corrosion resistant electrical contact surfaces are required. Rhodium provides a stable contact resistance and allows use of higher pressures in sliding contacts... Rhodium is not affected by atmospheric changes, provides a low noise level and is particularly adapted to applications in the printed circuit field.

WRITE FOR BOOKLET 17

BAKER & CO., INC.

113 ASTOR STREET, NEWARK 5, NEW JERSEY

NEW YORK • SAN FRANCISCO • LOS ANGELES • CHICAGO

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

Write TODAY for DP Bulletin covering the most complete line of Cannon Rack and Panel Connectors. Cannon Electric Company, 3209 Humboldt Street, Los Angeles, California. Factories in Los Angeles; East Haven; Toronto, Canada; London, England. Representatives and distributors in all principal cities.

Refer to Dept. 143

CANNON ELECTRIC

Since 1915

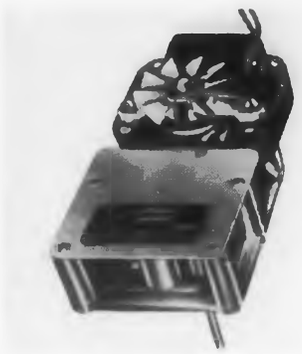
CANNON ELECTRIC

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

New Products . . .

Geared Motors

Sub-Fractional Units



The basic Model 300 Geared Motor is a two-pole induction motor, with horsepower available from 1/500hp to 1/75hp, depending on the coil and stack size. Output speeds are available from 1 rpm and up. A typical unit has an output speed of 9rpm and 16w input, and delivers a full load torque of 150 in-oz.

Power supply is 115v 50/60cy. Special motors can be wound for other voltages and frequencies. Rotation of the output shaft can be clockwise or counterclockwise, as required.

The units have porous bronze bearings and large oil reservoirs. A fan is standard on all units, providing trouble-free performance under high temperature conditions. Nylon high speed gears are provided for quiet operation. Loral Electronics Corp., Dept. ED, 794 E. 140th St., New York 54, N. Y.

CIRCLE ED-145 ON READER-SERVICE CARD FOR MORE INFORMATION

D-C Power Supplies

Low-Cost, Simple Design

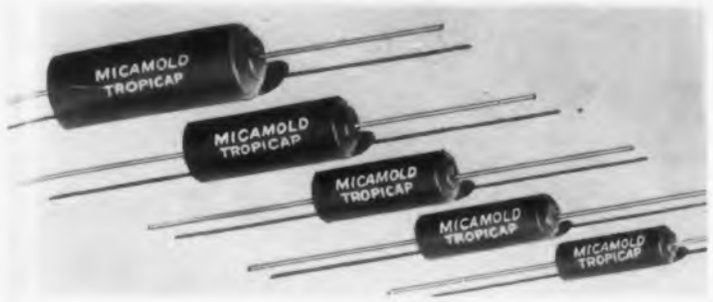
A line of low-priced d-c power supplies is designed for a wide range of laboratory and experimental applications. The units come in two types: the Model 3-150-L (illustrated), a cabinet - mounted supply with an output voltage up to 300v; and a series of sub-chassis mounting type packages with d-c voltages ranging from 150v to 500v. Low cost is made possible by quantity production.

The supplies have a simple, functional design, with performance comparable to that of much higher priced units. Ripple on all units is below 0.01v, peak-to-peak, at full load. Regulation ranges from 0.5% to 1% from no load to full load with ±10% line voltage variation. Dressen-Barnes Corp., Dept. ED, 250 N. Vinedo Ave., Pasadena 8, Calif.

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

Tubular Paper Capacitors

Withstand Humidity, Thermal Shock



"Tropicaps" is the designation given this line of molded tubular, paper capacitors, which are designed for superior resistance to extreme humidity. They will withstand severe mechanical and thermal shock and total immersion, and are non-inflammable.

The units will readily withstand 10 cycles of 16 hours at 40°C in humidity of 90-95%. They will operate at 1-1/2 times rated voltage for 250 hours at 85°C. A wide range of standard capacitance and voltage ratings is available. Micamold Radio Corp., Dept. ED, 1087 Flushing Ave., Brooklyn, N. Y.

CIRCLE ED-192 ON READER-SERVICE CARD FOR MORE INFORMATION

U-H-F Grid Dip Meter

Has 300 to 1000Mc Range

This Model 101B U H F Grid Dip Meter is made up of two units, a power supply and a u-h-f probe. The probe is connected to the power supply by a 3 ft cable. The frequency scale is approximately linear throughout the three ranges, which are from 300 to 425Mc, 425 to 650Mc, and 650 to 1000Mc. The meter employs three plug-in coils, which are mounted externally on the u-h-f probe for ease of coupling to circuits to be measured. The dial is individually calibrated to a frequency accuracy of ±2%.

The instrument has many applications in the u-h-f field such as measurement of capacity, inductance, circuit Q and choke resonance. It can be used as an auxiliary signal generator and an absorption wave meter.

A three-position switch on the power supply panel enables the instrument to be used in cw, modulated cw or as a detector. As a detector the instrument can be used to quickly determine the frequency of unknown radio frequency signals and parasitics. It may also be used as field strength meter. Boonton Electronics Corp., Dept. ED, Boonton, N. J.

CIRCLE ED-193 ON READER-SERVICE CARD FOR MORE INFORMATION

Hughes Diodes for Computer Applications

Types 1N191 and 1N192

Actual dimensions of diode body: .265" X .130"

The reliability of Hughes Germanium Diodes in many types of computer applications has been recognized in the field for some time. Their performance—frequently under severe operating conditions—continues to add to this reputation.

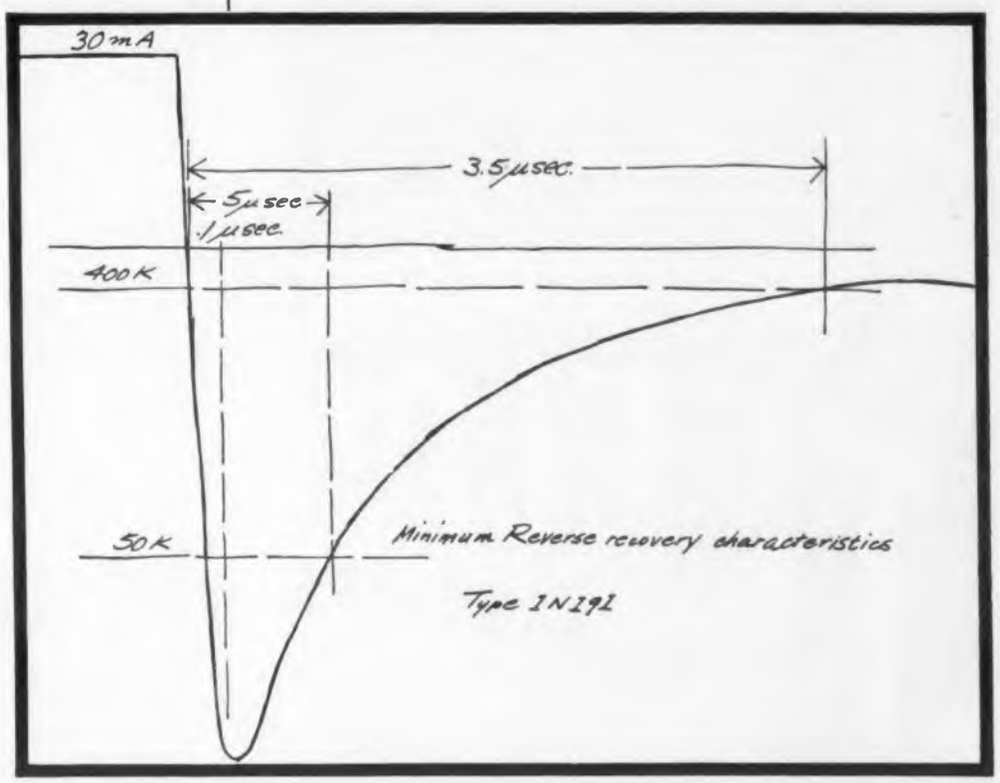
Now, as part of the continuing program to meet the expanding requirements for computer components, Hughes announces the registration of Diode Types 1N191 and 1N192. Both are selected for their outstanding performance in computer service.

These computer type diodes, like all Hughes diodes, are designed to ensure extremely high moisture resistance... thermal stability... electrical stability... subminiature size... thorough dependability. These features mean long life with minimum maintenance.

Recovery Time Characteristics *at 25° Centigrade*

Type 1N191
50 KΩ @ 0.5 μsec and 400 KΩ @ 3.5 μsec maximum.
Type 1N192
50 KΩ @ 0.5 μsec and 200 KΩ @ 3.5 μsec maximum.

To measure pulse recovery for both types, diodes are pulsed at 30 mA in the forward direction and then a back voltage of −35 volts is applied.



