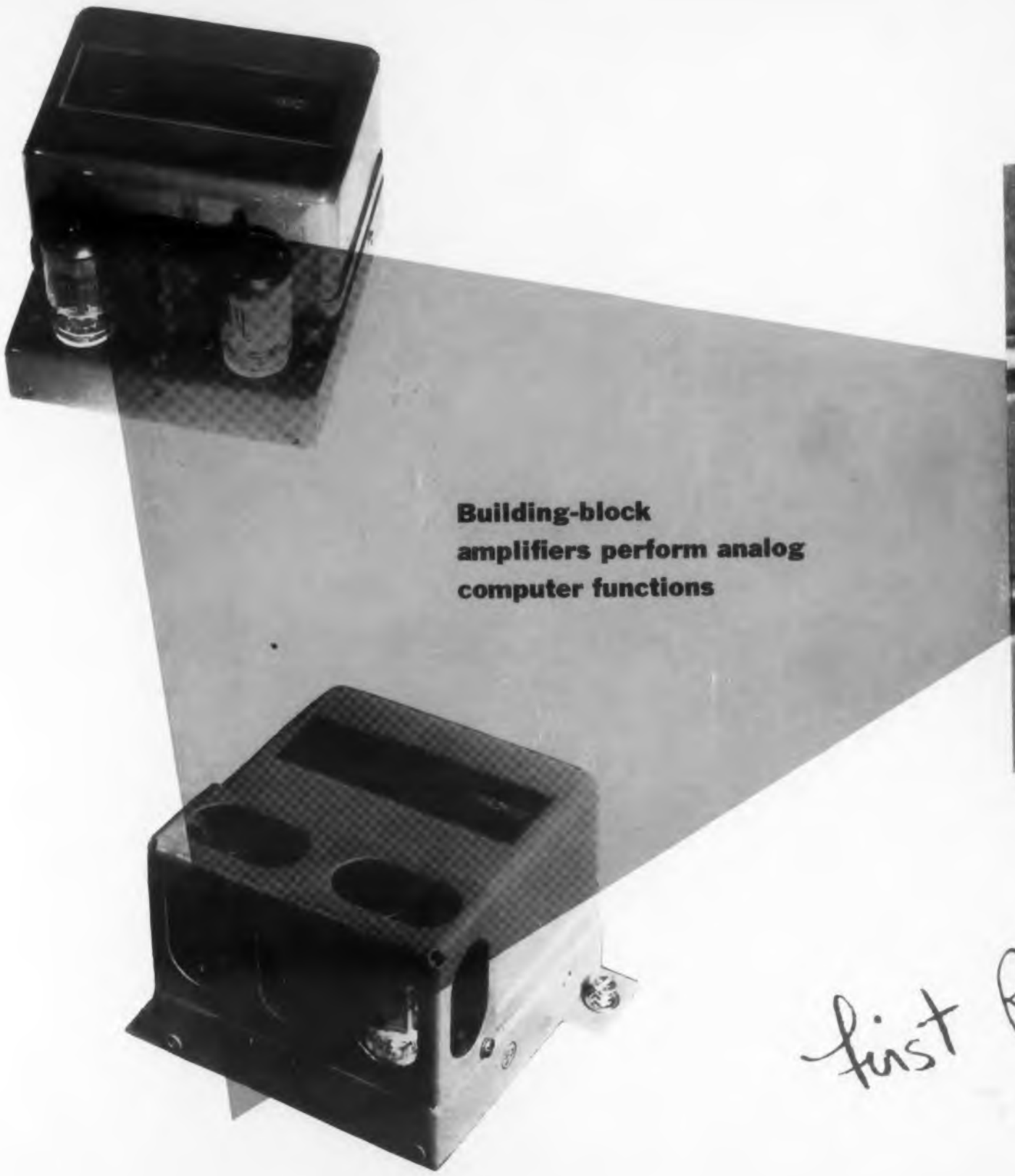
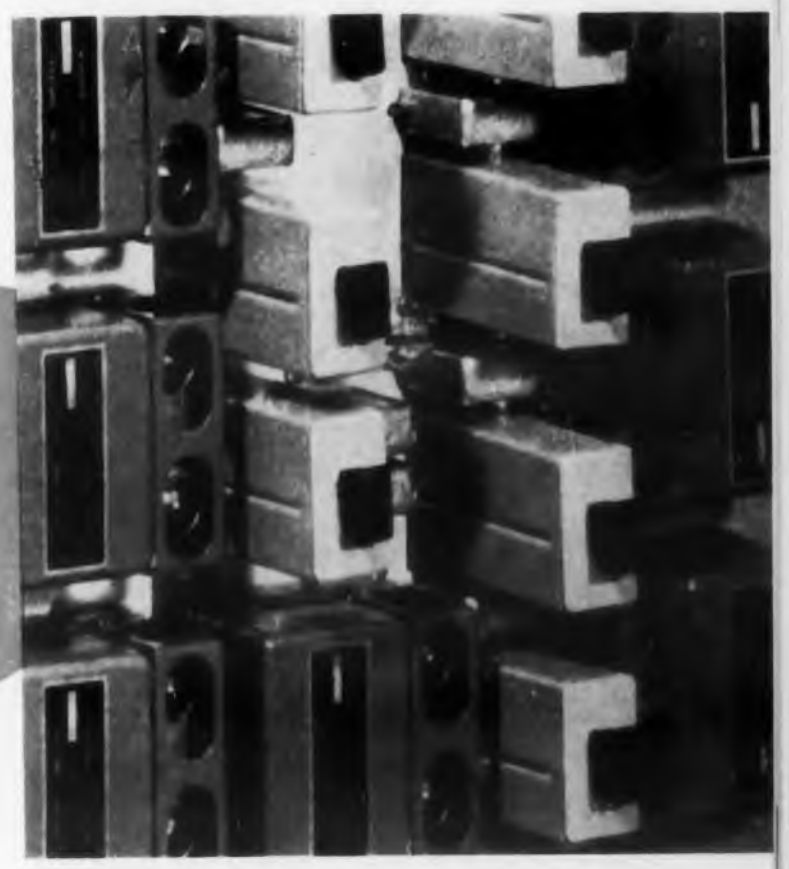
ELECTRONIC DESIGN

August 15



Building-block amplifiers perform analog computer functions



first Russian translations

Page 20

TRANSCO

CO-AXIAL SWITCHES

...a complete line for *high-efficiency* RF switching

Reliable switching is routine with any unit in the comprehensive Transco line. These switches actually improve your RF system performance—they're designed for minimum insertion loss and low VSWR. Isolation between channels is unusually high—hence no interaction. You get flexibility without penalty.

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14000 Series
MINIATURE SWITCH—SP4T
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ELECTRONIC DESIGN

Contents

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BPA

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CIRCLE ED-3 ON READER-SERVICE CARD FOR MORE INFORMATION

Editorial

Russian Translations

In a recent report to Congress, the Hoover Commission Task Force stated that ". . . Our Government and its intelligence forces are not fully exploiting the possibilities of valuable military and technological data potentially available in scientific reports and technical publications issued in foreign countries . . .". Certainly no great effort is being made to acquaint our engineers about progress in foreign electronic technology.

This is especially true in the case of Russia. Articles on Soviet electronic accomplishments rarely appear in the U. S. technical press. On the other hand, it is common knowledge that the Soviets buy practically every technical publication published in this country. They also have a program for translating and dissimenating this information among their engineers.

Their deep (and official) interest in foreign technology is indicated by the recent remarks of Premier Bulganin as reported in the New York *Times* of July 12, 1955. Speaking before a group of industrialists the Premier said, ". . . Some of our people think there is no point in studying foreign experience and indeed these people try to mask their ignorance by boasting. . . . One should condemn such an attitude toward the study of achievements of science and technology abroad. We must constantly study everything . . .". He went further and called for increased purchases of technical literature and wider dissemination of such material throughout the Soviet Union.

In this particular instance we might well follow his advice to our own advantage. A number of Soviet technical magazines reach this country, several concerned with electronics. Some articles are translated by companies for their private perusal. Others, perhaps all are translated by various government agencies. In either case, however, this information rarely appears in print and therefore gets little dissemination.

We feel this material would be of great interest to the readers of ELECTRONIC DESIGN, and therefore, are initiating a program of publishing regularly translations and summaries of articles dealing with Russian electronic technology. At the same time we wish to urge our public officials in Washington to start such a program of translating and disseminating foreign technical information on an official basis. We will be glad to cooperate in any way to assure its success.

Let's make information dissemination a two-way process.

Engineering Review

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

Constant Voltage for Two Years . . . Offering virtually constant voltage for two years of intermittent duty, a newly developed miniature battery has a capacity per unit volume that is at least 125% that of mercury cells. The "micro-cell" has a shelf life of two years and does not swell or leak. When offered for sale, it should have wide application in transistor devices such as hearing aids.

The cell was developed by Elgin National Watch Co., Elgin, Ill. By using indium as the anode material, swelling and leakage has been eliminated. As a result, the cell can be encased in only a thin plastic case. The present cell has the shape of a half-moon, about 3/16" thick, but it can be made in any size or shape.

The nature of the cathode material was not revealed. The present cell delivers about 1.15v, compared with 1.35v for most other miniature cells, but the output voltage could be increased to 1.37v by using another cathode material. Indium, a soft, silvery metal has few other applications.

Automatic Programming . . . The most time consuming element in computer operation, programming, has been placed on an automatic basis by one manufacturer of large computers. By means of this development, an operator not skilled in the special techniques of programming can instruct the computer in business English.

The automatic programming feature has been added to the "Univac" digital computer by Remington Rand Div., Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y. This feature is available in three degrees of complexity. The first is a compiling system designed for use by trained programmers. Its special code is an outgrowth of the computer's regular code with added letters and special terms. The second development, "Business Input-Output Rerun", handles input and output procedures. It can reconstruct the data-processing operations in case of trouble.

The most complex of the automatic programming features does not require any familiarity at all with Univac. It produces a tape that programs the computer completely. It is this last development that should make the large high-speed computer even more valuable to large business organizations.

Clock-TV . . . Portable television receivers with built-in clocks that turn programs off or on automatically have been designed by two manufacturers. Motorola, Inc., Chicago, Ill., is producing a 17" TV set with a clock mounted below the screen. The unit, priced at about $170, weighs 45 lb. General Electric Co., Syracuse, N. Y., is marketing a 14" clock-TV selling for about $100. It weighs 35 lb.

These clock-TV sets should help to stimulate TV receiver sales in the same manner that clock-radio combinations have aided sales of radios. Since these receivers are not likely to be used in the kitchen, they do not include provisions to turn on other appliances. Most clock-radios are equipped to turn on other devices.

TV Controlled by Flashlight . . . A television receiver controlled remotely by a flashlight has been placed on the market. By training the light on cadmium-sulphide photocells mounted about the picture tube, the viewer can switch channels, lower volume, or turn the set on or off. The set can also be controlled in the conventional manner. Known as the "Flash-Matic Remote Control", it was developed by Zenith Radio Corp., 6001 Dickens Ave., Chicago 39, Ill.

Two photocells mounted above the screen control channel selection. Flashing a light on the right-hand cell turns the selector clockwise, and flashing the light on the left-hand cell turns the selector counter-clockwise. The photocells are in circuits that control a motor connected to the tuner. The motor will turn the tuner as long as the light beam is held on one of the two photocells.

Two photocells mounted in the corners below the screen actuate the switches that turn power and volume, respectively, on or off. These cells are in the circuits of *2D21* thyratrons.

These remote controls could be operated accidentally if too much room, sun, or reflected light fall on the receiver. Therefore, the set must be located where too much ambient light will not fall on it. A special flashlight is furnished with the set, but an ordinary household flashlight is also satisfactory. By eliminating the need for wires running across the room, this system should make remote control more acceptable in many homes and taverns.

Better Prints

These prints were made from the same negative on the same grade of paper and developed together. Left one was contact printed in usual way. Right-hand print was exposed to a scanning spot from a cathode-ray tube. Spot intensity is varied by photocell according to the density of the negative at that point. Greater detail results. The electronic contact printer was developed by Logetronics, Inc., Washington #7, D. C.

NEW.... SIGNIFICANT....

Unaline®

S band SERIES

OF MICROWAVE ISOLATORS

The important load isolation functions of Unilines are now available to designers and users of microwave systems and test equipment operating in the S-Band.

New, inherently rugged mechanical designs permit safe operation at substantial peak and average powers. Cascade Research has designed these units to optimize isolation-to-insertion loss-ratio. Special techniques have made possible a reduction in size and weight of the integral permanent magnets. As in all Unilines, no external power source is required.

These Unilines can also be furnished as an integrated part of a microwave circuit and may include such elements as directional couplers, hybrid junctions, twists, bends, mixers and crystal holders. Unilines with even greater power ratings are now under development.

MODEL	28-32A	28-32B	28-32C	28-32D	SL-132	SL-133	SL-131
FREQUENCY RANGE	2.8-3.2 KMC	2.8-3.2 KMC	2.8-3.2 KMC	2.8-3.2 KMC	2.0-2.4 KMC	2.0-2.4 KMC	1.7-2.0 KMC
FORWARD ATTENUATION (TYPICAL)	1.6 DB	1.2 DB	0.8 DB	0.4 DB	1.0 DB	1.0 DB	1.0 DB
REVERSE ATTENUATION (TYPICAL)	27 DB	20 DB	13 DB	6 DB	20 DB	20 DB	20 DB
V.S.W.R. (TYPICAL)	1.20	1.20	1.20	1.20	1.20	1.20	1.20
AVER. TRANSMITTER POWER INTO V.S.W.R. OF 2:1	350 WATTS	350 WATTS	350 WATTS	350 WATTS	350 WATTS	350 WATTS	350 WATTS
PEAK POWER INTO V.S.W.R. OF 2:1	400 KW	400 KW	400 KW	400 KW	150 KW	400 KW	150 KW
WAVEGUIDE SIZE	RG-48/U	RG-48/U	RG-48/U	RG-48/U	——	RG-105/U	——
WAVEGUIDE FLANGES	UG-53/U	UG-53/U	UG-53/U	UG-53/U	COAX TYPE "N" OUTPUT	UG-437/AU	COAX TYPE "N" OUTPUT

APPLICATIONS

LOAD ISOLATION: Will provide substantial isolation between source and load with negligible loss in transmitted power.

ELIMINATES LONG LINE EFFECTS present where antennas are located remotely.

REDUCES PHASE DISTORTION by eliminating multiple reflections.

PROVIDES SMOOTHER TUNING, greatly reduces mismatch presented to a magnetron by the antenna, eliminates tendency of magnetrons to lock on some frequencies or fail to operate on others.

SMOOTHS OUT POWER VARIATIONS WITH TUNING: Magnetron power output to Uniline is maintained at maximum despite changes in line parameters due to changes in frequency.

KLYSTRON, OSCILLATOR-AMPLIFIER BUFFER: Addition of Uniline between oscillator and amplifier can markedly reduce possible pulling and power inconstancy.

CASCADE RESEARCH CORPORATION

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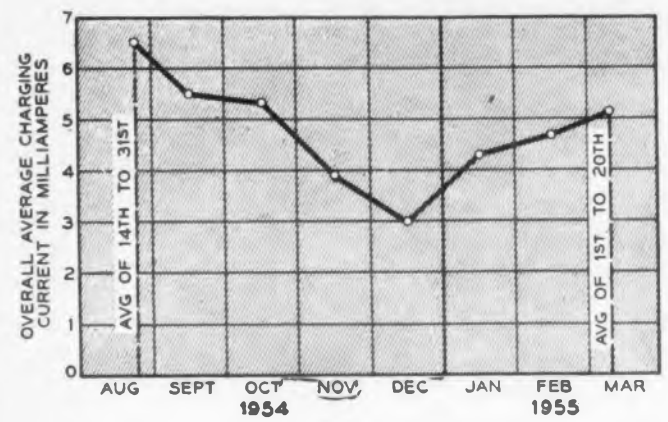

Solar Power

This is a model of the battery of solar cells that will be installed on telephone poles to power rural equipment in an experiment at Americus, Ga. There are 432 discs in this model. During daylight hours will power terminal equipment directly and also charge a storage cell for night operation. The mounting can be tilted to the most favorable angle. A Bell Telephone Laboratories engineer is pictured with the model. The average monthly charging current from a 5-cell solar battery is shown on the graph.