Maximum Back Current *at 55° Centigrade*

Type 1N191
.025 mA @ −10V and .125 mA @ −50V.
Type 1N192
.05 mA @ −10V and .25 mA @ −50V.

If you need special computer type diodes, chances are that we can furnish them on a production basis—because we are constantly producing and providing *many* types to meet literally hundreds of electronics and communications applications. Among these are high forward conductance, low-voltage diodes, used for certain computer applications. Write for new descriptive brochure.

Hughes

NEW YORK CITY CHICAGO

CIRCLE ED-194 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Connectors

In Subminiature Designs

Type "SM" subminiature connectors are constant impedance units of fractional size and weight, with a frequency limit of 2000Mc and a maximum voltage of 500v peak. Straight and elbow plugs, a chassis receptacle, and a junction are available in both 50 ohm and 75 ohm types. Insulation is "Teflon" or "Rexolite", depending on impedance. Precision made, they are well matched in impedance, simple to assemble, and heavily silver plated.

This firm also manufactures the Type "NC" single and multi-way precision connectors with a frequency limit of 3Mc and standard impedances of 40 ohms.

Also available are Type "MX" miniature connectors, only slightly larger than the Type "SM". These are non-military plugs and socket with a matched impedance of 63 ohms, "Teflon" insulation, and spring-loaded quick connect-disconnect action. Transradio, Ltd., Dept. ED, 138A Cromwell Rd., London S. W. 7, England.

CIRCLE ED-157 ON READER-SERVICE CARD FOR MORE INFORMATION

Terminal Block

Subminiature, Barrier Type

Designed for electronic assemblies, this subminiature, barrier type terminal block is molded of CFG, MFE, MME, and MDG in accordance with MIL-P-14C. It is supplied with 1 to 24 terminals.

Overall maximum length is 4-3/8"; width of block including barrier is 5/16", and without barrier is 1/4"; thickness of block including barrier is 0.260", without barrier is 0.160". Screws are binding head No. 0-80 x 1/8" long, of silver-plated brass and gold-flashed. The spacing between screws is 3/16". Fastening holes are at each end, between barriers, and are 0.093"diam for No. 3 screws, but also available for threaded No. 4-40 screws.

Three styles of the same block are supplied: the screw type illustrated, designed to take AMP 1/8" wide solderless lug; with a "one-sided" soldering lug attached; and with a "two-sided" soldering lug attached. Lugs are of brass, hot-tinned. Kulka Electric Manufacturing Co., Inc., Dept. ED, 633-643 S. Fulton Ave., Mt. Vernon, N. Y.

CIRCLE ED-158 ON READER-SERVICE CARD FOR MORE INFORMATION

Laboratory Oscillator

Covers 1.8cy to 2.2Mc

The Model 10 oscillator has a 6″ full vision dial with 300° rotation on all ranges, giving an effective scale length of 90″ over its complete range of 1.8cy to 2.2Mc (in six overlapping decades). Dial calibration is precise, and no zero setting is required. Drift is less than 2%, including warmup. Power supply for operation from 115v a-c is self-contained. Magnetic amplifier types of regulation limits frequency error to 0.1% for 10% variation in supply voltage.

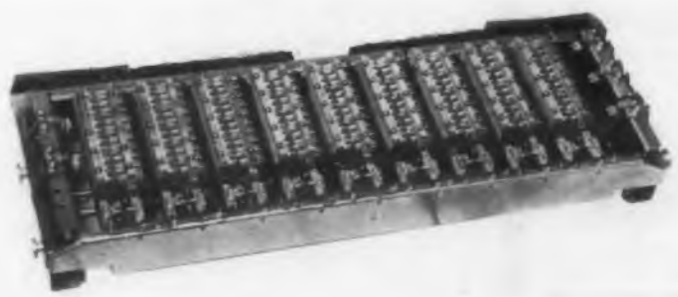
Output at all frequencies is greater than 20v rms, measured at the end of a 4′ length of RG-62/U cable. Distortion at full output is less than 1% over most of the range. Output voltage is constant within 1db over the entire frequency range for any amplitude setting. Size of the unit is 7-3/8″ x 10-3/8″ x 8-1/8″ deep; weight is 15.5 lb. Donner Scientific Co., Dept. ED, 2829 7th St., Berkeley 10, Calif.

CIRCLE ED-163 ON READER-SERVICE CARD FOR MORE INFORMATION

Crossbar Switch

For Switching Complex Circuitry

This Crossbar Switch provides a fast, economical means of interconnecting or selecting many different circuits common to the large-scale complex switching required in automatic control systems or computers. Mounted for drawerlike removal from its rack, it



incorporates palladium contact points and can provide any circuit connection in approximately 50 millisec by the energizing of two specific coils.

The switch is capable of many applications, such as connecting any three of 60 circuits to any 75, or of choosing one circuit from as many as 936 circuits. Its modular-like construction provides many of the interconnections which must be made separately in relay trees, etc. Kellogg Switchboard and Supply Co., Dept. ED, 79 W. Monroe St., Chicago 3, Ill.

CIRCLE ED-164 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products...

TV Picture Tubes

21", 90° Deflection Types

These new "Reliatron" tubes are 3" shorter than previous 21" types, yet the viewing area has been increased about 5%. The new design is shown on the right in the illustration.

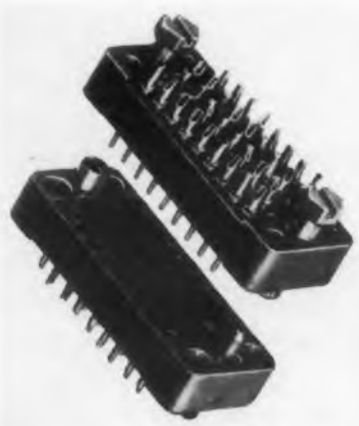
Four new types are available. All are directly-viewed picture tubes of rectangular glass construction, with a nominal screen diagonal of 21". The 21ALP4 and 21ALP4A are electrostatic focus tubes; the latter is aluminized. The 21AMP4 and 21AMP4A are magnetic focus tubes; the latter is aluminized. All tubes have external conductive coating.

The electrostatic types also contain a new gun (FM-44) which is capable of producing a sharper picture than old types despite an increased deflection angle of 90°. Westinghouse Electronic Tube Division, Dept. T 028, Box 284, Elmira, N. Y.

CIRCLE ED-169 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Connectors

With Locking Feature



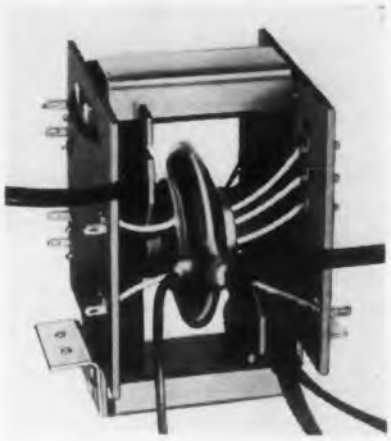
Polarizing "screwlock" guide pins and guide sockets provide positive means of locking "Series 20" Miniature Precision Connectors against vibration or accidental disconnection. This type of pin also provides a mechanical means of disconnecting the plug from the receptacle without prying or forcing. "Screwlocks" are of stainless steel which is passivated for extra protection.

These miniature rectangular connectors are available in 7, 9, 11, 14, 18, 21, 26, 34, 41, 50, 75, and 104 contacts. Hoods with either top-opening or side-opening feature are also available. DeJur-Amsco Corp., Dept. ED, 45-01 Northern Blvd., Long Island City, New York.

CIRCLE ED-170 ON READER-SERVICE CARD FOR MORE INFORMATION

Color TV Transformer

For Horizontal Output Circuits



This color TV horizontal output transformer is designed for use with a single 6DC6 driver tube and to work into an 11.8mh yoke. Known as the Type CTV515, it produces all pulses required for color synchronization, including keyed AGC, AFC, and peaking for horizontal driver circuits. High voltage is produced for focusing, beam acceleration, and beam deflection.

The unit delivers 20kv regulated out of three tube doubler circuit with 750ma maximum load. It is complete with four filament windings. Electrometric, Inc., Dept. ED, Woodstock, Ill.

CIRCLE ED-173 ON READER-SERVICE CARD FOR MORE INFORMATION

Multi-channel D-c Amplifier

Flat Response from 0 to 10kc

The Type DC-1B d-c Amplifier combines wide bandwidth, high gain, low drift, and high input impedance. Available in unitized systems containing from 1 to 12 channels and a matched power supply, the DC-1B may be used for driving galvanometers in a recording oscillograph, for pre-amplification in multiple cathode-ray installations or multi-channel tape recording.

Frequency response of the unit is flat within 1% from 0 to 10kc and is down approximately 3db at 100kc. Input impedance is 100,000 ohms and internal impedance 1,000 ohms. Other values of internal impedance can be specified. Noise level is 50 microvolts or less and d-c drift 50 microvolts per hour or less (after warmup).