House of Wire . . . An electronic test house, called a "house of wire", is used to duplicate electrically all of the physical factors and changing climatic conditions that affect home heating. Engineers at the General Electric General Engineering Laboratory, Bloomfield, N. J., are using an analog computer and a maze of electrical circuits to study reactions of houses to weather conditions.

These analog technique is applicable to other thermal problems. An example is the study of sudden temperature shocks to which supersonic aircraft and rockets are subjected during rapid changes of altitude.

Huge Atomic Research Outlay . . . Research institutions, manufacturers, electric power companies, and other non-governmental organizations will spend about $300 million of their own money on atomic energy research in the next four years. This figure is from a report prepared by the Atomic Industrial Forum, Inc., 260 Madison Ave., New York 16, N. Y., with the aid of the Atomic Energy Commission.

The report also reveals that between three and five million kilowatts of electric capacity may have to be built and operated on an uneconomic basis before reactor-generated power can become competitive with conventional power. Large reactor plants should become economic some time after 1962. By 1963 the manufacture of components for reactor plants may be over $700 million per year. By 1965, reactor operation may call for an annual consumption of 8000 metric tons of natural uranium, including 26 tons of enriched uranium 235. By the same year the number of scientists and engineers in the field should be double present totals.

The report indicates a considerably enlarged market for electronic detection and control devices in atomic research laboratories and increased employment for electronic engineers. The Forum is a non-profit association of nearly 300 industrial, research, and educational organizations.

New Plating Material . . . Tin-nickel alloy is gaining in use as a plating material, according to the Malayan Tin Bureau, 1028 Connecticut Ave., Washington 6, D. C. The alloy is 65% tin and 35% nickel.

The plating produced with this alloy is equal to nickel-chrome in corrosion and tarnish resistance. It also has exceptional hardness.

Converts TV Set for Color . . . A device that converts conventional monochrome TV sets to reecive color is being marketed. The addition of a color picture tube is not required. The device has a series of color filters spinning in front of the monochrome picture. The filters are synchronized with the scanning of the monochrome screen by that portion of the color signal that corresponds with the color of the filter.

The color picture is reduced to 14" wide no matter what the size of the picture tube. A picture-size-reducing circuit is required as part of the additional subchassis circuitry added to the conventional set to convert it for color. Known as the "Col-R-Tel", the device is made by Color Converter, Inc., Columbia City, Ind.

The filter wheel is contained in a circular housing about three feet in diameter that is mounted on the front of the set, making it resemble one of the old field-sequential color receivers. The filter housing can be removed easily to view monochrome screen in its original picture size.

PERKIN TUBELESS!!
MAGNETIC AMPLIFIER REGULATED
DC POWER SUPPLY

MODEL MR 532-15
5 TO 32 VOLTS @ 15 AMPERES

Immediate Delivery

YOU can test 6, 12, 24 and 28 volt systems . . . with this ONE UNIT!

- WIDE VOLTAGE RANGE
- ELIMINATES NEED FOR BATTERY
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- LOWER MAINTENANCE COST

PERKIN DC power supplies

MODEL MR 532-15
5 to 32 volts @ 15 amperes (continuous)

Specifications . . .

REGULATION ACCURACY: ± 1% (a) from 5-32 Volts D.C.; (b) from 1.5 to 15 amps.; (c) from 105-125 Volts A.C. (Single phase, 60 cps.)

RIPPLE: 1% rms @ 32 Volts and full load, increases to max. of 2% rms @ 5 Volts and Full Load.

A.C. INPUT: 105-125 Volts, Single Phase, 60 cps.

RESPONSE TIME: 0.2 Seconds Max.

AMBIENT TEMPERATURE RANGE: Up to 45°C

METERS: 4½" Rectangular AM and VM — 2% Accuracy

TYPE COOLING: Convection cooled

AC INPUT AMPS: 12 amps

DIMENSIONS: 22" Wide x 17" Deep x 14½" High

MOUNTING: Cabinet with handle or (19" rack panel — 19" wide x 17" deep x 12¼" high)

FINISH: Baked Grey Wrinkle

WEIGHT: 150 lbs.

Wire the factory collect TODAY for price quotations on above and other standard models!

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345 KANSAS STREET, EL SEGUNDO, CALIFORNIA • OREGON 8-7215 or EASTGATE 2-1375

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

Ashtray-Radio . . . One form in which a newly developed transistor radio has been packaged is in an ashtray. The experimental radio, about the size of a package of cigarettes, can also operate with a hearing-aid speaker or with an accessory speaker about the same size as the radio.

Designated the TX-10, the four-transistor radio was developed by Capehart-Farnsworth Co., Fort Wayne, Ind. In the ashtray mount it is connected to a speaker facing the top of whatever surface the unit rests on. The unit delivers 12mw to the speakers and 2mw to the hearing-aid speaker. It operates for 80hr on four hearing-aid batteries. The unit uses printed circuits.

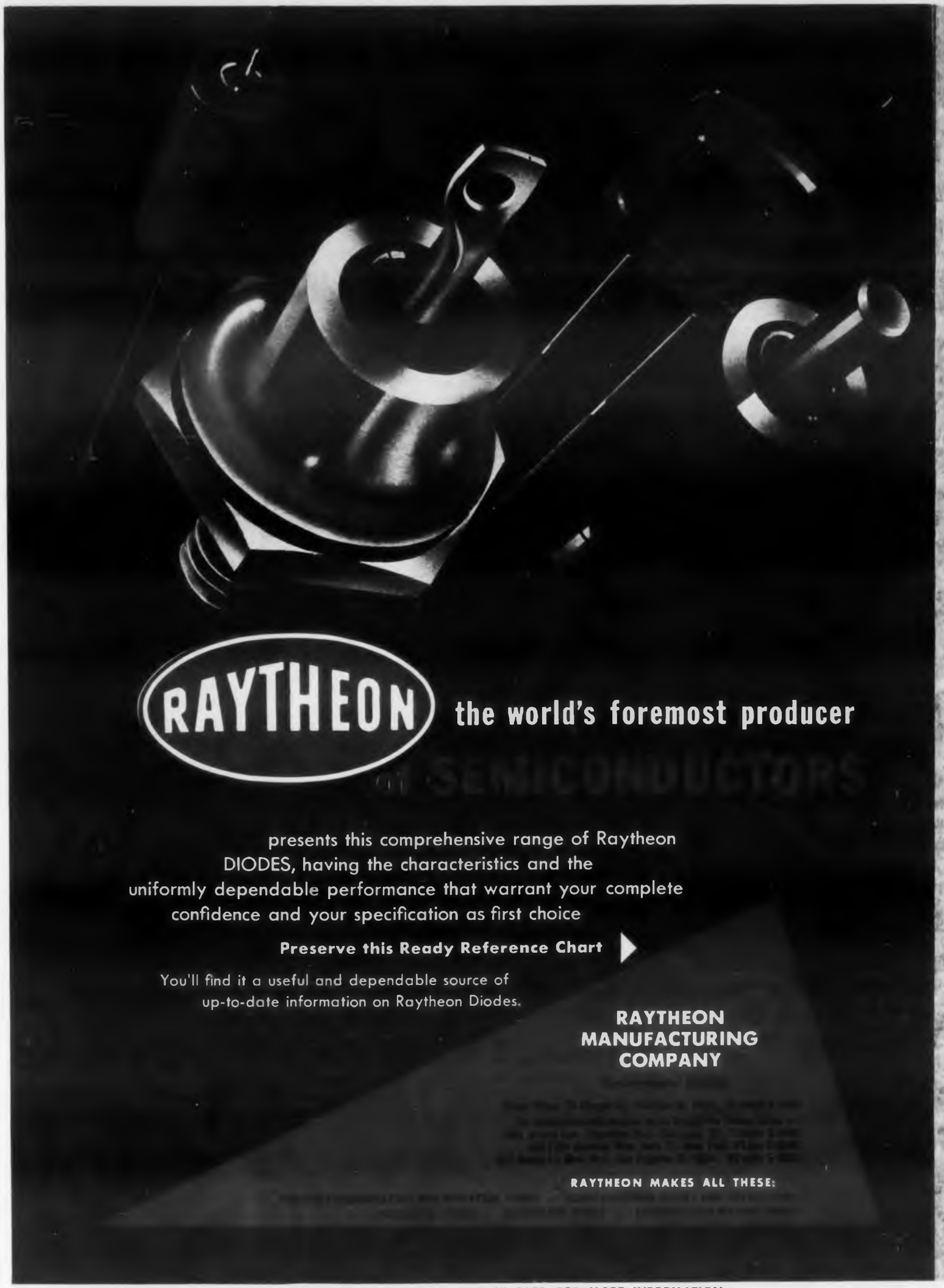
Scatter Propagation . . . Following an earlier announcement of "over-the-horizon" u-h-f transmission (*ED, April, '55, p. 6*), a research program in u-h-f scatter propagation has been launched at Syracuse Univ., Syracuse, N. Y, under Air Force Sponsorship. Pulse-type, a-m, and f-m modulated signals from a transmitter at Lexington, Mass., are being picked up 250 miles away at Syracuse.

The carrier frequency is 915Mc. Enough of the transmission is reflected from the ionosphere or troposphere to be received. All the signals received are indicated by graph lines on recording instruments. It is hoped that some correlations can be made between reception variations and the time of day, weather, and seasons. The principle of scatter propagation is of particular interest to the military because it would enable them to eliminate relay stations in bad terrain.

Clock-Radio with Calendar . . . Automatic calendars have been added to clock-radios by one electronic manufacturer. Motorola, Inc., 4545 W. Augusta Blvd., Chicago 51, Ill., is marketing the unit at about $40. The radio also features twin speakers.

Civil Defense Communications on Wheels . . . A mobile communications center for civil defense has been constructed. The communications gear is installed in a route-van truck and power for the unit is generated by equipment carried in a small trailer towed behind the truck.

The entire assembly was designed and installed in the truck by Instruments for Industry, Inc., Mineola, N. Y. A rack of two-way handy-talkies for use by radiological monitoring teams as well as complete radio gear covering a wide band of frequencies is contained in the truck. A collapsible mast is provided for raising the high-frequency antenna to 50′ for greater coverage.



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

RAYTHEON POINT CONTACT GERMANIUM DIODES

These diodes combine good transient response, low capacity and high frequency capabilities with low cost and dependability. Ambient temperature range −50 to +100°C.

Type	Dimension Outline	Peak Inverse Volts	Average Rectified mA (max.)	Peak Rectified mA (max.)	Maximum Inverse Currents in μA at −5v	at −10v	at −50v	at −100v	Forward mA at +1v
General Purpose									
1N66 (CK705)	A	60	50	150		50	800		5.
1N67	A	80	35	100	5		50		4.
1N68 (CK708)	A	100	35	100				625	3.
1N294 (CK705A)	A	60	50	150		10	800		5.
1N297 (CK707)	A	80	35	100	10		100		3.5
1N298 (CK713A)	A	70	50	150		250μA (max.) at −40v.		(50°C)	30mA (min.) at +2v.
CK801	A	60	50	150			50		5.
CK802	A	80	50	150			100		7.5
VHF and UHF									
1N82A	B	5	50	150	UHF mixer	14 db max. noise — see data sheet for test circuit			
1N295 (CK706A)	A	40	35	125		200	Video detector		
CK715	A	40	35	125		Special tests for VHF to UHF freq. multiplier			
Multiple Assemblies									
CK709	C	Four 1N66 matched within 2.5% at +1.5 and −10 volts for bridge circuits							
CK711	C	Four 1N67 matched from 0 to +3 volts. 30μa (max.) at −50v. for bridge circuits							
CK717	C	Four 1N66 matched within 2.5% at +1.5 and −10 volts for common anode circuits							
CK719	C	Four 1N67 matched from 0 to +3 volts. 30μa (max.) at −500							

RAYTHEON GOLD BONDED GERMANIUM DIODES

This group of diodes features small size, high forward conduction, high back resistance, and good temperature characteristics. Because junction area is increased over that of point contact types, capacity is slightly higher, transient response slightly slower.

Type	Dimension Outline	Peak Inverse Volts (max.)	Average Rectified mA (max.)	Peak Rectified mA (max.)	Maximum Inverse Currents in μA at −10v	at −20v	at −50v	at −100v	Forward mA at 0.8v	at 1.0v	Ambient Temperature Range °C
1N305 (CK739)	D	60	125	300	2.0		20		100		−55 to +70
1N306 (CK740)	D	15	150	300	2.0				100		−55 to +70
1N307 (CK742)	D	125	50	300	5.0			20		100	−55 to +70
1N308 (CK741)	A	10	100	350		500μA at −8 volts				300	−55 to +90
1N309 (CK747)	A	40	100	300		100				100	−55 to +90
1N310 (CK745)	A	125	40	100		20		100		15	−55 to +90
1N312 (CK748)	A	60	70	250			50			30	−55 to +90
1N313 (CK749)	A	125	40	100		10		50		15	−55 to +90

Note: 1N305-6-7 have very high back to forward ratio, high back resistance, sharp Zener characteristic, average transient response
1N308-13 have good transient response with good forward characteristics, high back resistance

RAYTHEON BONDED SILICON DIODES

Raytheon Bonded Silicon diodes provide high back resistance, a sharp Zener characteristic and fair transient response (large overshoot, fast recovery) over an ambient temperature range of −55 to +150°C.

Type	Dimension Outline	Peak Inverse Volts	Average Rectified mA	Peak Rectified mA	Maximum Reverse Currents in μA at −5v	at −10V	at Volts shown	Forward mA at −1v	100°C Average Rectified mA	Max. Reverse mA at −10v
1N300 (CK735)	D	15	40	120		0.001		8	15	0.01
1N301 (CK736)	D	70	35	110		0.01	0.05 at −50	5	12	0.2
1N302 (CK737)	D	225	25	80		0.01	0.2 at −200	1	8	0.2
1N303 (CK738)	D	125	30	100		0.01	0.1 at −100	3	10	0.2
1N432 (CK856)	D	40	40	120		0.005		10	20	0.05
1N433 (CK860)	D	145	30	100		0.03	0.3 at −125	3	15	0.5
1N434 (CK861)	D	180	30	100		0.05	0.5 at −160	2	15	1.0
1N438 (CK852*)	D	7	100	200	10			50	50	

*8 volt Zener regulator

Note: All ratings at 25°C unless otherwise indicated.

RAYTHEON SILICON POWER RECTIFIERS

This new Raytheon silicon rectifier is the first to give high current rectifying capacity in extremely small volume. The rectifiers operate to 175°C, to 200 volts peak and to over 99% efficiency. Back to forward resistance ratio is over 100,000.

Type	Dimension Outline		Maximum Voltage RMS Volts	Peak Volts	Maximum Current Peak Amperes	Average Amperes	Typical Dissipation Watts
CK775	E	Case Temp. 30°C*	40	60	50	15	40
		Case Temp. 170°C*	40	60	15	5	10
		No Heat Radiator					
		Ambient Temp. 25°C	40	60	6	2.0	3.0
		Ambient Temp. 170°C	40	60	2.0	0.5	0.5
CK776	E	Case Temp. 30°C*	125	200	50	15	40
		Case Temp. 170°C*	125	200	15	5	10
		No Heat Radiator					
		Ambient Temp. 25°C	125	200	6	2.0	3.0
		Ambient Temp. 170°C	125	200	2.0	0.5	0.5

ADDITIONAL RATINGS (25°C)
Both CK775 and CK776 have maximum drop at 5 amperes of 1.5 volts
CK775 has maximum reverse current at −60 volts of 25 mA
CK776 has maximum reverse current at −200 volts of 25 mA

*maintained by external heat radiator

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

Another Electronic Reservations System . . . In a further extension of electronics to railroading, the New York Central System will install an electronically controlled central reservations system. This system is similar to the one recently announced by the New Haven Railroad (*ED, May, 1955, p 10*).

The reservation control will be installed by the Teleregister Corp., Stamford, Conn., and ticket agents at stations on the railroad's lines east of Buffalo, N. Y., will have access to the center. The company may later extend use of the system to its entire line.

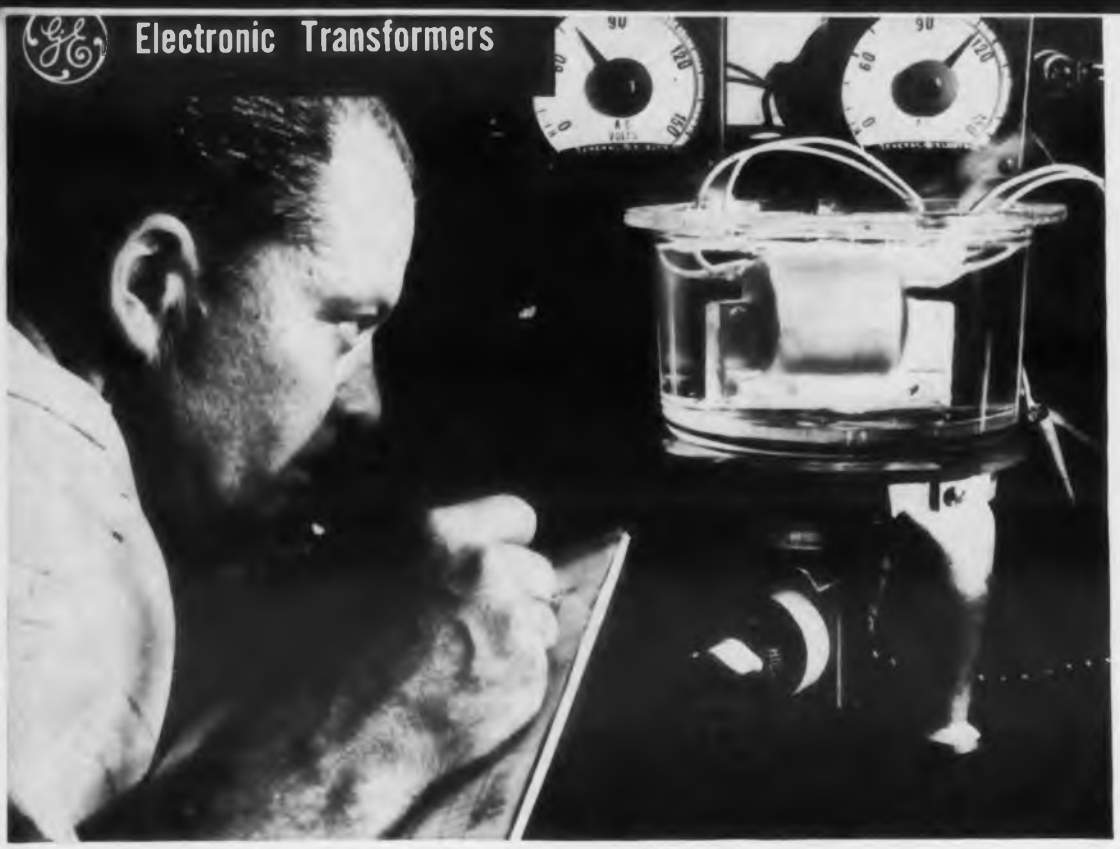
Computer Code Library . . . By building up an extensive library of codes for its two computers, the Midwest Research Institute, 4049 Pennsylvania, Kansas City 11, Mo., is able to offer considerable economies to firms that rent the calculators. Coding a problem for insertion into a computer often makes rental of the computer prohibitive.

The Institute has developed a library of computer instructions for a wide variety of problems in all branches of engineering. With this system the client need pay only for the actual time spent in calculation on the calculator, plus a nominal amount credited to the development of the code library. With each new problem completed, new codes are added to the library.

Wires Used to Print . . . New high-speed printers employ the ends of fine wires to print characters at the rate of 1000 lines per minute. The wires are grouped together in a matrix. The printers, Type 719 and 730, were developed by International Business Machines Corp., 590 Madison Ave., New York, N. Y., to be used in conjunction with their high-speed computers. They can prepare many types of business documents such as bills, checks, and receipts.

Photocell Protects Planes . . . A lead sulphide is being employed in a device that automatically ejects a rocket if it ignites accidentally in an airplane's rocket bay. The fire detection system operates in 1/2000sec. It is now being evaluated by the Air Force.

The Air Force is concerned about the danger to pilots and planes from accidentally ignited rockets or rockets "hanging up" when the rocket cradle is retracted into the rocket bay in the fuselage. Electronics Corp. of America, Cambridge, Mass., developed the compact device. The photocell functions by detecting incipient infrared radiations.



TO PROVE THE MOISTURE-RESISTANT QUALITIES of G-E high temperature encapsulated transformers, our engineers operated one in boiling water. Your application probably won't ever require this much protection, but it proves that G.E.'s encapsulated transformers can take it!

NEW G-E ENCAPSULATED TRANSFORMER

Operates in boiling water

RESISTS SHOCK, SOLVENTS AND HUMIDITY

Humidity — shock — corrosive atmospheres—high temperatures—G.E.'s new line of encapsulated transformers protects against them all. This new line features a wide range of encapsulation processes and transformers to meet your specific equipment needs.

These encapsulated transformers are designed for use in a range from Class H temperatures in military applications requiring MIL-T-27, Grade 2 performance, to industrial and commercial applications where protection is required against greases, oils and corrosive atmospheres.

MANY COMBINATIONS AVAILABLE

Now the designer has a freedom of choice to specify the exact degree of encapsulation required without having to pay for unnecessary encapsulation protections.

Various combinations of encapsulation are used, including an extremely durable elastomer formulation, a Class A modified epoxy resin, and others used in combination with varnishes and permafils, to produce a coating specifically designed to meet specified environmental characteristics.

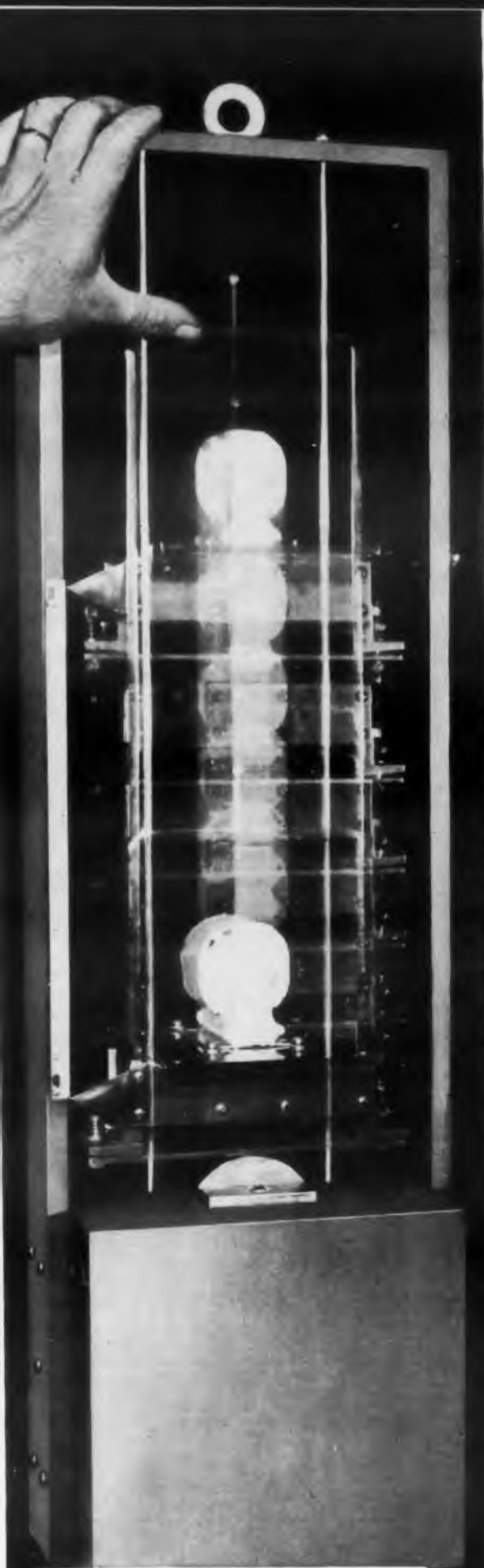
"TAILOR-MADE" UNITS

By balancing the physical requirements of size and weight, ambient temperatures, atmospheres and equipment specifications, G-E engineers can now provide you with a "tailor-made" encapsulated transformer combining many of the proved qualities of hermetically-sealed, metal-clad, and open core-and-coil transformers which have been a standard of quality in the electronic industry.

Where encapsulated transformers may solve your design problem, consult your nearest G-E Apparatus Sales Office, or write the General Electric Company, Section 410-14, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC



EVERY DESIGN of G.E.'s new line of encapsulated transformers is subjected to this severe Government-specified shock test . . . further proof that G-E encapsulated transformers can take it.

Phototransistors in Street Lights . . . A phototransistor has been incorporated in a newly developed switch for street lamps. The switch automatically turns on the lamp according to the degree of light at the lamp location.

The switches were developed by Broadway Maintenance Corp., Long Island City, N. Y. They replace two types of switches. The vacuum-tube type is two or three times the size of the phototransistor type, while an older clock-type is also much larger and not as useful. The new type switch is expected to lower maintenance costs.

Women Better Fixers . . . Women are being employed to repair TV receivers in England, according to the July, 1955, issue of *Wireless World* (*p 352*). One repair shop finds that the greater manual dexterity of women is a major advantage. Only married women with at least one child are employed by this shop because their experience with crying babies made them more sensitive to the different sounds produced by radios and TV receivers. The article didn't explain who is home taking care of the kids while mother is out on an emergency call.

Heavy Water for Sale . . . The Atomic Energy Commission has made agreements to sell heavy water to Australia, India, Italy, and France. Heavy water is used as a moderator in reactors to slow down the speed of neutrons. The agreements are part of the "atoms-for-peace" program.

Electronic Gear Checker . . . An electronic device that checks gears for tolerances and stops the gear-making machine when it starts to produce out-of-tolerance gears has been developed. The unit also indicates when the hob, the gear-cutting tool, is beginning to wear.

The device is custom-made for each installation by Airborne Instruments Laboratory, Inc., 160 Old Country Rd., Mineola, New York. The unit is capable of handling as many as 1000 gears per hour.

◀ CIRCLE ED-7 ON READER-SERVICE CARD

Over-the-Horizon TV . . . TV experts of the Canadian National Research Council are testing a new invention called a time-space modulator which, it is claimed, will enable transmission of TV signals past the limits of the earth's horizon. The invention, reported in the July issue of the *Du Mont Dispatch*, Allen B. Du Mont Laboratories, Empire State Bldg., New York. N. Y., is intended to reduce frequency of TV signals at the transmitting end, permitting short-wave transmission over long distances.

Electronic Auto Horn . . . A reader has proposed an electronic automobile horn to help make crowded cities quieter and more liveable. The horn would be used to warn other cars, but pedestrians wouldn't hear it.

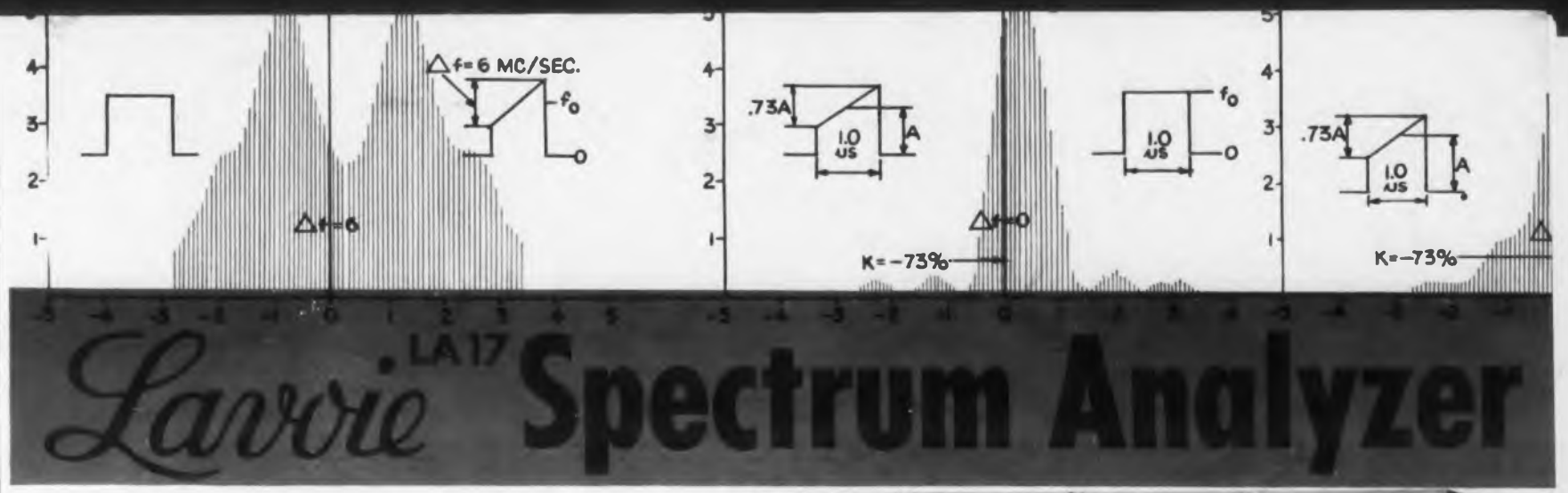
Pressing the horn button would trigger a low-power transmitter. The signal sent out by the transmitter would sound a pleasant bell inside other cars within about a hundred yards. The bell would become louder as the cars approach each other. A directional effect could easily be incorporated. The regular horn would be used to warn pedestrians.

Suspended Room . . . A room isolated from vibration and noise has been constructed at a new laboratory. The entire room is supported on vibration isolators. This anechoic room will be used for sensitive testing of various electronic devices.

The room was installed at the Cherry Hill, N. J., laboratory of the Radio Corp. of America by Robinson Aviation Inc., Teterboro, N. J.

Highest TV Tower Planned . . . What is believed will be the highest TV tower in the world, a 2160′ structure to be built of concrete, is planned by 1958 at the Brussels, Belgium, International Exhibition. The tower will function as part of a vast European interchange system and will reduce the need for relay stations. This will be the first structure in Europe higher than the Eiffel Tower.

CIRCLE ED-8 ON READER-SERVICE CARD ➤



Lavoie LA17 Spectrum Analyzer

- ★ Finer Resolution . . . 10 Kilocycles
- ★ Complete in one unit . . . no extra tuning heads required
- ★ Single Dial tuning . . . Use of stable triode oscillators eliminates klystrons
- ★ Smooth tuning without backlash
- ★ Ruggedized to military specifications
- ★ Simplicity of operation permits use by production line personnel
- ★ Usable to 34,000 megacycles

SPECIFICATIONS

DIMENSIONS
25-7/16" high by 20⅛" wide by 19⅛" deep.

WEIGHT
150 pounds

PRESENTATION
5CPIA 5" cathode-ray tube (other persistances available).

SENSITIVITY
At signal to noise ratio 2:1, and spectrum width 25 megacycles:
— 75 dbm at 10 mc to
— 50 dbm at 16,000 mc

RANGE
10 megacycles to 16,000 megacycles calibrated. Usable 1 to 34,000 megacycles.

ACCURACY
Dial accuracy ±1.0% at the operating frequency of the local oscillator.