Each amplifier channel is individually controlled from its front panel to permit gain adjustment from a maximum of 10,000 to a minimum of 10. William Miller Instruments, Inc., Dept. ED, 325 North Halstead Ave., Pasadena 8, Calif.

CIRCLE ED-174 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Ten-turn Pot Dial

Has Turn Indication Window

The Model A-230 Miget-Mite Dial is designed for use with 10-turn or less potentiometers. It requires one square inch of panel space, and provides smooth continuous rotation in any direction. The turn-indication window shows only one numeral, thus affording rapid reading. Numerals appear with shutter-like speed and are held in place until the next full rotation of the 100-graduation dial.

The dial is connected directly to the potentiometer shaft by means of a set screw. It is made from aluminum and finished in anodized satin black. S. A. Asquith Co., Dept. G., 2439 Fletcher Drive, Los Angeles 39, Calif.

CIRCLE ED-179 ON READER-SERVICE CARD FOR MORE INFORMATION

Silicone Rubber Insulation

Vulcanizes at Room Temperatures

"RTV Silastic" is a silicone rubber that vulcanizes at room temperatures into the various forms shown. It develops the high and low temperature stability, water repellency, and chemical resistance characteristic of silicone rubber within 24 hours after application.

Neither heat pressure, nor full exposure to air is

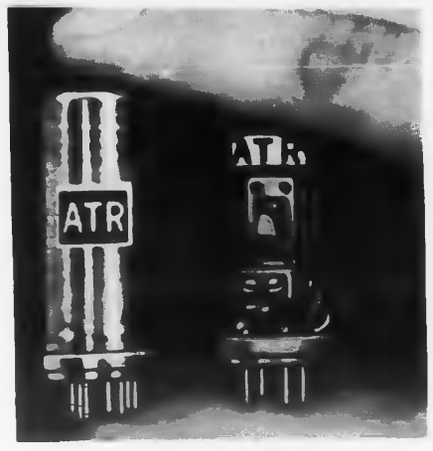
required to cure sections up to 1/8" thick. Sections up to 1" thick, however, may be cured under pressure up to 50 psi.

It is stored in the form of two separate components, each containing a catalyst. When the components are mixed, they react to form a non-heat vulcanizing system. The material sets in 4 hours, cures in 24 hours, and develops optimum properties in 4 to 7 days. Dow Corning Corporation, Dept. ED, Midland, Michigan.

CIRCLE ED-180 ON READER-SERVICE CARD FOR MORE INFORMATION

Subminiature Vibrator

Supplied by Miniature Battery



This subminiature vibrator powered by miniature batteries is designed for radiation measuring devices, photo multiplier cells, and infrared detection equipment. The unit is of full-wave non-synchronous driver design, having a frequency of 100cy and total time efficiency of 80%. The driving coil voltage is 1.5, 3, or 6v d-c, and operates on coil power of less than 45mw.

Seated height is 1-3/4" x 5/8"diam, with a total volume of 0.675 cu in. Weight is 0.6 oz. The vibrator fits a 7-pin miniature tube base. American Television & Radio Co., Dept. ED, St. Paul, Minn.

CIRCLE ED-185 ON READER-SERVICE CARD FOR MORE INFORMATION

Alarm System

For Remote Control Equipment

This alarm system reports any malfunction in unattended operation or equipment, and warns of breakdowns of remote control telemetering apparatus. Typical examples are power failure, excessive temperatures, fire, failure of control equipment, abnormal system conditions, and automatic transfer to standby gear.

The basic alarm system consists of a battery-operated tone transmitter and a frequency selective re-

ceiver with a suitable alarm. These two units may be joined by standard phone circuits. The system may be expended by the addition of a coding unit at the transmitting end for classification of the types of failure. The signal is either a continuous or interrupted 1000cy audio tone.

The coded transmitter includes memory facilities which make possible the simultaneous acceptance of reports from two or more areas of failure, and proper notification of these failures. Hammarlund Manufacturing Company, Inc., Dept. ED, 460 W 34 st., New York 1, N. Y.

CIRCLE ED-186 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Miniature Permanent-magnet Generator

Develops 33v, 2-phase, 20cy Output

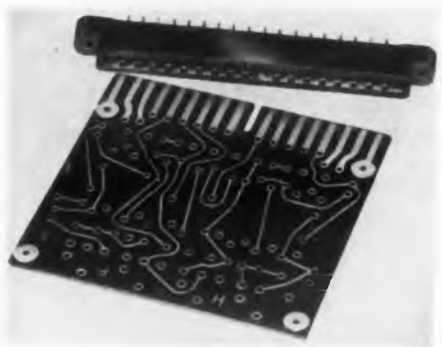
Rated for continuous duty with an output of 2-phase, 20cy a-c, the Type 44A Generator is recommended for instrument indicating and other similar applications. Voltage is linear with speed, and the unit develops 33v at 4500 rpm. Harmonic distortion is 3% max. Internal winding resistance is 30,000 ohms per phase.

Weighing 8 oz, the permanent-magnet generator is 2-1/8" long x 1-3/4"diam, and has a 5/32"diam shaft extending 0.340". Special shaft arrangements including splines, keyways, and gears can be supplied. The unit is pressure-sealed and has permanently-lubricated bearings. Electrical leads or terminations can be specified in a number of different types. Dalmotor Company, Dept. ED, 1326 Clay St., Santa Clara, Calif.

CIRCLE ED-190 ON READER-SERVICE CARD FOR MORE INFORMATION

Printed Circuit Connector

With 6 to 22 Contacts



Printed circuit cards with 6, 8, 10, 12, 15, 18, or 22 contacts are received by this receptacle connector. Design of the contacts provides positive mating of the connector with printed circuit cards of from 0.061" to 0.071" thickness. Proper tension to assure constant conductivity is maintained at all times.

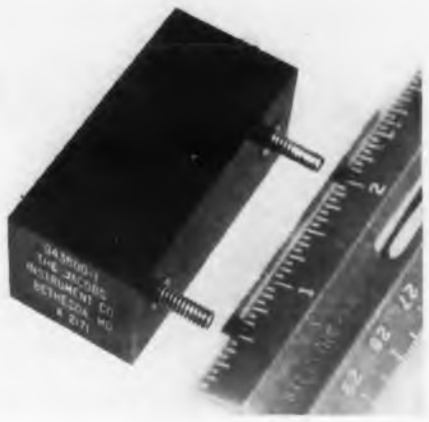
The body is compression-molded melamine for high dielectric and mechanical strength. Contacts are of spring-tempered beryllium copper, goldplated over silver for ease of soldering and prevention of corrosion.

Voltage breakdown at sea level is 2500v rms, and at 60,000 ft is 700v rms. Minimum creepage is 5/64". Minimum air space is 1/8". Mechanical spacing is 5/32". For use with No. 16 wire size. Gorn Electronics, division of Gorn Electric Company, Dept. ED, 883 Main St., Stamford, Conn.

CIRCLE ED-191 ON READER-SERVICE CARD FOR MORE INFORMATION

Precision Delay Lines

Operate in Adverse Environments



These delay lines for military use are characterized by excellent electrical characteristics, constancy of delay with temperature, high temperature stability, hermetic sealing, and resistance to shock and vibration. They can be used up to 125°C, and at altitudes up to 65,000′.

Electrical characteristics (delay, rise time, characteristic impedance, distortion, attentuation) are specified by the customer, and this firm makes the electrical design to achieve these requirements with minimum size and weight. A typical line has dimensions of 2.13″ x 15/16″ x 15/16″ and weighs 2.12 oz. Two mounting bolts with 6-32NC-2A threads protrude from one of the long faces, and the solder lugs are located on one of the small end faces. The Jacobs Instrument Co., Dept. ED, Bethesda, Md.

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

Circuit Comparison Bridge

Has Pushbutton Circuit Selector

The "Circuit Matcher" is a general utility comparison bridge complete with bridge supplies and detectors. Comparison of unknown circuits is made against those of a prototype of known performance.

The instrument is equipped with two 9-conductor shielded cables terminated in noval plugs and mating adapters for other socket types. A pushbutton selector provides rapid comparison of similar circuits by a-c or d-c bridge tests. A point-to-point ohmmeter with flexible selector means is provided as a servicing aid. Two pairs of panel terminals are provided for component comparison. A single balance control indicates circuit deviation from 75% to 130% of normal impedance with 1% accuracy over a wide range. Control simplicity permits non-skilled operation. McShan Development Corp., 71 Murray St., New York 7, N. Y.

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

New Products . . .

Motor-Generator Set

Operates on 6 or 12v

The Duovolt Genemotor meets the need for a motor-generator that operates on two voltages, 6v or 12v, due to the development of the 12v electrical system for many automobiles. The unit incorporates two separate 6v input windings, each having its own field. Six or twelve volt operation is obtained by simply connecting the four input leads in parallel or in series, respectively.