SPECTRUM WIDTH
0.5 to 25 megacycles

RESOLUTION
10 kilocycles

TEMPERATURE RANGE
Operating — 40 to + 130° F

HUMIDITY
90% RH.

SHOCK
(Non-operating in transit case.) One 12G impact, 10 mlsec duration on each face. One 37G impact, 10 mlsec duration on each face.

Lavoie Laboratories, Inc.

MORGANVILLE, NEW JERSEY

Call The Lavoie Representative nearest you for complete information on The L A 17 Spectrum Analyzer and other Lavoie equipment.

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J. A. Reagan Co.
51 Summit Avenue
Phone: 4-7676

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Southeastern Industrial Instruments
374 Hascall Road, N.W.
Phone: Exchange 7801

Baltimore, Maryland
Thomas L. Taylor
2100 St. Paul Street
Phone: Belmont 5-9126

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R. Edward Stemm
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Phone: Columbus 1-2227

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Montclair, New Jersey
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Phone Montclair 3-0257

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Edwin H. Murty
3505 Ridgedale Avenue

YES . . . 2 OUT OF 3 ELECTRONIC ENGINEERS SPECIFY MOLONEY TRANSFORMERS FOR TRANSMITTERS

Big league designers recognize that the key man on a transmitter team is the dependable transformer. Therefore, it is not surprising that 2 out of every 3 transmitter manufacturers specify Moloney Transformers. That's a .667 batting average and that's good in any league.

With Moloney in the lineup . . . you aren't fielding a rookie . . . but a seasoned veteran.

For your transmitter specify a league leader.

- Modulation Transformers
- Modulation Reactors
- Rectifier Transformers
- Filter Reactors

Write for Bulletin ST3505.

MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Step Voltage Regulators • Regulating Transformers Load Tap Changing Transformers • Load Center Transformers • Unit Substations • Network Transformers • Constant Current Transformers • Capacitors • Transformers For Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

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

Large Area Mapped Electronically . . . Shoran equipment is being employed to help map a large part of the Canadian Northwest. Six land-based Shoran field stations and two airborne units are being used in the survey.

The mapping of the half-million square mile area is being done for the Canadian Dept. of National Defense. Shoran was developed during World War II as an aerial navigation aid by Radio Corp. of America, 30 Rockefeller Plaza, New York, N. Y.

Continuous Tape Reel . . . A continuous loop magnetic tape magazine that does not have to be rewound has been developed. A recording and playback device utilizing the magazine has also been developed. The tape can also be removed from the magazine for recording on standard equipment. Although the magazine was conceived as an advertising device, it can also find application in data recording, telephone answering services, juke boxes, broadcast studio operation, and as a teaching aid.

The magazine and playback equipment were developed by Cousino, Inc., 2325 Madison Ave., Toledo 2, Ohio. The playback machine is much simpler mechanically than standard playback equipment. The playback device, known as the Audio Vendor Riviera, employs a half-track magnetic playback head. One knob controls the play, stop, and eject of the tape magazine. The tape used in the magazines is specially processed for low friction.

Continuous loop magazines of recording tape have been in use in Europe for four years (*ED, May, 1955, pp. 20-21*), but the tape is scribed with a needle like conventional records and not recorded magnetically.

The playback device for the continuous-loop magazine is only 9" x 11" x 13" in dimension.

Tool Control Without Relays . . . A machine tool control system that eliminates relays has been developed. Utilizing transistors, photo transistors, magnetic amplifiers, semiconductor diodes, and magnetic cores, the control, known as the "Cypak" system, offers greater reliability, longer life, and less complexity than machine tool controls with moving parts.

Developed by the Westinghouse Electric Corp., Pittsburgh, Pa., the development of the Cypak system is based on a careful analysis of present machine controls. It was found that most of the relays and other elements in conventional controls were processing information rather than handling power. The information-processing steps were broken down into four types of logic functions: "and"; "or"; "not"; and "time" functions. Each of these functions is served by a different combination of static elements such as diodes or magnetic cores.

By analysing each machine control problem by Boolian algebra, the proper logic functions can be specified. In the information-processing stages, low power levels are suitable. Levels as low as 10mw are being considered. In the final power-handling stages, transistor and magnetic amplifiers are employed to amplify the signals from the logic stages. Where large amounts of power are required, a relay may still be necessary in the final stage.

The low power levels in the logic stages means that control switches without moving parts, such as phototransistors, may be employed for still greater reliability. The Cypak system is of particular value in automated factories where the control systems would necessarily be of great complexity.

Huge Ferrite-Core Memory . . . A memory incorporating 170,000 tiny ferrite cores has been developed. The attendant reading and writing circuitry includes 1200 tubes. Known as the "Mneotron", the unit can write in a 40-digit word in 15μsec and read it out in 8μsec.

The cores are enclosed in 40 matrices. The Mnemotron is made by International Telemetering Corp., Los Angeles, Calif. It was developed by a design group headed by Raymond Stuart-Williams, Matthew Arnold Alexander, and Milton Rosenberg.

Radio Receptor Stops Making Transistors . . . Radio Receptor Co., Inc., has temporarily suspended its production of germanium transistors. Manufacture of germanium diodes continues, and development work on silicon transistors and diodes is being increased.

The Brooklyn, N. Y., firm found that the national demand for transistors was not sufficient at this time to enable the firm's other operations to support the transistor department. Radio Receptor has been in the transistor business for four years. They will continue to sell transistors from stock.

No longer need the lack of material deter you from switching to printed circuitry. Revere *Rolled* Printed Circuit Copper is now available to laminators in standard coils of 350 lbs. in widths up to 38″, and in .0015″ and .0027″ gauges weighing approximately 1 oz. and 2 oz. per square foot.

Revere *Rolled* Printed Circuit Copper is accurate in gauge, of high conductivity, and uniform density. It is easily etched and soldered.

The next time you order blanks from your laminator, specify Revere *Rolled* Printed Circuit Copper.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y
Sales Offices in Principal Cities, Distributors Everywhere.

CIRCLE ED-10 ON READER-SERVICE CARD FOR MORE INFORMATION

Too much competition ?

High Voltage Comes of Age!

Offers *Heavy-Duty* Industrial High Voltage Power Supplies

The Basic 20

No Extras—Every safety and performance feature you need is standard equipment!

- Reversible polarity
- Adjustable over-current trip-out
- Adjustable over-voltage trip-out
- Three-ranges grounded voltmeter
- Three-range grounded milliammeter
- Automatic output-grounding switch
- Zero-start interlock—with bypass
- Double-interlock protection on doors
- Provision for auxiliary interlock
- Self-holding primary contactor
- Safety resistor in output lead
- Output continuously adjustable, 0 to 100%
- Low corona levels
- RF interference effectively suppressed
- Neon-gap protection on meters, relays
- Three-wire primary circuit
- Six pilot lamps indicate circuit status
- Blown-fuse indication on all fuses
- All panel elements "dead-front" connected
- Meters are hand-calibrated to 2%

Off The Shelf—We stock all 23 standard sizes!

Max. Output MA. DC	Max. Output Kilovolts DC							
	2.5	5	10	20	30	50	60	120
5		H-20 $415	H-30 $440	H-40 $500	H-50 $590	H-60 $1,070		H-80 $1,580
10				H-41 $660	H-51 $740	H-61 $1,240	H-71 $1,440	
15						H-62 $1,420		
20		H-23 $500	H-33 $625	H-43 $900				
35		H-24 $600			H-54 $1,000			
50	H-15 $560		H-35 $800	H-45 $1,020				
100	H-16 $620	H-26 $740	H-36 $1,100					
200		H-27 $900						

All units can be equipped at the factory with line-regulating input transformers and line filters. All units can be supplied with AC/DC output.

Model H-50—Highest output voltage in the air-insulated style. This rugged unit develops 0—30 KV at 0—5 ma DC. Ripple is 1% at 2 ma, 2.5% at 5 ma. Regulation is 35% at 30 KV, no load to full load. Input 115V AC 60 cps, 4 amperes, 80% P.F. Safe, stable, Corona-guarded and virtually indestructible.

Write for Catalog H5

For our complete line of electronic power supplies See electronics Pp. 113-120 BUYERS' GUIDE

NJE CORPORATION

Electronic Development & Manufacturing

343 Carnegie Avenue
Kenilworth, New Jersey

Rapid, complete, competitive custom quotes from 1000 Amperes (low voltage) to 250 KV (low current).

COMPETENT ENGINEERING REPRESENTATION EVERYWHERE

Visit N J E — Booth #205 at the Wescon Show

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

Tiny Silicon Rectifier . . . A tiny silicon rectifier that handles 10a at 100v has been developed. Capable of operating at 400°F continuously, the unit is about the same size as silicon diodes presently used in computers. It operates at about 99% efficiency.

The rectifier was developed at Bell Telephone Laboratories, Inc., 463 West St., New York 14, N. Y. It will be manufactured by Western Electric Company for use in its own products. Since silicon rectifiers that are not much larger than this unit and handle practically the same amount of current are already available commercially, it should not take too long for rectifiers this size to be made by a number of manufacturers.

First Synthetic-Music Record . . . The first record of simulated music made by the "Electronic Music Synthesizer" (*ED, February, 1955, p 5*) has been released. The synthesizer creates by electronic means any known or imaginable combination of sounds.

The device was developed at the David Sarnoff Research Laboratories of the Radio Corp. of America, Princeton, N. J. The record is entitled "The Sound and Music of the RCA Electronic Music Synthesizer". It includes an early experiment in electronic synthesis of the human singing voice.

New Computer Uses . . . Electronic computers are being used to design lenses, airplanes, and transformers in various parts of the nation. In another use, a computer is being employed to cut oil exploration costs in Texas.

The lenses used in "Cinemascope" cameras were designed with the aid of two computers at the plant of the Bausch and Lomb Optical Co., Rochester, N. Y. The computers were a type 604 and a type 607, both made by the International Business Machines Corp., 590 Madison Ave., New York 22, N. Y.

Studies of scaled models of planned supersonic planes and missiles are implemented at Moffett Field, Calif., by means of a "Datatron" digital computer. This type of computer is also being used by an oil company to help pin-point underground oil traps and lower the number of dry wildcat wells. The instrument is operating at the Field Research Laboratories, Magnolia Petroleum Co., Dallas, Texas. The Datatron is made by Electrodata Corp., 717 North Lake Ave., Pasadena 6, Calif.

Complete designs for power transformers are available in minutes from an IBM 701 Computer at the Transformer Div., Westinghouse Electric Corp., Pittsburgh, Pa. This division is acquiring another computer, an IBM-705, next year.

A method of speeding up airplane and engine design utilizing an IBM-701 computer has been developed. At the Aircraft Gas Turbine Div., General Electric Co., Cincinnati, Ohio, planes and engines are tested while they are still on the drawing board.

Electronics in Banking . . . One of the fields in which electronic devices are being used to an increasing extent is banking. Closed circuit TV has been installed in the Central State Bank, Oklahoma City, Okla., and the Irving State Bank, Irving, Tex., to enable tellers to verify bank balances and signatures remotely and to speed withdrawal service for depositors. The industrial TV equipment for these installations was made by the Radio Corp. of America, Camden, N. J.

Ultrasonic waves are being used by Diebold, Inc., Canton, Ohio, in burglary equipment. The alarm system saturates a bank's lobby and working area with ultrasonic waves that will trigger an alarm whenever the slightest movement occurs in the protected area. The ultrasonic features of the equipment are manufactured by Walter Kidde & Co., 477 Main St., Belleville, N. J.

An automatic bank bookkeeping system designed to bring a high degree of automation to the task of processing checks has been announced by Burroughs Corp., 6071 2nd Blvd., Detroit, Mich., Todd Co., Inc., Rochester, N. Y., and Addressograph-Multigraph Corp., Cleveland, Ohio. The new system uses an invisible code placed on paper checks as a by-product of other necessary printing. Devices for automatically reading this code will make it possible to sort checks automatically. It is anticipated that it will also be possible to code the amount.

Burroughs Corp. also has demonstrated a new electronic device that "reads" travelers checks at the rate of 7200 an hour and automatically punches the information onto punch cards. The output cards are then used to operate other equipment which carries out the necessary accounting and record-keeping operations.

French Stamp Honors TV . . . Designed as a tribute to television, the French have issued a 15-franc "television" stamp. According to the Admiral Corp., 3800 Cortland St., Chicago 47, Ill., the stamp shows the Paris skyline highlighted by television antennas, including the biggest antenna of all—the Eiffel Tower. The famous tower is a sort of prototype for the giant TV transmitting and receiving towers now being constructed in many parts of the world.

Candlebra-Like TV Antennas . . . Two TV stations are employing an unusual candlebra-like TV antenna installation recently completed at Dallas, Tex. By sharing the same tower, stations WFAA and KRLD are saving a great deal of money. The separate antennas—a different type for each station—are mounted 75′ apart on a rectangular platform atop the tower.

The antennas, made by Radio Corp. of America, New York, N. Y., will reach up 1521′, one of the tallest structures in the world. The installation is also of benefit to the stations' audience, since they can now have their antennas focussed in one direction.

The *All-Metal* Multi-directional Mounting*

ROBINSON originated and universally APPLIED

1955
1954
1953
1952
1951
1950
1949

*This multi-directional mounting, when installed as recommended, protects equipment from imposed vibration and shock emanating from any angle and permits installation and use in any position.

ROBINSON Series 9300 plate type double acting multi-directional mount shown here in actual size No. 1, and available in any size required. Load ranges per mount:

Model 9301.....½-3 lbs. Model 9303.....2-7 lbs.
Model 9302....1-6½ lbs. Model 9304..Up to 15 lbs.

Natural frequencies 12-15 c.p.s.
Higher stiffnesses available.
Special designs upon request.

ORIGINATED BY ROBINSON in 1949, the all-metal multi-directional mounting was designed to meet the radically new and different problems of ***guided missiles and jet aircraft*** requiring protection of electronic equipment from every angle against shock and vibration.

ENGINEERED AND TESTED in 1950, in the laboratory under rigorous specifications anticipating actual use, and in field tests far exceeding probable requirements, this mounting was quantity produced only when its performance had been demonstrated.

SERVICE PROVED AND UNIVERSALLY APPLIED since 1951, Robinson multi-directional mountings are now preferred for practically all military and commercial aircraft and in the newest of the guided missiles.

RADICALLY DIFFERENT from all other shock and vibration control mountings, this Robinson mount furnishes unique performance because of the inherently damped resilient cushions of patented Met-L-Flex, exclusively Robinson. No auxiliary damping means is required or used. Met-L-Flex is unaffected by attitude, extremes of temperature, aging, or the presence of oil, dust or dirt.

WHEREVER UNFAILING PERFORMANCE of equipment under maximum environmental difficulties is required, ***only Robinson*** multi-directional mountings will meet the difficulties involved.

If your need is for complete multi-directional protection of airborne electronic equipment and the assurance of its optimum performance, call on Robinson.

SEND FOR BOOKLET No. 900 "A New Concept in Vibration and Shock Control for Airborne Electronic Equipment."

ROBINSON AVIATION INC.
TETERBORO NEW JERSEY
Vibration Control Engineers
AIRBORNE DIVISION

WEST COAST ENGINEERING OFFICE—Complete engineering design and test service. 3006 Wilshire Blvd., Santa Monica, California.

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

Announcing A-MP®

MINIATURE *TAPER PINS*

FOR MINIATURIZED COMPONENTS!

A-MP's new Miniature Taper Pins, shown here actual size, provide the same uniformly reliable wire connections for your miniature components, as the larger, widely used and accepted A-MP Taper Pins. Miniature Taper Pins are applied to wire with A-MP Automatic Machines at speeds up to 4000 per hour They are then inserted into components quickly and easily with A-MP CERTI-LOK Insertion Tools. Miniature Taper Pins are available for wire sizes #26 to #20.

A-MP®

CA-MP

Send today for your copy of "A-MP's Creative Approach to Better Wiring"

AIRCRAFT-MARINE PRODUCTS, INC., 2100 Paxton Street, Harrisburg, Pa.
In Canada: AIRCRAFT-MARINE PRODUCTS OF CANADA, LTD., 1764 Avenue Road, Toronto 12, Ontario, Canada

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

Precision Wire Stripper

Because the strands in this wire are too fine to be stripped by ordinary wire stripping tools, this precision wire stripper was developed by Martin Aircraft Co., Baltimore, Md. The wire is placed in a recess in the block, the blade is closed to cut the Teflon insulation, the wire is rotated and pulled out.

Further Closed-Circuit TV Uses . . . Closed-circuit TV is now being used in such diverse fields as dentistry and medicine, manufacturing, and whale fishing.

A closed-circuit system has been employed for the demonstration of dental techniques. Two small TV cameras focussed on the patient's mouth enabled dentists in an adjoining room to follow every detail of an operation. The equipment was made by Kay Lab, 1090 Morena Blvd., San Diego, Calif.

A compatible color TV system has been designed specifically for medical use. The system, built by the Radio Corp. of America, Camden, N. J., is built around a compact new camera which can be focussed remotely. A simple lens fitting converts the camera for use with a light microscope, permitting color transmission of microscopic studies.

Cigarette-paper production is being speeded through the use of another system at Peter J. Schweitzer, Inc., Spotswood, N. J. The system, also made by RCA, is used for remote observation of a paper-pulp washing tank to assure against jamming or plugging. The observation warns the attendant two floors below of impending trouble in time to prevent jamming of the equipment.

The Armstrong Cork Co., Lancaster, Pa., is using closed-circuit TV to bridge a three-story gap in linoleum operations. The camera is used to ensure uniformity of linoleum mix entering calender rolls.

An experimental use of industrial TV on the highly mechanized docks of the Free Port of Copenhagen,

Denmark, is reported. A camera is attached to the head of the boom of the loading crane, and the crane operators can see exactly what is going on in the ship's hold.

A small camera and monitoring screen on board a whaling factory ship lets the watch officer on the bridge see what is going on at the stern where other smaller vessels of the whaling fleet deliver their whales and replenish their stores and harpoons. Manufactured by Pye, Ltd., Cambridge, England, the system be used on large ocean liners during mooring.

Speed of Sound in Sea Measured . . . An instrument that automatically measures the speed of sound in the sea and plots the result as a function of depth or time has been developed. The "Velocimeter" is expected to be useful in underwater signalling and detecting and as a research instrument inn oceanography.

The speed of sound in water varies with temperature, depth, and salinity. In current practice an estimate of the sound velocity is calculated from the measured temperature and an assumed salinity. The device was developed by M. Greenpsan and C. E. Tschiegg of the National Bureau of Standards, Washington 25, D. C. It consists essentially of a pair of piezoelectric transducers of polarized barium-calcium-lead titanate and a reflector. The sending transducer is connected to a pulse generator, and the receiving transducer provides the input for a high-gain pulse-shaping amplifier.

Color Added to Monochrome Slides . . . A device that adds color to black-and-white slides or artwork for color TV transmission has been developed. The equipment can be used by stations equipped to transmit color but lacking color cameras. Color commercials can be sent during breaks between color shows.

A product of Radio Corp. of America, New York, N. Y., the color-effects equipment permits electronic addition of up to 24 different pre-selected colors.

Gas Prevents Corona . . . By filling the housing around a light amplifier tube with perfluoro-cyclic ether, the designers of a fluoroscope have prevented undesirable corona effects. Any corona would blot out the image under medical observation.

The X-Ray Div., Westinghouse Electric Corp., Baltimore, Md., makes this fluoroscope. The gas, an electronegative substance, traps free electrons, thus helping to prevent corona. Composed of carbon, fluorine, and oxygen, the gas has 2½ times the insulating strength of air. An alternate method of preventing corona would have been filling the air space around the tube with oil. This design would have been much more bulky.

Which of these important jobs can easy-to-use EPON® RESIN do for you?

COMBINING EXCELLENT dielectric properties and high strength with dimensional stability . . . Epon resins are solving many long-standing problems in electronics and electrical manufacturing.

As impregnating and potting materials, Epon resins form powerful bonds to glass and metal. Their dimensional stability and low shrinkage on curing allow safe enclosure of delicate subassemblies. Epon resin's characteristic high resistance to mechanical and thermal shock permits rapid cycling between –60°F and 260°F without cracking or deforming. Epon resins can be cast at room temperatures, cured in a short time.

Epon resins may readily be bonded to inert fibrous fillers, producing laminates that may be sheared, punched and drilled—that will maintain high electrical resistance under extremes of temperature and humidity.

Still other important Epon resin applications—as adhesives; for forming dies, jigs, fixtures; as corrosion-resisting coatings, and sealing compounds.

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CIRCLE ED-14 ON READER-SERVICE CARD FOR MORE INFORMATION

Using Ceramic Capacitors? Specify RMC DISCAPS

Temperature Compensating

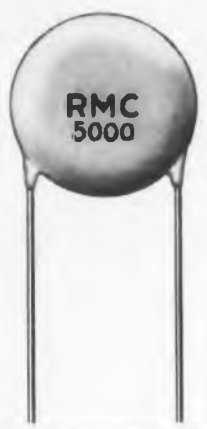
These DISCAPS meet all electrical specifications of the RTMA standard REC-107-A. Small size, lower self inductance and greater dielectric strength adapt them for VHF and UHF applications. Type C DISCAPS are rated at 1000 working volts providing a high safety factor. Available in six sizes in all required capacities and temperature coefficients.

Heavy-Duty

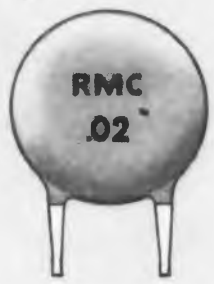
RMC Type B "Heavy-Duty" DISCAPS are designed for all by-pass or filtering applications and meet or exceed the RTMA REC-107-A specifications for type Z5Z ceramic capacitors. Rated at 1000 V.D.C.W., Type B DISCAPS cost no more than lighter constructed units. Available in standard capacities between 470 MMF and 40,000 MMF.

Type JL

Type JL DISCAPS afford exceptional stability over an extended temperature range. They are especially engineered for applications requiring a minimum capacity change as temperature varies between −60°C and +110°C. The maximum capacity change between these extremes is only ±7.5% of capacity at 25°C.



Wedg-loc



The exclusive wedge design of the leads on these DISCAPS lock them in place on printed circuit assemblies prior to the soldering operation. "Wedg-Loc" DISCAPS are available in capacities between 2 MMF and 20,000 MMF in TC, by-pass and stable capacity types. Suggested hole size is an .062 square.

High Voltage

Special high voltage DISCAPS are available in a wide range of capacities for color television and other electronic applications. RMC DISCAPS for deflection yokes insure the voltage safety factor required in this application. They are available in all capacities between 5 MMF and 330 MMF.

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RMC Plug-in DISCAPS will speed up production time in printed circuit operations. Leads are constructed of No. 20 tinned copper (.032 diameter) and are available up to 1½" in length. Manufactured in TC, by-pass and stable capacity types, Plug-in DISCAPS have all the electrical and mechanical features of standard DISCAPS.

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

Electronic Cancer Detection . . . Electronic techniques have been utilized in two new methods of detecting cancer. A newly developed device known as the "Cytoanalyzer" measures four characteristics of cells in smears obtained from natural body openings. In the second technique, ultrasonic sound waves are employed to diagnose growths in patients prior to surgery in much the same manner as non-destructive testing of metals is performed.

The Cytoanalyzer was developed by a research group under the direction of Walter E. Tolles at Airborne Instruments Laboratory, Inc., 160 Old Country Rd., Mineola, N. Y. Slides with smears are scanned by a photocell. The signal is fed to a computer that can distinguish between normal and cancer cells. The four cell characteristics measured by the instrument are color, size, diameter of the cell nucleus, and optical density of the nucleus. The pathological technical staff need examine only those smears selected by the electronic scanner as abnormal. The human task is reduced by about 95%.

In the ultrasonic technique, the echos produced by ultrasonic bombardment are examined on an oscilloscope. Irregularities such as cancer, nonmalignant solid tumors, and liquid-filled cysts can be recognized from their characteristic pictures. This technique has been successfully used at St. Barnabas Hospital, Minneapolis, Minn.

"Perfect" Iron . . . Pure iron slivers with tensile strengths approaching a million pounds per square inch have been produced in the laboratory. The crystals are as much as two inches long and a thousandth of an inch thick. Previous attempts to produce such "whiskers" have resulted in crystals that could be observed only with the aid of a microscope.

The production of iron crystals so pure that no defects can be detected in their structure is being accomplished at Westinghouse Research Laboratories, Pittsburgh, Pa., to gain a greater knowledge of the fundamental properties of metals. The tensile strength of the iron crystals is at least three times that of steel piano wire.

Military Electronics Drops . . . The current rate of production of electronic devices for the military is about 10% below last year, according to a recent speech by Glen McDaniel, president, Radio-Electronics-Television Manufacturers Association, 777 14th St., N. W., Washington 5, D. C. The current rate is about $2.25 billion per year.

Mr. McDaniel also stated that ". . . many old-time electronic manufacturers have been disturbed by changes and trends in procurement policies and procedures which threaten to divert a large share of this business (military electronics) to new and untried suppliers."

Electronic Gear Withstands Atomic Blast . . . Commercial electronic equipment proved to be remarkably rugged when exposed to the atomic test explosion at Yucca Flats in May. About 150 pieces of radio and TV equipment were in structures 4700′ and 10,500′ from ground zero. After the explosion, nearly all items were operable or readily repairable. Damage was due almost entirely to falling structures.

This evaluation was part of a report by Raymond H. Williamson, General Electric Co., Syracuse, N. Y., who was head of a joint atomic test committee of the Federal Civil Defense Administration and the Radio-Electronics-Television Manufacturers Association. The products of 30 manufacturers were included in the test. No broken vacuum tubes or TV picture tubes were observed. Since it was not indicated if any transistorized equipment was included, it is not possible to find out from this test what affect thermal shock from the explosion would have on transistors.

TV in Railroad Yard . . . Night testing of closed-circuit TV is being conducted at a large railroad yard. Television is already in use at the yard during the day. If the tests are successful, industrial TV will be used to observe all car movements from a central location on a 24-hour basis. The tests will determine how much additional lighting is needed to provide satisfactory TV reception after dark.

The yard is the Southern Pacific Railroad Taylor Yard at Los Angeles, Calif. Thirteen compact cameras are employed. Eight of the cameras, in fixed positions and with wide angle lenses, are intended to give the yardmaster a view of the entire yard. Five telephoto cameras are employed to enable him to select a particular section of the yard and obtain a close-up view. Remote control mechanisms effective up to 3000′ enable the operator to swing the camera 340°, select any of its four lenses and control the optical focus of each. In permanent installations, cameras would be housed in all-weather boxes fitted with automatic temperature controls, windshield wipers, and remote control mechanisms.

Bolts Used Improperly . . . Designers of equipment enclosed in cases that are sealed with bolts will find the following design hint of value. According to one manufacturer of bolts, many engineers do not know that the holding power of a bolt is determined by the residual tension in the tightened bolt and not by its actual strength.

Many bolts are improperly specified, according to Russel, Burdsall, Ward Bolt and Nut Co., Port Chester, N. Y. A 1/2″ bolt correctly tightened with the proper torque wrench setting, will seal better than a 1″ bolt tightened too little. A bolt that is tightened too much losses holding power.

this i

Type 116R Polar Pattern Recorder

160 OL

s not something new!

Leading members of the aviation industry have long known about this means of measuring aircraft and missile antenna radiation patterns. In the course of various engineering projects, they have come repeatedly to Airborne Instruments Laboratory with antenna test problems. As always, Airborne's scientists sought to create equipment, singularly perfect in performance yet flexible enough to meet many specific needs. Their efforts resulted in the Type 105 Model Range System, which automatically records polar plots of the relative field strength of aircraft radiation patterns.

The Type 105 System, however, is not only important within itself. Out of its totality have emerged several significant devices, designed for many recording purposes. Among these are the 116R Polar Pattern Recorder, the Type 124A Wide Range Power Oscillator, and the Type 373 Rectangular Coordinate Recorder.

Here again is an example of creative initiative, by AIL engineers, providing a continuous succession of advanced instruments for America's industrial progress.

Visit us in Booth 1406, 1955 WESCON, August 24, 25 and 26 or send for information about the 105 Model Range System and literature on other recording devices.

Type 373 Rectangular Coordinate Recorder

Type 124A Wide Range Power Oscillator

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

Technical Translations from the USSR

In this issue ELECTRONIC DESIGN initiates a new service for our readers. We are starting a program of regularly publishing translations and summaries of articles dealing with Soviet electronic technology.

A number of Russian technical publications reach this country—several directly concerned with electronics. These are probably translated by various U. S. government agencies, but the information rarely appears in print and therefore gets little dissemination.

We feel that this material should be of great interest to the readers of ELECTRONIC DESIGN as a source of ideas and as a means of keeping posted on progress in Soviet electronic technology. The summaries will appear each month in the Abstracts department.

Shown below are condensations of articles appearing in *Radiotekhnika*, the journal of the All-Union Society of Radio Technique and Electro Communication; and in *Radio*, a magazine for amateurs and armed forces technicians. These are merely samples and are not necessarily the most significant technical stories. They do, however, reflect to some degree practical electronic techniques in general use in Russia. Also included is a summary of all the articles in a recent issue of *Radiotekhnika*. Readers' comments on these summaries and our translation program are invited.

Semiconductor Radio Receiver

SEMICONDUCTOR devices are daily finding ever wider application because they consume much less power. Industry has in production at present semiconductor diodes and triodes (transistors) which are used in diverse applications very advantageously. It is possible to realize loudspeaker reception of radio-broadcast stations in places not yet having electric power supply. Moreover, the use of semiconductor electronic devices reduces the dimensions and weight of portable equipment.

Described here is an economical receiver for loudspeaker reception of local radio stations. It consumes only 0.03-0.05w (2-3ma with 12-15v battery). The receiver is designed for direct amplification to reduce the number of transistors and power consumption.

In big cities and their environs the field intensity of local radio stations is sufficient, with a small antenna and one stage of h-f amplification, for normal operation of semiconductor diode detector. Satisfactory volume with a good electro-dynamic loudspeaker can be attained if the speaker be supplied a power in the order of 10mw. It is not hard to get such power in one stage of l-f amplification.

Thus, the simplest receiver using semiconductors designed for loudspeaker reception of local stations must contain one stage of h-f amplification, a detector and one stage l-f amplification. (See diagram.)

For the stage of h-f amplification working in the medium-and long-wave bands (200-2000 meters), the best of the transistors produced at present are the *S1G* point contact types. Transistor type *S1B* can also be used, but it yields less amplification. Any point germanium diode type *DG* is good for detection of signals. The best l-f amplifier uses a junction transistor type PT_2 since the junction types yield greater amplification than the point type. In this stage, junction type *P2* can also be used, and in extreme cases, point contact transistors *S1B* or *S1A* as well.

To simplify design and reduce dimensions, the receiver is made with fixed tuning on local broadcast stations. Capacitors are not included to increase sensitivity in the input circuits of the receiver; their role is performed by the capacity of the antenna itself. Since the capacity of different antennas is not identical, (if the receiver has to operate from different antennas) it is necessary to install a small trimming capacitor C_1 with an air dielectric (maximum capacity 30-50mmf) between the antenna and the chassis.

Any standard one- or two-way switch with three positions, having not less than three independent sections, can be used as the fixed-wave switch. The inductance coils L_1, L_3, and L_5 of input circuits, and also coils L_7, L_8, and L_9, are made in multi-layers on small forms. They include cores of iron, alsifera or ferrite, inserted in the primary for frequency alignment. Point contact transistors work most stably when connected with grounded base. Therefore, switching is applied in the h-f amplifier.