The unit is fully efficient at either voltage. It was designed to operate mobile radio equipment, and may be transferred from one vehicle to another with ease. Carter Motor Co., Dept. 27-ED, 2664 N. Maplewood Ave., Chicago 47, Ill.

CIRCLE ED-197 ON READER-SERVICE CARD FOR MORE INFORMATION

Electronic Counter

Direct Reading, Accurate Unit

With this direct-reading Model 524B Electronic Counter, one can measure transmitter and crystal oscillator frequencies, electronic, electrical, and mechanical time intervals, pulse lengths and repetition rates, frequency drift, and make high accuracy ballistics time measurements or high resolution tachometry measurements. The instrument is also a precision frequency standard with an accuracy of 1/1,000,000 ±1 count.

The unit employs four plug-in units which extend range, increase sensitivity, or provide time interval measuring circuits. The basic range of the instrument itself is 10cy to 10Mc for frequency counting, or zero cycles to 10kc for period measurements.

Cabinet size is 19" wide x 19-1/4" x 17" deep, and the instrument weighs 112 lb. Hewlett-Packard Company, Dept. ED, 395 Page Mill Road, Palo Alto, Calif.

CIRCLE ED-198 ON READER-SERVICE CARD FOR MORE INFORMATION

Silicone Enameled Wire

For High Temperature Use

This silicone enameled wire is intended for use in electrical equipment operating at temperatures of at least 130°C. It has good abrasion resistance, is smooth, and is not attacked by common solvents. The enamel will not craze when exposed to solvents, and will not crack even at —65°C.

Dielectric strength is 1500v/mil. Wires insulated with the varnish are furnished in single and heavy grades. The film is easily removed by "chemical strippers" such as those used for "Formvar", or by wire brushes. In general, the wire has much the same appearance as other synthetic resin insulated wires. Anaconda Wire & Cable Co., Dept. ED, Muskegon, Mich.

CIRCLE ED-200 ON READER-SERVICE CARD FOR MORE INFORMATION

Nylon Control Knob

Has No Metal Bushing

The strength of the nylon plastic from which these Model 1431 control knobs are made eliminates the usual metal bushing. Designed to fit any shaft up to 1/4"diam, the knobs are of the bar type measuring 3/4"diam at skirt and 1-1/4" along the bar.

The inherent insulation characteristic of the nylon protects the operator. A tapped hole with set screw is provided for locking the knob on the shaft. The knob is available in black or red, with the color running throughout the material. Industrial Devices, Dept. ED, Edgewater, N. J.

CIRCLE ED-201 ON READER-SERVICE CARD FOR MORE INFORMATION

Chilling Machine

Temperature Range from +70° to —120°F

This Model A-120-1 low temperature chilling machine, designed for small heat treating departments and laboratories, has a one cubic foot chilling chamber, 12" x 12" x 12" in size. Temperature range is +70° to —120°F. Temperature range from +250°F to —120°F can be obtained with the addition of a heater.

The unit weighs 500 lb, mounted on casters, and is 20" long x 18" deep x 43" deep. Cincinnati Sub-Zero Products Company, Dept. ED, 3932 Reading Road, Cincinnati 29, Ohio.

CIRCLE ED-275 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Message Indicator
For Tape Recorder

This compact counter assembly indicates the position of messages on tape recording machines. Before the first recording on a tape is started, the indicator is reset to zero. When the recording of each message is started the number shown on the indicator is written into a message index. Whenever it is desired to select a particular recording for transcription, the tape is merely run through until its index number appears on the indicator.

The number wheels are driven by a small belt from the tape spool spindle. The indicator is designed for back-of-panel mounting with only the numbers and the reset wheel visible through suitable openings. Production Instrument Company, Dept. ED, 706-34 W. Jackson Blvd., Chicago 6, Ill.

CIRCLE ED-204 ON READER-SERVICE CARD FOR MORE INFORMATION

"S" Band Wavemeter
Range from 2.3 to 4.5KMc

The Model 229 "S" Band Wavemeter, a coaxial-line type instrument, covers the frequency range from 2.3 to 4.5-KMc. The unit also features a precision-ground lead screw, which helps give a high accuracy of measurement, and a cavity body made from a solid block.

Invar is used in the line displacement portion, affording a high frequency stability throughout the temperature range of 10° to 40°C. All radio frequency surfaces are tri-plated. Power handling capability by the absorption method is from 0.5mw to 1w maximum. Power handling by transmission method is from 1mw to 25w peak power. Approximate loaded Q is 2000. Cabinet size is 8" wide x 6-1/2" deep x 5" high. Net weight is 4-3/4 lb. Amerac, Incorporated, Dept. ED, 116 Topsfield Rd., Wenham, Mass.

CIRCLE ED-205 ON READER-SERVICE CARD FOR MORE INFORMATION

Remotely Controlled TV Camera

Operates up to 500′ from Control

This small, remotely controlled TV camera offers possibilities of new control or monitoring features to automation designers. It can also be used by designers to observe equipment being tested at dangerous locations.

The camera is 9-1/2″ long x 3-1/2″ wide x 5-1/4″ high. It has the standard 525 scanning lines transmitted over an 8Mc bandwidth. With an *f*1.9 lens, it has a sensitivity of 1 to 2 ft-candles. Remotely controlled servos can be used to rotate the camera in different directions. The lens mount is a 16mm Type C.

Power requirements are 150w at 115v a-c. The camera control measures 19″ x 8-3/4″ x 13-1/4″, and the synchronizer-monitor measures 19″ x 19″ x 12-1/4″. The video output of the camera can be modulated at the frequency of any one of the 12 commercial television channels.

Up to 500 ft of cable can be used between the camera and its control unit. Remote 10″, 12″ and 17″ monitors are available. Switching equipment is available for operating a large number of cameras from one control unit. Kalbfell Laboratories, Inc., Dept. ED, 1090 Morena Blvd., San Diego 10, Calif.

CIRCLE ED-210 ON READER-SERVICE CARD FOR MORE INFORMATION

Toroidal Coils

Meet Close Tolerances

Sizes of these toroidal coils range from 1/4″ID to 10″ID, with height to 3-1/2″. Wire sizes from No. 10 to No. 42 have been handled efficiently on production runs with 100% turns accuracy or an inductance

of ±2%. The toroids are wound, impregnated, and cased (if required) to customer or MIL-T-27 specifications. Universal Manufacturing Co., Inc., Dept. ED, Michigan & Monroe Aves., Kenilworth, N. J.

CIRCLE ED-211 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products...

Sensitive Galvanometer

Used with High-Impedance Transducers

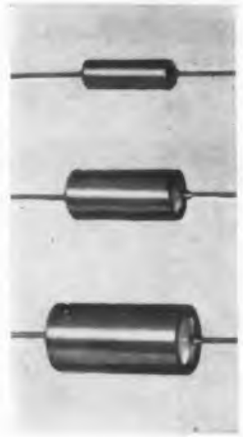
This Type 40-1000 Galvanometer, designed for use with relatively high-impedance transducers, has a frequency of 40 cy, a sensitivity of 2.8μamp per inch (12" optical arm), an external damping resistance of 1000 ohms, and a coil resistance of 109 ohms.

Other features include a completely dustproof solid case, a rotational limit stop, an improved connector terminal, and rapid horizontal and vertical adjustment. The unit is interchangeable with all other types of this company's galvanometers. Heiland Research Corporation, Dept. ED, 130 East Fifth Ave., Denver 9, Colo.

CIRCLE ED-215 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniaturized Capacitor

Stable to 200°C



These Type TI Capacitors vary less than 5% in value from −80° to +200°C. Insulation resistance, even at 150°C, exceeds 1000 megohms per microfarad. Capacitance is substantially unaffected by frequency and has a dissipation factor of less than 0.0008.

These capacitors are hermetically sealed with 100% tin-coated glass-kovar end seals. Container ends are pressure-crimped. Available in the complete RETMA capacitance series, their standard tolerance is ±10%. They also can be obtained with tolerances of ±5% and ±2%. National Capacitor Company, Dept. ED, 385 Washington Street, Quincy, Mass.

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

Molding Material

With High Arc Resistance

"Resinox 3700" has an arc resistance measured at 184sec in standard ASTM tests. It also has excellent dimensional stability and moldability, including good transfer molding properties.

Mineral filled, the material is recommended for use in distributor caps, motor control circuits, power transmission circuits, electrical connectors, ignition parts, switch panels, and radio tube bases. Plastics Division, Monsanto Chemical Co., Dept. ED, Springfield, Mass.

CIRCLE ED-216 ON READER-SERVICE CARD FOR MORE INFORMATION

Regulated A-c Power Supply

Precision Unit for Laboratory Use

This precision, regulated a-c power supply is designed to operate from a 60cy line. Suitable for laboratory use, the unit is rack-mounted and measures 12-1/4" x 19" x 6-1/2". Several models are available for varying output requirements ranging from a minimum of 0.1amp to a maximum of 100amp. Output voltages are controlled by a simple front-panel wheel control. Summit Electronics, Inc., Dept. ED, 7 Industrial Place, Summit, New Jersey.