The input resistance of transistors is very slight and, for the point contact type, amounts to only a few hundred ohms. In order to weaken the shunting action of the input circuit of the transistor on the antenna circuit, the h-f signal is supplied by means of coupling coils L_2 (or L_4 and L_6) which have a small number of turns. For a frequency the order of 1500kc, the most amplification is obtained when the number of turns of the coupling coils (secondary) are approximately ten times less than the number of turns of the primary winding; for a frequency of 150kc it is thirty times less. Coupling between the coils must be as strong as possible. Therefore, the secondary winding should be wound directly over the primary winding.

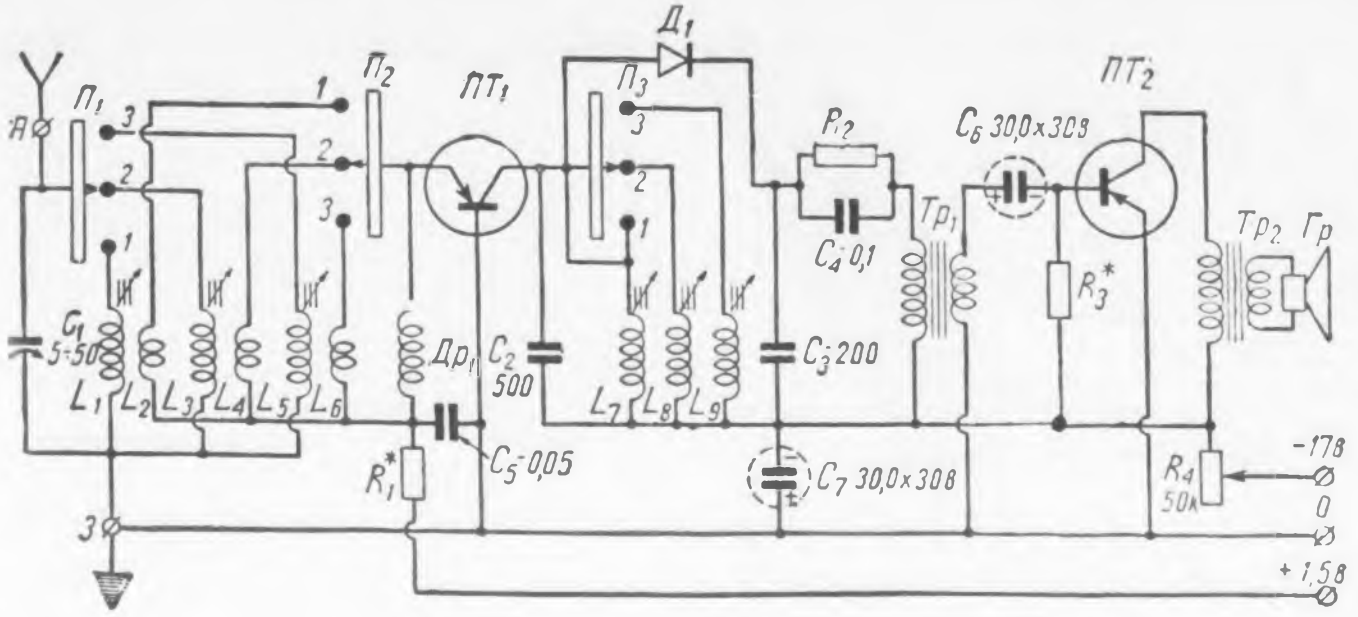
Point contact transistors demand at the emitter, positive bias of about several tenths of a volt. To supply such biasing at the emitter of transistor PT_1, one cell of a common battery or a separate 1-1.5v cell, is used. Excess voltage is dropped across resistance R_1. Since the most suitable current for biasing is not identical in different transistors, R_1 should be selected to give the most amplification with the particular transistor used (nominally 5 to 20k).

A characteristic peculiarity of point-contact transistors is their sensitivity to overvoltage and to sharp transient increase of current that takes place in apparatus during switching operations. Abrupt changes of voltage and current which usually has no influence whatever on electronic tubes, can worsen the parameters and even destroy transistors. For this same reason, faulty design of sockets may fail to ensure reliable contacts resulting in spoilage.

For the purpose of preventing circuit breaks when switching, a choke Dr_1 is inserted in the circuit of the emitter of transistor PT_1. The number of turns is non-critical, but must be ten times more than the number of turns of the biggest coupling coil. To prevent a break in the circuit of the collector of PT_1 when switching, the end of coil L_7 is joined to the slide of the switch. As a result, coil L_7 (on other wave-lengths) is switched in parallel to coils L_8 and L_9, which must be taken into account in estimating the value of the coils.

To prevent sharp jumps of current and voltage when switching the receiver on and off, a variable resistance R_4 with cutout and capacitor C_3 are included in the voltage supply circuit. If the resistance lacks a cutout, then the conducting layer of resistance must be arranged so that in the extreme counter clockwise position of the tap, the supply circuit is broken. Volume is also regulated by resistance R_4.

Practice has shown that the adopted measures of precaution have proved most effective. The transistors work in the receiver faultlessly and their parameters remain unchanged over a very long time.



Resistor R_2 and capacitor C_4 equalize the load resistance of the detector for alternating and direct current, which is necessary when the diode is connected to a transformer because of its low d-c resistance. Resistor R_2 serves to increase the d-c resistance of the circuit, while capacitor C_4, shunting resistance R_2, passes a-c.

Since the most suitable load resistance of the semiconductor diode used as a detector exceeds many times over the input resistance of the l-f amplifier triode, a step-down transformer Tr_1 is used. The inductance of its primary windings is selected comparatively large (order of 20-36h), so that the l-f characteristic is flat down to about 100cy.

In the h-f stages it is best to install junction transistors by grounding the emitter, since this yields the greatest amplification. The input resistance usually amounts to several hundred ohms, and the most suitable ratio for transformer Tr_1 appears to equal approximately 7:1.

Resistance R_3 installed between the negative pole of the voltage source and the base of the transistor, is selected in the process of regulating the receiver (usually 30 to 300k). It must be so selected that there is enough amplification without distortion.

Sockets for point triodes should have reliable contacts made of phosphor, bronze. The tiny leads of junction triodes should simply be soldered to appropriate places in the assembly.

Output transformer Tr_2, when using an electrodynamic loudspeaker whose sound coil has a d-c resistance equal of 4 ohms, has a ratio of 45:1 and a primary winding inductance in the order of 25h.

To reduce the sizes of transformers, they should be made with permalloy cores. For instance, permalloy containing 45 to 50% of nickel should be used for small-dimensional receivers. The 30mm-square E-laminates should have a thickness of 0.2-0.4mm, the thickness of the complete core of transformer Tr_1 should be 6mm, and for transformer Tr_2, 9mm.

The primary winding of transformer Tr_1 contains 5000 turns of wire PEL-1 0.08, the secondary contains 600 turns of wire PEL-1 0.2. In transformer Tr_2 the primary winding also consists of 5000 turns of PEL-1 0.08, and the secondary contains 110 turns of wire PEL-1 0.6. [Translation of wire code not available.]

It is desirable to make the winding of the transformers turn to turn. The liners between layers of the primary winding should have thickness 0.02-0.03mm, and between layers of the secondary winding—0.05-0.07mm. Two or three layers of cable paper, having 0.05-0.07mm thickness, serve an insulation between the windings.

The sensitivity and out-put of the receiver can be raised by adding stages. Two stages of h-f amplification arranged for triodes *S1G* and two stages of l-f amplification arranged for junction transistors gives, with a small frame or magnetic antenna placed inside the receiver, loudspeaker reception of all local stations (100-200mw, 40v battery). With the small-dimensional loudspeakers that are now available, such a receiver (including the battery and a magnetic antenna) can be made in a small size that will fit in a pocket. *Translated from an article by Professor G. Tsykin, Doctor of Technical Sciences.* RADIO, *No. 5, May, 1955, Pages 42-44.*

New Generator of Noise Voltages

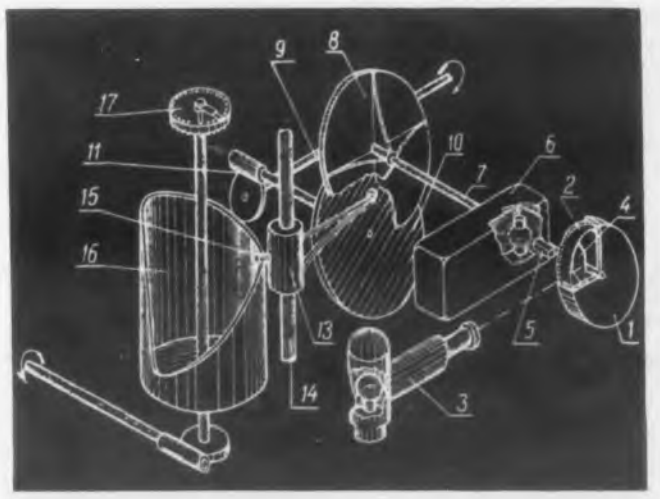
IN MAKING electro-acoustical measurements the need often arises for a generator whose output signal would be a noise band of a given relative width capable of uninterrupted travel over the range of sound frequencies. Such a generator, which can be called a generator of sliding noise band, can be realized by several different approaches. For example, band filters that shift automatically can be applied, the principle of heterodyning can be used, etc. However, this problem is solved most conveniently by recording a noise on a sound-recorder and reproducing it at a variable speed.

A generator working on this principle is shown in the accompanying drawing. The drum *1*, with attached photographic phonogram *2* of about 120mm diam, revolves in front of sound optics *3*. The light stream which penetrates the phonogram falls on mirror *4*, passes through the light-conductor *5*, and lands in the phototube *6*. The output voltage of the phototube is supplied to the input of an ordinary a-f amplifier. Thus, the path of sound frequency of the generator is made of standard parts and no kind of difficulty is encountered in its manufacture, adjustment, or operation.

Drum *1* is fastened to axis *7* which is rigidly fixed to disc *8*. The latter, by means of roller *9*, is linked with disc *10* which through reducing gear *11* is rotated by a motor. Disc *10* rotates at a constant speed of about 60rpm; to stabilize the speed of disc *10* a flywheel is attached. Roller *9* is fixed to link *13* which can travel along shaft *14*. Meanwhile roller *9* travels on discs *8* and *10* and the speed of disc *8* changes accordingly. If, for example, the roller rises upward, the speed of disc *8* increases. In the bushing of link *13* there is a guide *15* which lays on the cam surface of profiled drum *16*. When drum *16* is rotated in the direction of the arrow, guide *15* and the attached link *13* and roller *9* rise. The speed of disc *8* and drum *1* increase correspondingly, as does also the line speed of phonogram *2*.

The parameters of the device are selected so that while the speed of disc *8* goes from minimum to maximum, the line speed of the phonogram varies from 45.6 to 4560mm/sec. Moreover, if drum *16* is rotated uniformly, the form of its profile produces variations according to a logarithmic function.

Assume a phonogram has been recorded at a normal speed with continuous sound over the range of 950 to 1050cy. The signal at the output of the generator will represent also a noise band the average frequency of which will vary from 100 to 10,000cy as the speed of drum *1* changes from minimum to



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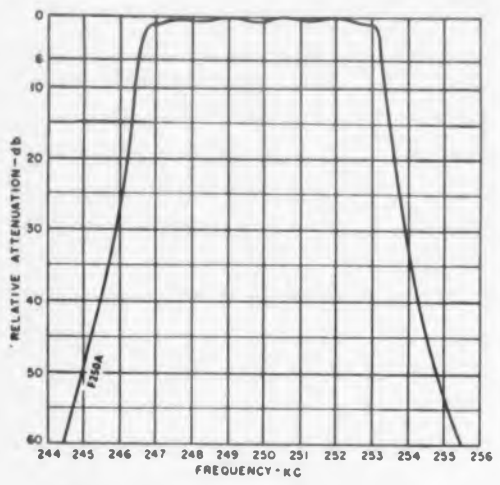
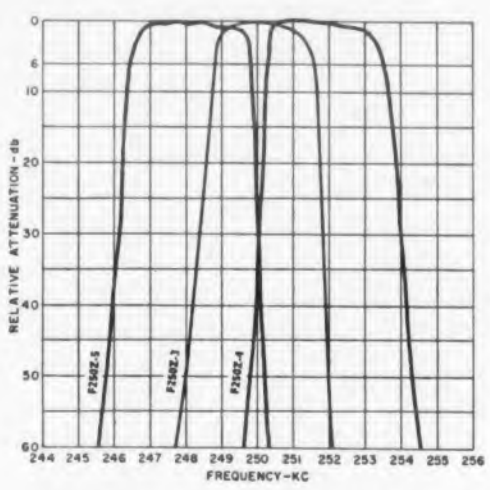
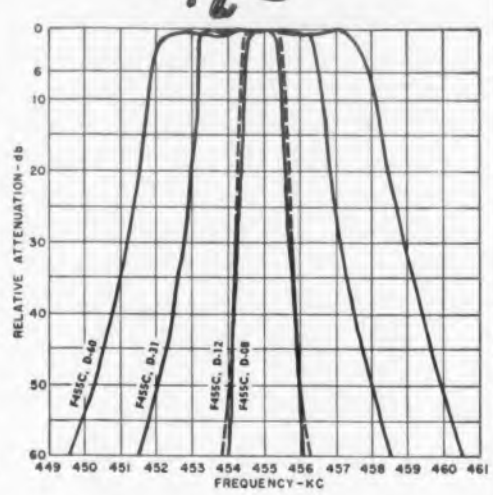
Collins Mechanical Filters are now available in six series for design needs where superior selectivity and small cubic volume are important. Permanently-tuned, hermetically-sealed and not affected by wide variations in ambient temperature, the Filters have greatly improved the selectivity characteristics of many commercial and military equipments. Mechanical Filters of special design can be supplied for most requirements in the range of 60 kc to 550 kc center frequencies and your inquiry is invited.



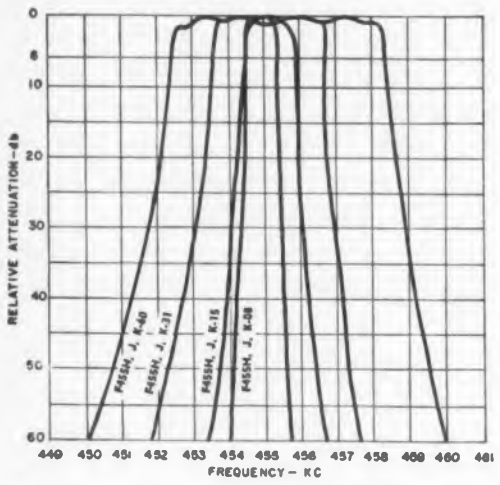
F250A A filter for double sideband signals at a center frequency of 250 kc. Bandwidth 6.7 kc at 6 db attenuation. Transmission loss 13 db.
Write for Technical Bulletin 201.



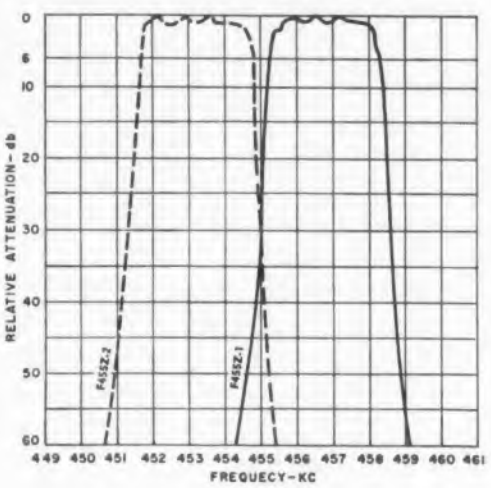
F250Z For single sideband signals at a carrier frequency of 250 kc. Bandwidths of 2.7 and 3.2 kc at 6 db attenuation. Transmission loss, 10 db.
Write for Technical Bulletin 202.



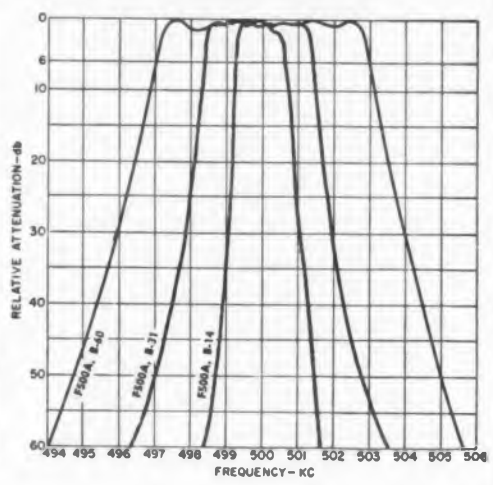
F455C, F455D Low insertion loss filters for AM, CW, RTTY and FSK signals at 455 kc. Bandwidth of 0.8, 1.2, 3.1 and 6.0 kc at 6 db attenuation. Transmission loss, 12 db.
Write for Technical Bulletin 203.



F455H, J and K New tubular case mounting, temperature compensated for signals at 455 kc. Bandwidths of 0.8, 1.5, 3.1 and 6.0 kc at 6 db attenuation. Transmission loss, 10 db.
Write for Technical Bulletin 204.



F455Z Mechanical Filters for single sideband signals at a carrier frequency of 455 kc. Bandwidth 3.3 kc at 6 db attenuation. Transmission loss, 10 db.
Write for Technical Bulletin 205.



F500 Mechanical Filters for AM, CW, RTTY signals at 500 kc. Bandwidths of 1.4, 3.1 and 6.0 kc at 6 db attenuation. Nominal transmission loss, 23 db.
Write for Technical Bulletin 206.

Write for a copy of Collins Mechanical Filter Theory and Application Bulletin #200 and for any of the Technical Bulletins described above.

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

Purpose of Room	Materials	Seam Design
10-100kc Laboratory with highly sensitive apparatus. Shop for tuning highly sensitive radio-receiving apparatus when operating near radio transmitters.	Sheet steel of any grade 1.5mm in thickness	Welding along seam in overlap as structural strength demands.
1-10kc For tuning sensitive radio-receiving apparatus without operating radio-transmitters nearby. For measuring radio interference from electric installations. For industrial and medical h-f apparatus.	Sheet steel of any grade 0.5 mm in thickness	Overlap 20-30 mm and spot welding every 50mm* in less critical cases, every 100mm
100-1000cy Shop for tuning radio-broadcast receivers. Shop room for measuring radio interference from electric equipment.	Sheet steel of any grade from 0.5mm, or dense copper network (mesh 1mm x 1-mm, wire diameter 0.1 or 0.2-mm.)	If sheet steel overlap 20-30mm and spot welding every 100mm* If copper mesh reliable electric contact any design, every 100mm

Tabulated above are construction details for designing shielding rooms taken from a *Radiotekhnika* article "Calculation of Effectiveness of Shielding Rooms" by D. N. Shapiro. The author posed questions (answered in the table) and developed approximation formulas for determining effectiveness [these are not presented as the 12 pages of material could not be condensed satisfactorily]. The author deferred the question of filters, for eliminating penetration of undesirable electromagnetic oscillations along wires running into the shielded room, to a later article.

maximum. The relative width of the band of frequency range embraced will remain constant, always amounting to 10% of the average frequency. By having a set of drums with phonograms on which bands of varied widths of the spectrum have been recorded, noise bands of diverse width sliding over the range can be obtained.

The generator control *17*, directly fixed to the axis of drum *16*, can be used for switching auxiliary circuits (switching on and off of measuring lens, control of scanning of oscilloscope, etc.).

The quality of the work of the generator is to a considerable degree determined by distortions arising in it as determined by the irregularity of the speed of the phonogram. Strict mathematical calculation of the distortion that arises in reproduction of a noise band because of irregular speed is considerably difficult. By examining a Bessel function and accepting simplified conjectures, it can be determined that distortion be within 1.5%, a value easily accomplished in practice. *Translated from an article by B. G. Belkin,* RADIOTEKHNIKA, *No.4, April 1955, pp 56-58.*

Windows	Doors	Ventilation
Closed with two layers of dense copper or steel lattice spaced 50 to 100 mm from each other, or cellular grating with provision in both cases for unbroken electric contact along entire wall perimeter	Electric contact with the walls every 20 or 30 mm (spring comb of phosphorite bronze)	Round holes with inserted socket pipes 2-2.5 times longer than the hole diameter
Closed with one layer of dense copper lattice or cellular grating with provision in either case for electric contact with the walls every 100 or 200mm*	Electric contact with the walls every 100 or 200-mm*	Round holes with inserted socket pipes 1.5-2 times longer than the hole diameter
Made tight with thin copper lattice or cellular grating with provision in both cases for electric contact with the walls along the perimeter every 200 or 400mm*	Electric contact with the walls every 200 or 400-mm*	Holes, drawn with thin copper lattice

* Distance between points of contact must be not greater than 0.1λmin, where λmin is shortest wave to be shielded.

Contents of Radiotekhnika

(April 1955, No. 4, 80 pages)

Radio-Astronomy, by S. E. Khaikin, Society Member. Reviews the origin of cosmic radio emissions, surveys basic methods of cosmic ray observation, and presents information about radio emission from varied cosmic sources.

Stabilization of Frequency of 3-cm Klystron with Aid of Spectral Line, by Irisova, Zhabotinsky, and Veselago. It presents the results of theoretical analysis of the scheme, formulas, and also the characteristics of a prototype.

Radiation of Slits Cut in Ideally Conducting Round Disc. by F. N. Kocherzhevesky, Society Member. Develops strict formulas of diagrams of direction for slits cut in round disc. Estimates are made of directional diagrams in equatorial and meridianal surfaces.

Matrix Coefficients of Two Types of Cells from Segments of Two Interacting Long Lines, by V. M. Agafonov. Develops matric coefficients of matrix //A// for two types of four-poles that consist of segments of two interacting long lines carrying arbitrary resistances.

Investigation of Impulse Erasure in Magnetic Recording. by R. G. Ofengenden. It gives methods of enlarging the relation signal/interference.

Transition Characteristics of Bridge Correcting Schemes, by S. A. Suslonov. Examines transition characteristics of bridge schemes applied as correcting four-poles. It gives equations of transition characteristics of eight-element bridge schemes.

Estimate of Effectiveness of Screening Chambers, by D. N. Shapiro, Society Member.*

New Generator of Noise Tensions, by B. G. Belkin, Society Member.*

* These two articles are abstracted above.

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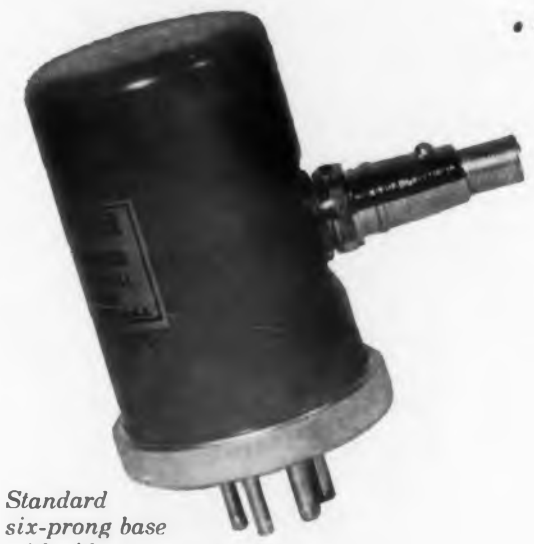

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Standard six-prong base.

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Magnistor Circuits

Richard L. Synder, Consultant

Potter Instrument Company,
Great Neck, L. I., N. Y.

GATING is one of the elementary applications of Magnistors. Gate and amplifier circuit design fundamentals using transient Magnistors are discussed in this article. The schematic diagram for the type *GTP2* Magnistor connected as an "and" gate is shown in Fig. 4. In this circuit, 1μsec pulses of 60v amplitude are gated by a source which can deliver 15ma at 60v. The magnistor can control pulses having a duration range between 1/3 and 2μsec. (It can also be used with sine waves between 200kc and 2Mc.) The load is 1000 ohms. The resistance, R, in series with the control coil C, limits the current from the gating voltage. The capacitor, K, increase the rate of rise of current at the start of the gating signal. Lowering R to increase the gating current will increase the saturated to unsaturated output signal ratio. The behavior of the circuit can be calculated with the help of the characteristic curves for the *GTP2*, Fig. 5. The dotted line represents a 1000-ohm load when the system has 60v pulses impressed on the signal coil input. At zero control current with a 60v input, approximately 8.5ma flow in the signal circuit, and 8.5v appears across the load. When 15ma flows in the control coil, about 28.5v appears across the load. If the load impedance is inductive, the pulses suffer little distortion. However, when the load impedance is resistive, and control current zero, the series inductance causes the output to be integrated and the pulses are lengthened exhibiting long slowly decaying trailing edges. When sufficient control current flows, the series inductance is so small that little distortion is produced (see Fig. 6).

The middle trace, Fig. 6, shows a series of pulses (100kc) which occur at twice the frequency of the gating current, lower trace. The pulse that occurs when the gating signal is falling is attenuated. Note that the transmitted pulse is quite narrow and large in amplitude. The pulse actually commences slightly before the gating current begins as some energy stored in the signal-winding core section is released by the saturation resulting from the gating signal. The upper trace shows the same pulses being transmitted and blocked by gating signals which differ from those in the middle trace by being shifted in phase about 90°. In this case the pulse occurs after the transient conditions in the control coil have disappeared. The pulses occur alternately when the gate is opened and closed; the opening and closing of the gate can be detected by the small pips which occur between the transmitted and the attenuated pulses. The gated pulse is somewhat lower and wider.

A fast rate of build up of current in the control coil is desired but maximum current must be held to the desired bias. By the simple expedient of inserting the resistance, R, the time for the current to build up exponentially to within $1/e$ times the steady state current is $T = L/R$ where e is the napierian base. In our example, using 4000 ohms as the series resistor $T = 4 \times 10^{3}/4 \times 10^{-6} = 10^{-6}$ seconds. However, the saturating current does not reach full value at the end of a microsecond and if a pulse must be gated at that time, the output resulting from this pulse will be lower than that for subsequent pulses which occur when he saturating current has risen more nearly to its specific value. To overcome this deficiency, it is usually desirable to connect a capacitor in parallel with the resistor. As the size of the capacitor is increased, the time required to cause development of full current in the inductance decreases. However, when the capacitance becomes larger than that necessary to produce the desired time constant, current overshoot occurs and the control current becomes, for a brief time, greater than desired. Usually a 10% overshoot is permissible and when it is present, the current rise time is little more than that for constant voltage build up. For large signal conditions, which always prevail in the control coil circuits when Magnistors are used for gates.

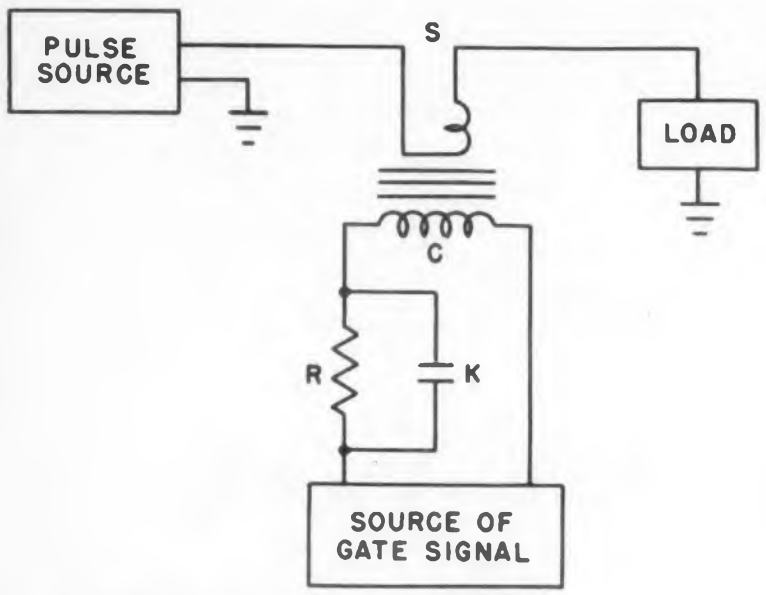


Fig. 4. *GTP2* gating circuit: pulses 1μsec, 30v from 200 ohms; gate 40ma in 1μsec.

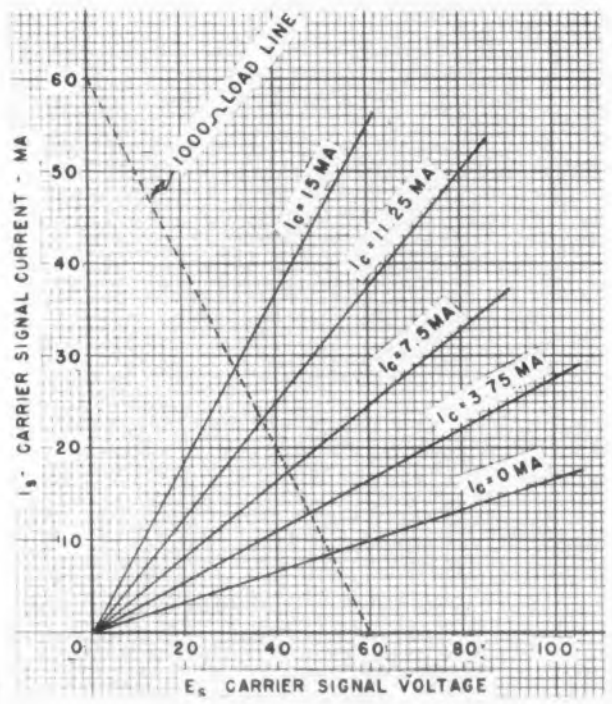


Fig. 5. Characteristics of type *GTP2*.

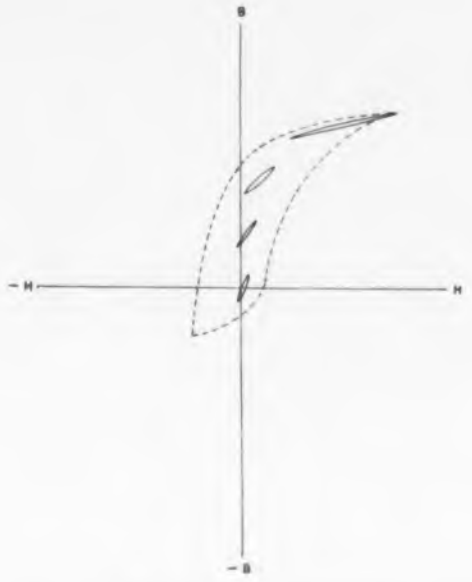


Fig. 3. Displaced hysterisis loops.

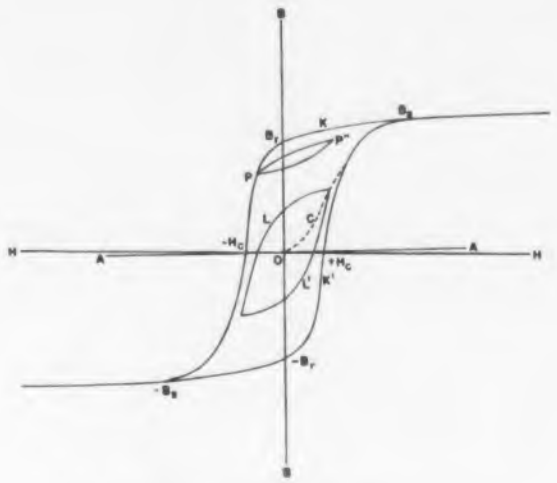


Fig. 2. Ferromagnetic B-H curve.