CIRCLE ED-217 ON READER-SERVICE CARD FOR MORE INFORMATION

Copper Clad Laminates

For Printed Circuits

"Panelyte" copper clad combinations are supplied with copper foil in 1 oz and 2 oz thicknesses, bonded on one or two sides, in sheet stock form. In addition to XXXP base materials, they are offered in melamine glass type GMG, plus silicone glass type GSG.

These combinations are available in standard sheets of 36" x 36" and 36" x 47". Panelyte Division, St. Regis Sales Corp., Dept. ED, 230 Park Ave., New York 17, N. Y.

CIRCLE ED-218 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature CW Magnetron

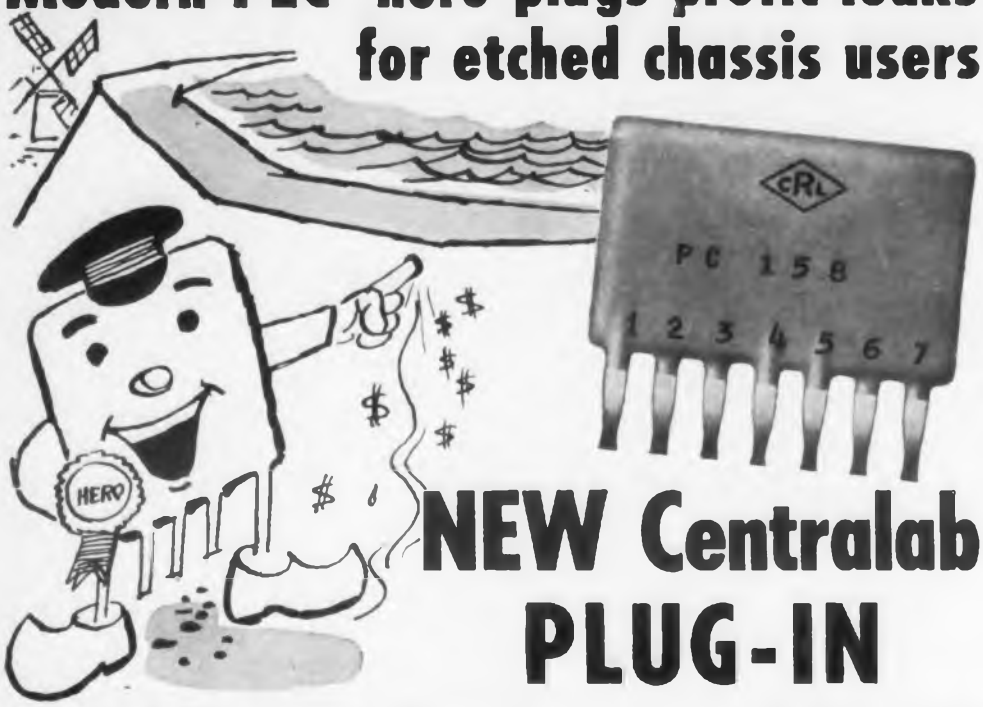
For 9800-10,000Mc Range

This CW magnetron physically resembles a standard receiving tube and operates from a plate supply of 450-500v and a heater supply of 6v. It is for use at a range from 9800-10,000Mc. Known as the Type *6444*, it is fixed-tuned, incorporates a long-life Philips dispenser-type cathode, and delivers 1w of CW energy into a standard klystron octal socket. The magnet is an integral part of the tube package.

The magnetron is extremely rugged, non-microphonic, and especially suited for Doppler-type radar and other field and laboratory use. Microwave Associates, Inc., Dept. ED, 22 Cummington St., Boston 15, Mass.

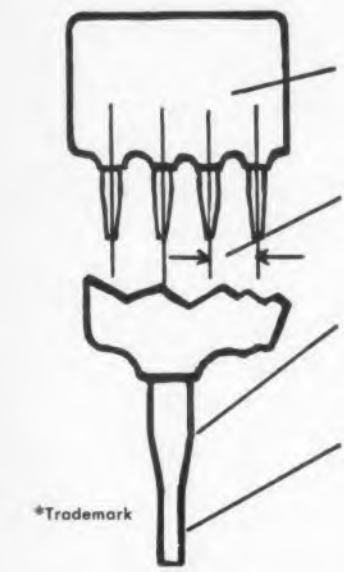
CIRCLE ED-34 ON READER-SERVICE CARD FOR MORE INFORMATION

Modern PEC* hero plugs profit leaks for etched chassis users



NEW Centralab PLUG-IN

Printed Electronic Circuits now available with exclusive, fast-soldering tapered tab leads



*Trademark

Plug-in PEC's are 100% standardized . . . for your *immediate* production use

- **30 STANDARD PEC PLATES** — PC-156, illustrated, contains 3 resistors, 4 capacitors. Eliminates 8 parts, 9 extra soldered points. Simplifies circuit board pattern. Cuts down size and cost of circuit board.**
- **STANDARDIZED FOR FASTER LOCATING** — uniform tabs spaced .172" ctr. to ctr., or multiples of .172" ctr. to ctr. Uniform leads are .344" long, and .045 — .049" wide at base.
- **STANDARDIZED FOR AUTOMATIC CENTERING** — twin taper tabs jam-fit in holes to hold plate away from chassis for above and below soldering. No accidental drop-outs.
- **STANDARDIZED FOR POSITIVE SOLDERING** — tab ends shaped flat to facilitate accurate soldering. Terminals fit 1/16" dia. (round) or 1/16" x 1/16" square holes. One shot of a solder-gun or dip soldering completes the job.

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CIRCLE ED-220 ON READER-SERVICE CARD FOR MORE INFORMATION

New Literature

Point Contact Transistors 221

A 32-page bulletin is primarily devoted to an introductory description of the operation of point-contact transistors in amplifier circuits, followed by typical examples of transistor oscillator and switching circuits. It also devotes four pages to data on characteristics of two specific point-contact transistors, one of which (Type 0C50) is intended for general amplifying purposes, and the other (Type 0C51) for switching applications. The bulletin should serve as a very useful text on the subject of point-contact transistors in general. Amperex Electronic Corp., 230 Duffy Ave., Hicksville, L. I., N. Y.

Power Supplies 222

In a 30-page tract (No. 528) entitled "When Normal Power Fails . . .", this firm compiles their services and products for use on the power side of electronics systems. It discusses devices designed and constructed to meet RETMA standards and such controls as automatic transfer switches, engine-generator starting units, differential relays, time delay relays, and complete control panels. Information on related subjects, current surge tests, adequate lighting, relay protection, and auxiliary equipment for engine generator controls is also included. Automatic Switch Co., 391 Lakeside Ave., Orange, N. J.

General Purpose Computer 227

The "ERA 1103" General Purpose Computer System is described in an 8-page, 2-color bulletin. This system is a general purpose digital computer type for applications requiring a large storage capacity and great programming versatility. In addition to performing large scale calculations, the system is adaptable to a wide variety of applications, including simulation and control in real time. Internal memory consists of 17,408 registers, individually addressed and directly accessible. Supplementary storage is provided by four magnetic tape units. Engineering Research Associates, Div. of Remington Rand, Inc., 315 4th Ave., New York 10, N. Y.

Thermocouple Wires 228

A 6-page specification sheet (307) lists and describes the company's line of thermocouple and extension wires. Sizes, accuracies, chemical compositions, weights and prices are listed in detail. Minneapolis-Honeywell Regulator Co., Industrial Division, Wayne and Windrim Aves., Philadelphia 44, Pa.

Audio Amplifier 229

A 4-page, 2-color bulletin (DB-85-950) describes the type FG 5kw or 10kw variable frequency audio amplifier, which will amplify 30cy to 10,000cy signals up to a million times. Design and construction features, operation, and suggested applications are included, as well as complete electrical characteristics. Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pa.

Copper Electroplated Wire 230

"Copperply", steel wire electroplated with copper, is the development treated in a four-page, two-color bulletin (No. 201) whose most informative feature is a comparison of Copperply and copper wire properties. Designed primarily for electrical applications, Copperply is for economical use wherever strength or stiffness in addition to conductivity is important. Charts showing comparative bending characteristics of 10% Copperply, commercial bronze, cadmium bronze, and copper wire are also provided. National-Standard Co., Niles, Mich.

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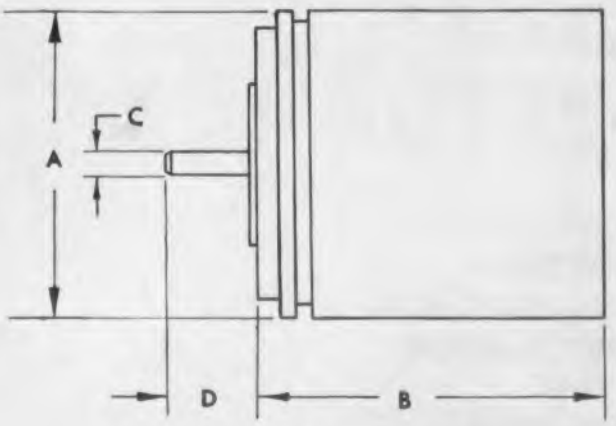

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New Literature . . .

Logarithms

A 501-page publication, "Table of Natural Logarithms for Arguments Between Zero and Five to Sixteen Decimal Places", meets the demand for 16-place tables of logarithms of numbers from 0.0001 to 5 at intervals of 0.0001. It is a reissue of Volume III of a four-volume table of logarithms published in 1941. Price is $3.25. Write direct to Government Printing Office, Washington 25, D. C.

Flexible Servo-Couplings 235

Flexible couplings for use in servo-mechanisms, computers, breadboards, and electro-mechanical instruments are treated in this descriptive six-page booklet. The couplings feature zero backlash, low inertia and high flexibility, and are available in any desired combination of hub and bore sizes. A new series No. 1 coupling is designed to meet the demand for miniaturization of electronic equipment. Rembrandt, Inc., 98 Kirkland St., Cambridge 38, Mass.

Meter-Relay Circuitry 236

This 8-page bulletin (112) explains the functioning of 11 control and alarm circuits utilizing meter-relays. Described are circuits for battery charging control, null-balance pulsing, over- or under-voltage or current alarm, temperature control, and other uses. The circuits have been adapted for vacuum pump control, radiation detection, and microwave transmitter control, as examples. Assembly Products, Inc., Chagrin Falls, Ohio.

Flow and Liquid Level 237

Bulletin 1160 is a 24-page manual on the measuring of flow and liquid level, providing much valuable data on this subject. It is divided into sections on basic principles of liquid level measurements, remote transmission of liquid level, automatic control of liquid level, hydrostatic pressure systems, float systems, displacements systems, electrical conductivity system, gamma ray system, and methods of handling difficult liquids. Industrial Div., Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Phila. 44, Pa.

Dry Process Photocopying 239

This 6-page 2-color brochure describes the "Dri-Stat" line of transfer-process photocopying equipment and materials, including a completely new design of flat-bed printer which is used to expose the original matter with a sheet of "Dri-Stat" No. 1 paper, and two models of a separate processing unit through which this No. 1 paper and a sheet of "Dri-Stat" No. 2 paper are passed to give the positive copy. Also described is a combination rotary printer-and-processer that prints any length of copy material up to 12" wide. Dri-Stat Division, Peerless Photo Products, Inc., Shoreham, L. I., N. Y.

Microwave Bolometers 240

Technical data, resistance and sensitivity characteristics on the new N-821B Bolometer are summarized in a two-page, two-color bulletin. Data on the X-band Model 810 Frequency Meter is also included. Applications and illustrations are provided for both instruments. Nassau Research and Development Associates, Inc., 66 Main St., Mineola, N. Y.

Converters 241

A 20-page catalog (No. 553) contains complete electrical and mechanical specifications, performance charts, and other pertinent data on d-c to a-c-converters, and inductor alternators. The equipment has many applications, such as with wire and tape recorders, communications equipment, and many other types of electric and electrical products. Carter Motor Co., 2644 N. Maplewood Ave., Chicago 47, Ill.

Proximity Meter 242

A 2-page bulletin describes the "Proximity Meter—Capacitance Gauge", a compact electronic device which compares, measures, or monitors dimensions and distortions without any physical contact with the specimen. It is applicable to an extremely wide range of both static and dynamic measurements, and is sensitive to 0.05mfd or closer. Specifications, and application and operating data are given. Fielden Instrument Division, Robertshaw-Fulton Controls Co., 2920 N. 4th St., Philadelphia 33, Pa.

New Literature . . .

Sub-Zero Test Cabinets 248

A 2-page bulletin describes a line of Module Cabinets for operation at temperatures down to —100°F. Each of the three models of this 0.8 cu ft mechanically refrigerated design is available for operation in a different temperature range. The bulletin covers applications, provides specifications, and gives information on the side-by-side "module" arrangement of cabinets according to user's requirements. Hudson Bay Division, Refrigeration Systems, Inc., 646 W. Washington Blvd., Chicago 6, Ill.

Thermocouples 249

This 36-page bulletin (235-5) provides a wide variety of basic thermocouple information. It covers installation methods; "Pyod" and "Baby Pyod" iron-constantan, wire type, chromel-alumel, angle type, and noble metal thermocouples; as well as extension wire, charted and selected couples, bulk thermocouple wire, and instruments. The Foxboro Co., Foxboro, Mass.

Pulse Instruments 250

This four-page, two-color brochure illustrates and describes briefly the manufacturer's range of block unitized multi-purpose pulse instruments. Covered are the Series 2200 Time Delay and Gate Generators, the Series 2300 Pulse Generators, and the Series 2100 Pulse Generators. Each instrument in the series is block unitized, providing change of function through a rear plug-in cable, and expansion of the basic instrument by extending range and application. Electro-Pulse, Inc., 11811 Major Street, Culver City, Calif.

Plug-In Units 251

This 12-page catalog (C-3) describes and gives specifications for a wide variety of packaged, plug-in circuits. These include numerous amplifiers, AND circuit flip-flops, a variety of gate circuits, a multivibrator, a one shot delay circuit, a squaring circuit, and a voltage regulator. Prices of these compact units are also included. Electronic Engineering Co., 180 S. Alvarado St., Los Angeles 57, Calif.

Electric Ovens 253

For general, electronic, and analytic laboratories, pilot plant, and production, a four-page, two-color illustrated brochure covers electric ovens, water baths, and laboratory heat furnaces. Units range in temperature from 100° to 2000°F. Blue M Electric Co., 306-308 West 69th Street, Chicago 21, Ill.

Screw Thread Inserts 254

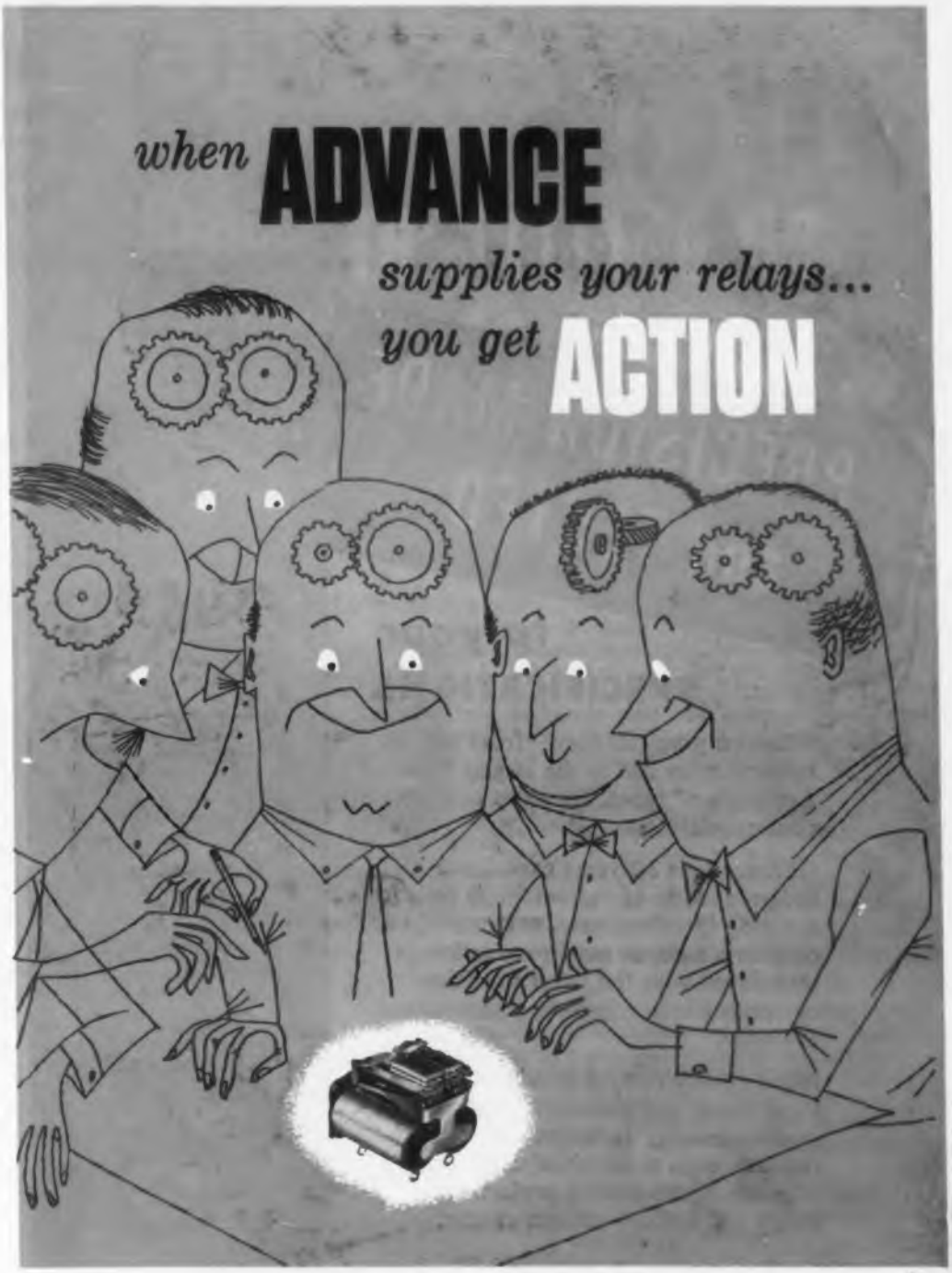
Engineers will find this four-page Thread Repair Bulletin No. 654 of use and interest. The four pages show how stripped or worn threads may be repaired quickly and permanently with the company's screw thread inserts, which are stainless steel, resisting high temperatures and stronger than the metal in material in which they are installed. The inserts may be installed easily in numerous applications of any material. Five tables show how to select the proper screw thread insert to repair and match National Coarse, National Fine, pipe, automotive and aircraft spark plug threads. Heli-Coil Corporation, 1467 Shelter Rock Lane, Danbury, Conn.

Linkages, Mechanisms 255

A mechanical system incorporating a rack-like flexible cable within a rigid conduit is described in the Bulletin 500, a 16-page illustrated booklet. The system, with its unusual ability to transfer accurately linear or rotary motion over a devious path, without intermediate links or pulleys, is completely covered. Of special interest to design engineers is a section on applications with schematic drawings and the specific requirements of each application. Teleflex, Inc., Dept. Y, 125 South Main St., North Wales, Pa.

Precision Metal Parts 256

A 20-page brochure, "Procedures for Precision", describes the facilities of this firm for the production of intricate metal parts held to exceptionally close limits. These parts are used in such equipment as aircraft instruments, radio and electronic equipment, etc. Numerous typical parts are shown, and there are sections devoted to machining, tooling, quality control, and other facilities. Conklin Swiss Screw Machine Co., 900 N. Franklin St., Chicago 10, Illinois.



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Patents . . . By John Montstream

Thermistor Control Circuit . . . *Patent No. 2,625,606. E. Lakatos et al, Summit, N. J. (Assigned to Bell Telephone Laboratories, Inc.).*

By means of this circuit it is possible to maintain a predetermined constant relation between variable impedance elements that are current controlled. For example two elements may be kept equal to each other. The control circuit has various applications such as controlling the gain of a circuit and to reduce inaccuracies in certain voltage multiplying circuits. One application is shown at the right.

The circuit describes particularly the use of thermistors (*3* and *4*) as the variable resistors that are connected to a utilization circuit in such manner as to control some of its characteristics. Briefly, a control voltage source (*5*) provides a frequency that is small compared to the operating frequency and a calibration voltage source (*8*) provides a frequency that is intermediate between the control voltage frequency and the operating frequency for the utilization circuits.

The two voltages are fed directly to one thermistor and connected to the other through a phase-reversing circuit. The other terminal of each thermistor is connected to a band pass filter (*16*) where the currents are summed. The output of this filter is coupled to a modulator and phase detector (*17*).

The modulator and phase detector compares the current flow to the thermistors, and should the currents deviate from the desired relative value, the difference is fed through a band pass filter (*23*) in this stage's output to the input of the ampli-

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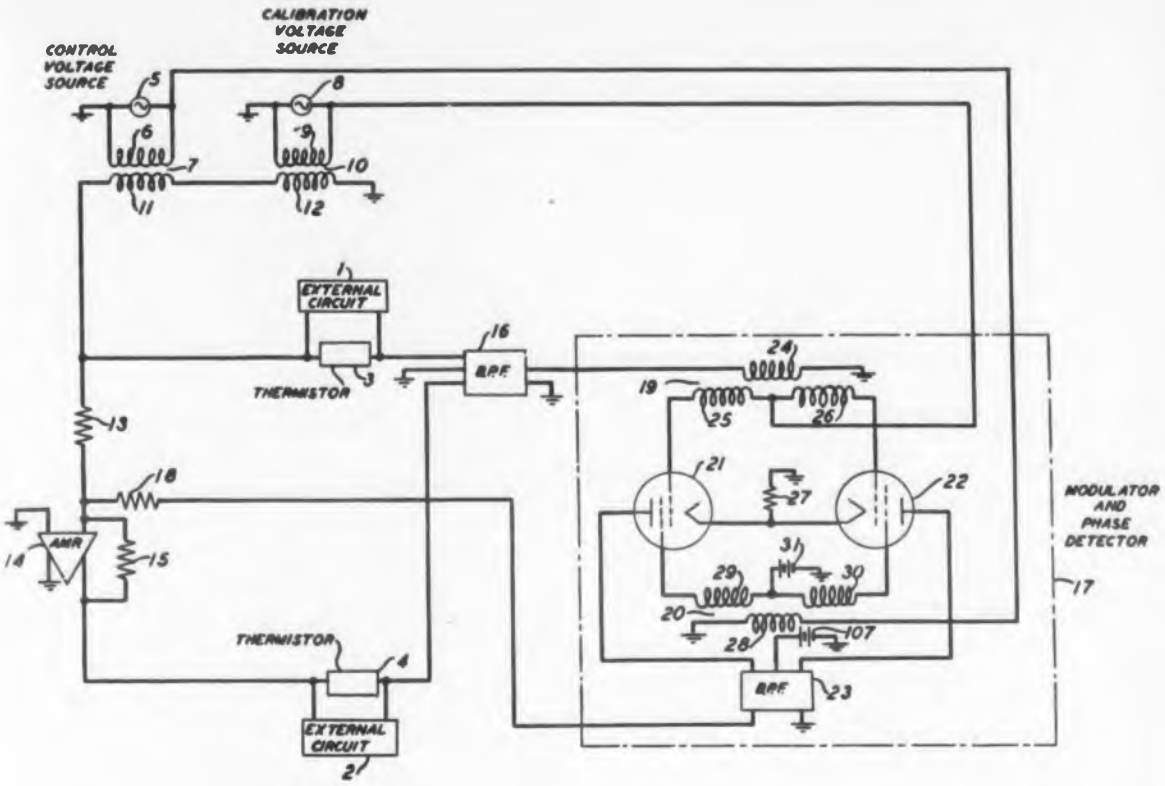

fier (*14*) until the desired current relation is restored in the thermistors.

The patent also includes three other circuit diagrams showing other applications. Two circuits deal with a wave transmission system employing two similar amplifiers and show two different methods of regulating the gains of those amplifiers equally. The last circuit is a highly accurate voltage multiplier.

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- Maintains accurate resistance settings, over a wide range of temperatures.
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Patents . . .

Four-electrode Transistor Modulator . . . *Patent No. 2,657,360. Robert L. Wallace, Jr., Plainfield, N. J. (Assigned to Bell Telephone Laboratories, Inc.).*

Increased efficiency and frequency range for three-zone (N-P-N or P-N-P) transistor modulators is the subject of this patent. The transistor considered is based on the discovery by the inventor that by using a pair of base electrodes (*9* and *10*, Fig. 1) at spaced points on the center zone and passing a current between them confined to the base, that the base resistance can be varied substantially linearly with this current. A variation of from 0 to .11ma produced a base resistance change from 1200 to 10 ohms or less. This discovery is described in an earlier application.

The discovery is used for modulation purposes. By applying a modulating current (S_2) to the auxiliary base electrode (*10*), and a carrier signal (S_1) to the emitter (*7*), the carrier is modulated. The modulated signal appears in the collector circuit. This same circuit can serve as an intermediate frequency detector in a superheterodyne circuit. The signal source (S_2) becomes a local oscillator in this case.

This transistor may be used with different circuitry as a feed back oscillator by feeding back collector current to the auxiliary base electrode, as a heterodyne converter, and, at frequencies of about 100Mc, as a generator of frequency modulated oscillations. Characteristic curves of the new transistor are also provided.

Fig. 1. Modulation circuit utilizing the second base electrode of the transistor.

AEC Patents For Industry

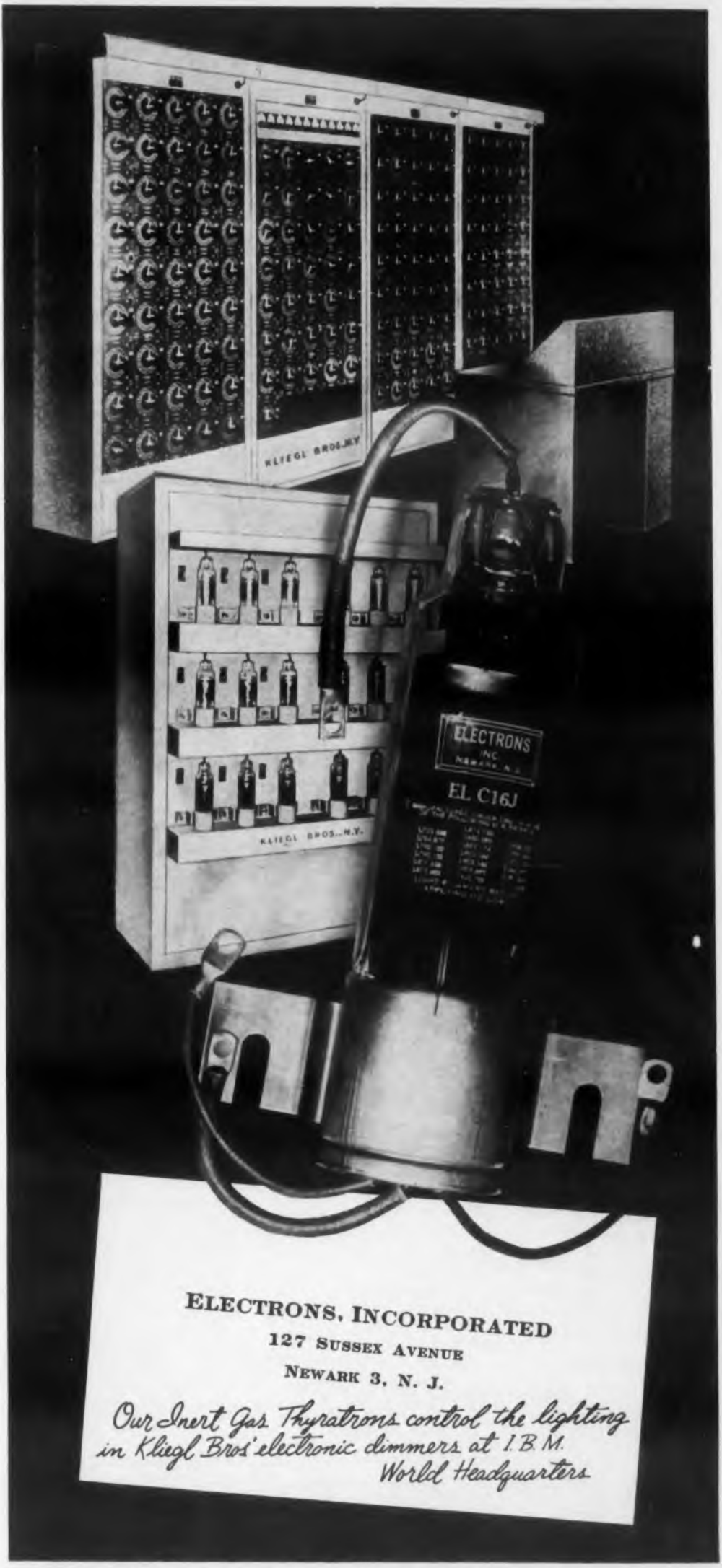
A number of patents held by the Atomic Energy Commission and owned by the U. S. Government have been filed at the U. S. Patent Office for registry and listing in the official register. Licenses on a non-exclusive, royalty-free basis will be granted to interested parties. Applications should be made to the Chief, Patent Branch, Office of the General Counsel, U. S. Atomic Energy Commission, Washington 25, D. C. Of the 26 new patents released, those particularly interesting to electronic design, research, and development engineers are listed below:

Method and Apparatus for Focusing Charged Particles (Patent No. 2,658,150); J. G. Backus and B. Peters, inventors. Dealing with the focusing of divergent beams of charged particles, this patent covers an improved method and apparatus for electrostatically increasing the sharpness of foci of divergent ion beams in the electromagnetic separation of ions.

Neutron Detector (Patent No. 2,663,802); P. E. Ohmart, inventor. This patent discloses a method and apparatus for detection of neutrons. The changes in volume charge in an electret caused by neutron bombardment are detected electrically. These charges are then counted and their time rate of occurrence indicated. This rate is proportional to the rate of neutron bombardment.

Magnetic Electron Multiplier (Patent No. 2,664,515); L. G. Smith, inventor. This invention multiplies electrons by the following means: an electrically conductive plate is located parallel to the lines of flux in a homogeneous magnetic field; some secondary electron emission dynodes are placed about the plate; a uniform electrostatic field is established between the plate and the dynodes (this field is perpendicular to the magnetic field); the electrons to be detected strike the outside dynodes; the secondary emission electrons produced are attracted and amplified in succession by the remaining dynodes; the amplified secondary emission of the last and closest dynode is then collected by the plate.

Light Valve (Patent No. 2,667,104); W. E. Buck, inventor. Without imposing a load on the voltage source, this invention indicates changing voltages by means of a piezoelectric crystal-operated oscillograph. Light interference is used to measure variations in an electric potential that is impressed across a piezoelectric crystal.



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CIRCLE ED-267 ON READER-SERVICE CARD FOR MORE INFORMATION

Books . . .

Principles of Radar . . . *By J. Francis Reintjes and Godfrey T. Coate, third edition, 985 pages. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y. $7.75.*

Like the two previous editions, this book deals with the basic principles of pulse radar. It has been greatly revised however, and the order of presentation of the subject matter has been completely reorganized. Nearly all the material has been rewritten to introduce improved techniques of presentation and to bring about better continuity of articles and chapters. The subject matter has been increased by about 20% and more than half the illustrations are new.

The basic concepts and techniques of radar comprise the subject matter of the book. It is assumed that the reader is familiar with vacuum tubes and their behavior, the basic principles of a-c and d-c circuits, and that he can carry out simple differentiation and integration.

Since radar components can be classified into low frequency and high frequency groups quite readily, the book is organized along these lines. The first six chapters deal with pulse circuits and their application to radar modulators, indicators, and receivers. Synchro and servomechanism circuits also are covered in this section.

The latter part of the book is devoted to the radio frequency aspects of radar. It includes such topics as r-f transmission lines, waveguides, resonant lines and cavities, high-frequency triode oscillators, klystrons and magnetrons, r-f transmitting and receiving systems, antennas, and propagation.

Modulation Theory . . . *By Harold S. Black, 363 pages. D. Van Nostrand Company, Inc., 250 Fourth Ave., New York 3, N. Y. $8.75.*

Written for advanced students and practicing engineers, this book covers the fundamentals of modulation theory in the light of recent progress in this and related fields. It treats modulation systems on a unified basis consistent with modern information theory. Communication engineers are now able to use the advances in communication theory to realize more efficient system design by taking into account the statistical structure of the original message, the matching of the information signals to the noisy channel, and the final destination of the message.

The book stems from a revision of material used in the Communication Development training program of the Bell Telephone Laboratories and, in fact, it is part of the Bell Laboratories Series of books published by Van Nostrand.

The first eight chapters cover the general philosophy of the subject to provide a framework that permits comparison of one system with another on a rational basis. Topics include historical background, reasons for modulating, kinds of modulation, the sampling principle, quantizing, code transmission, and multiplexing; efficient systems of communication; speed of signaling and channel capacity; and reduction of signal power through the use of redundant codes.

The last twelve chapters contain theoretical treatments of various modulation systems. These include amplitude modulation, amplitude modulators and demodulators, amplitude modulation systems, frequency modulation, frequency modulators and demodulators, noise and interference in f-m systems, pulse modulation essentials, pulse-amplitude modulation, pulse-duration modulation, pulse-position modulation, pulse-code modulation, and mobile pulse-modulation systems.

According to the author, a knowledge of elementary calculus and some familiarity with Fourier methods is all the mathematical background required to make good use of the book. Design techniques, methods of instrumentation, and specific applications are not discussed in the book, except to illustrate a discussion or to promote understanding by dealing with concrete situations.

Linear Scale Non-Logarithmic Slide Rules . . . *By Morris L. Groder, paper bound, 64 pages. Published by G&G Corp., 2003 East 12th Street, Brooklyn 29, N. Y. $2.98.*

This interesting work describes methods of constructing slide rules to perform a wide variety of calculations without using logarithmic scales. All scales are equally spaced, and cross section paper can be used as the slide rule body.

Multiplication, division, and folded scales which can be constructed by drawing single straight lines on the slide rule body are described. Addition, subtraction, multiplication, division and combinations of these operations can be done on the same scales.

After a brief introduction to the principles involved, the book covers such topics as division, automatic index shifting, multiplication, combined operations, reciprocals, folded scales, trigonometric functions, polar-rectangular coordinate conversion, and squares and square roots. One section describes how to obtain logarithms from linear scales.

Special slide rules, an electrical linear-scale slide rule, and multiplication and division with an ordinary ruler are also covered.

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