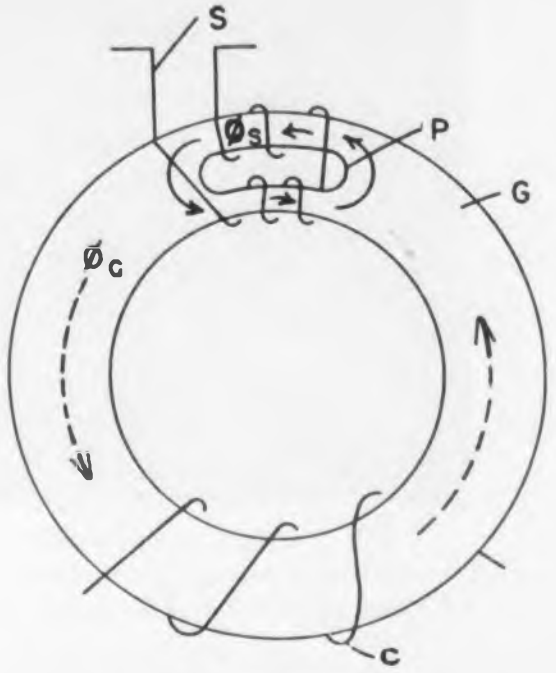


Fig. 1. Shape of basic Magnistor.

What is a Magnistor*

Magnistors are very small ferrite saturable reactors that have a speed of response equalling vacuum tubes. They are nondeteriorating and are essentially non-dissipative devices.

There are two different basic magnistor elements: the transient type in which the signal is modulated by current passing through the control coil; and the permanent type in which the signal is controlled in an "on" or "off" condition by a current pulse through one of two control coils called the "set" and "reset" coils. In the permanent magnistor, a pulse through the reset coil raises the impedance of the signal coil so that the device is essentially non-transmitting. A pulse through the set coil lowers impedance. Either condition persists, even if the unit is disconnected from the circuit.

The basic design of the transient magnistor is illustrated in Fig. 1. It consists of a ring shaped ferrite core *G* pierced with a small hole *P* and two windings *S* and *C*. The winding, *S*, is called the signal winding. It is made in two coils, connected in series in such a way that current through them causes flux to pass around *P* as shown by the solid arrows and not around the main body of the ring. Passing current through control winding *C* causes flux to develop around the ring as indicated by the broken arrows and to go through the walls of the small hole *P* in the same direction.

In the absence of control current, an alternating current passing through the signal coil will cause the flux in the relatively thin walls of the signal coil core to behave as shown in the *BH* diagram of Fig. 2. For low current, the flux will change according to the small hysterisis loop. Larger currents will make the flux behave as shown by the large loop. It is clear that at high levels, the coil current (corresponding to *H*) increases more rapidly than the voltage corresponding to *B* so that the impedance of the coil diminishes at high currents.

When current is passed through the control coil, the hysterisis loops are displaced in the *B* direction. This effect is illustrated by the small hysterisis loops drawn in solid lines, Fig. 3. As the biasing force from the control coil is increased, the magnetizing force necessary to maintain a constant flux excursion increases in the manner shown until saturtion sets in. The ratio of unsaturated to saturated impedance can, in extreme cases, exceed 500. Distortion that might occur from excessively large signals is canceled since coils are connected in series aiding. The behavior of one coil during a positive flow of current is the same as that of the other during a negative current flow, thereby canceling nearly all of the distortion.

The magnetic circuit of the magnistor is efficient; the path around the signal coil section is as short as possible. The control winding is separated so that the signal currents are not required to excite additional core material. The magnetic efficiency of the control coil is not sacrificed because the flux it must generate only approaches saturation densities in the region about which the signal coils are wound.

The energy, or power, handled by an inductance is proportional to the value of the inductance and the maximum current. If a given current is to be established in a coil in a given time and the current is to rise linearily, a fixed voltage must be established across the coil until the specified current flows and then the voltage must collapse to zero. If the current must be built up faster, the voltage is increased so that the same amount of energy is involved; that is, the product of amperes times volts time seconds is constant. However, the power handled increases with decreasing time. Therefore, power accommodated by an inductance is proportional to the frequency of the current change. Further, for a given maximum current changing at a constant frequency, the power is proportional to the magnitude of the inductance.

It is desirable to operate the signal coil of magnistors at extremely high frequencies and to reduce the saturating current-inductance product of the control coils to a small value.

the control current build up time is reduced by the non-linearity of the control coil inductance which diminishes as saturation is approached. This effect can be quite appreciable as will be shown in more detail when amplifiers are discussed.

The balanced structure of the signal section causes no voltage to be induced in the control coil when no control current flows. Although high currents flow in the signal circuit (which is usually the case at saturation), one half of the signal winding will, at peak currents, generate a magneto-motive force counter to that of the control coil. This effect is normally of no importance because the impedance ratio of control coil to signal coil is so high that any double frequency pulses are short circuited by the distributed capacity of the control coil and the relatively low impedance of the control current source.

In some gating systems, the residual or "leakage" signal which is transmitted when the gate is closed, (no control current) is objectionable. This can be reduced in several ways.

The most obvious means of increasing the ratio

* Trademark Potter Instrument Co. See *ED*, April 1955.

Fig. 6. Oscillogram shows gated pulse, center, for gating current, bottom. Top trace output is for phase-shifted gate.

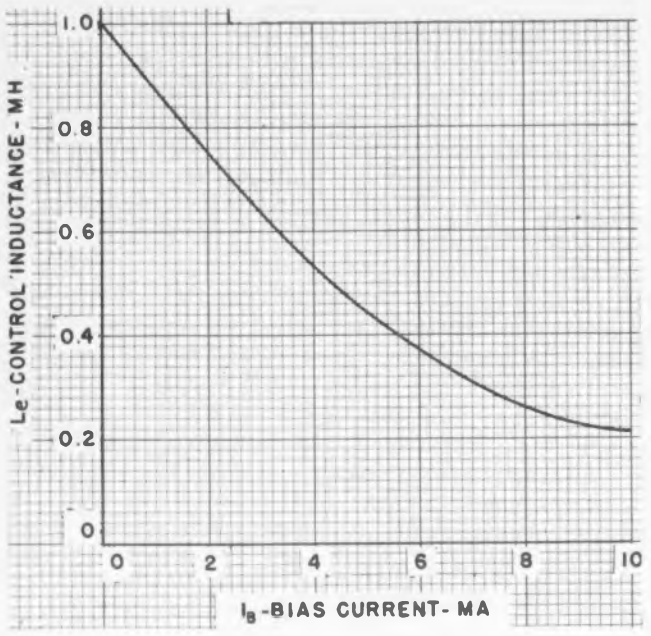


Fig. 7. Control inductance variation.

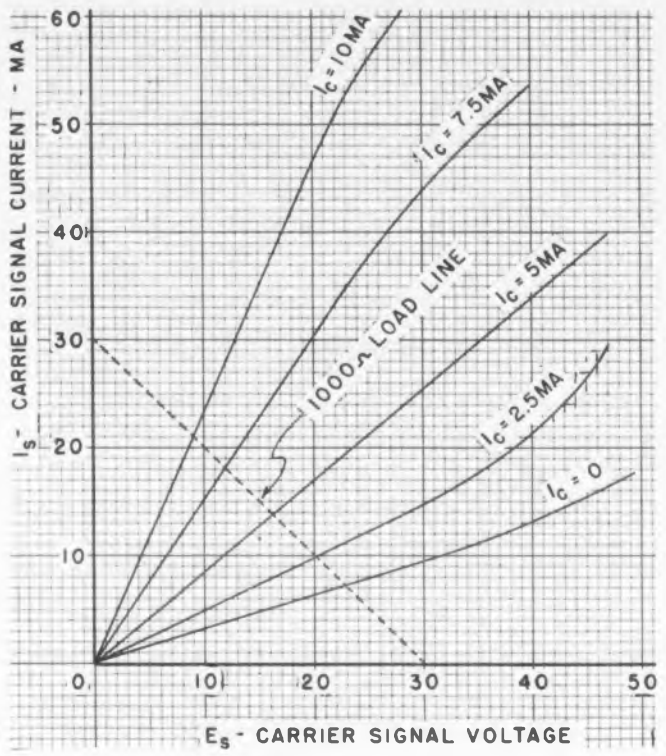


Fig. 8. Characteristic of type *ATC1*.

between wanted and unwanted signal amplitude is to decrease the load impedance and raise the control currents. When carried to extremes, ratio as high as twenty or thirty to one can be achieved.

Figure 9 shows a second method of improving the transmitted to blocked signal ratio. The unwanted signal is opposed by generating a pulse of opposite polarity by means of a transformer *T* and coupling it to the output of the signal coil by an inductance *L*. The value of *L* equals that of the unsaturated signal coil, multiplied by the ratio of the amplitudes of the inverted and original pulses.

A third method of reducing unwanted signals is shown in Fig. 10. In this circuit, a second Magnistor is connected between the output terminal of the first Magnistor and ground. The control coils of the two Magnistors are so connected and biased that in the absence of a gating signal, the control coil of the grounded Magnistor is energized; whereas, in the presence of a gate, it is de-energized while the other control coil carries current. The second or grounded unit in this case is a low impedance shunt when the system is non-transmitting and as a high impedance in parallel with the load when the gate is open. Referring to Fig. 5, two *GTP2* Magnistors connected in the circuit of Fig. 10 with a very high load impedance and an input pulse of 50v will produce an output of 4.5v when no gating signal is present and a signal of 45.5v during a gating signal.

Magnistors as Amplifiers

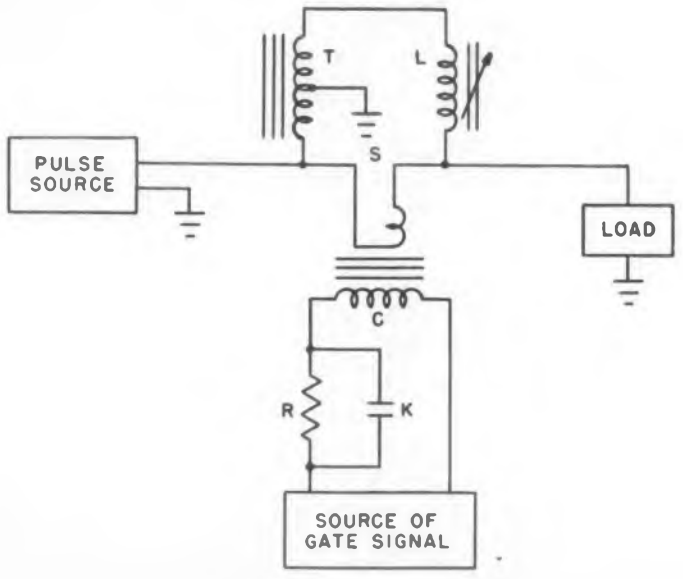
Physical factors limit frequencies at which currents may circulate in the signal coil inductance, and these, indirectly, impose lower limits on the control coil saturating current-inductance product.

The type *ATC1* is a typical magnistor. It is designed to be operated with a 15Mc carrier. The signal winding has about 20 turns (200μh) on each coil through the small hole; the control coil has about 100 turns (1mh). Fig. 8 shows characteristics.

In Magnistor amplifiers, the signal coil is connected between a source of h-f power and a rectifier system similar to that shown in Fig. 11. The output circuit, in this case, uses a transformer-coupled full-wave circuit having germanium diodes as the rectifiers. Although the rectifying efficiency of germanium diodes diminishes rather seriously when the frequency exceeds 10Mc, the conversion gain, that is, the ratio of r-f power handled by the signal coil to power required by the control coil, increases with frequency so that a compromise in carrier frequency at about 15Mc appears to be most advantageous. Two germanium rectifiers connected as shown in Fig. 11 can deliver a maximum steady state output of about 25 to 35v across 1000 ohms when rectifying 15Mc power. The diodes, then, limit the maximum output power of the amplifier to about one watt. (Although germanium diodes heat up when overloaded, they return to normal operation without suffering apparent damage even for repeated overloads of 100%).

When the carrier frequency and maximum power output of the amplifier have been determined, the remaining characteristics are also limited and the most advantageous compromise for a particular application must be determined by various practical considerations.

Although a description of the calculations involved in such a procedure is too long to be included here, the curves relating to the *ATC1T* Magnistor, Fig. 12 show typical characteristics. The output current and voltage is plotted for various control currents as the amplitude of the supply voltage is varied. Unlike the usual characteristic curves used to describe tubes, transistors, and saturable reactors, these



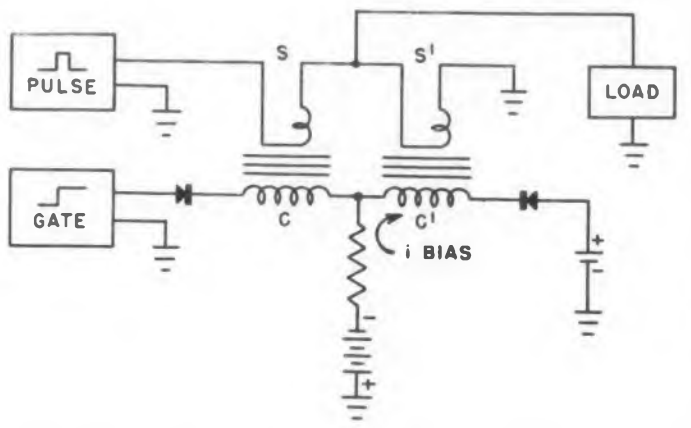


Fig. 9 (left). Balanced gating circuit for reducing blocked signal. Compound method, Fig. 10 (right).

curves are for more limited conditions in which the load is specified.

When this amplifier is operated with a 35v, 15Mc supply, the output for zero control current is approximately 11v and 11ma. When the control current is 10ma, the output is 35v and 35ma. If a biasing current of 11ma from a relatively high d-c source of polarity opposite that of the output at zero control current, the output will be zero, and at an I_c of 10ma, the output will be 25v and 25ma. (As the output voltage is reduced by the bias, the total output current increases.) This output can then be used to drive the control coils of two more similar amplifiers through two 2000-ohm resistors, each of which may be connected in parallel with a 500mmf capacitor. The control coils have a zero current inductance of about 1mh so the rise time of each amplifier will be about 1/2μsec.

If such abrupt rise time is not necessary, Magnistors with more turns on their control coils, which require less control current, may be used; for example, the *ATC2T* has twice the number of control turns as the *ATC1T* and requires just half the control current for a given output. The series resistor must be changed or several control coils in series can be driven from one output. Over a thousand control coils of one type can be driven by one output.

When Magnistors are used for low frequency amplifiers, design considerations are somewhat different. In the class-A audio amplifier shown in Fig. 13 for example, a bias current is impressed through the control coil to place the system about half way to saturation, otherwise, control currents varying in either direction from zero would produce a double frequency output. The partial saturation caused by the bias current reduces the inductance of the control coil and lowers the input impedance. Such a variation of inductance with bias current for an *ATC1T* is shown in Fig. 7. If the amplifier under these conditions is to pass a 10kc frequency band and the bias is to be such that the control inductance is about 400μh, a series resistor of 25 ohms shunted by a capacitor of about .07mmf will provide a flat frequency response in the control current. The impedance of the control circuit will be 25 ohms. The gain of the amplifier can now be found by referring to Fig. 12. If an r-f supply voltage of 35v and a bias of 5ma are used, a change of 5ma in the control current will produce an output current change of about 11ma. Since the control current is through 25 ohms, the input power is $(5 \times 10^{-3})^2 \times 25 = 625 \times 10^{-6}$w. The output current is through 1000 ohms so that the output power is $(11 \times 10^{-3})^2 \times 10^3 = 0.121$w. The gain is, therefore $0.121 \div .000625 = 200$.

There are rectifier circuits, using diodes which do not require the transformer of the *ATC1T* and the *ATC2T* but require only the less complicated *ATC1* and *ATC2* Magnistors. Fig. 14 is a typical example.

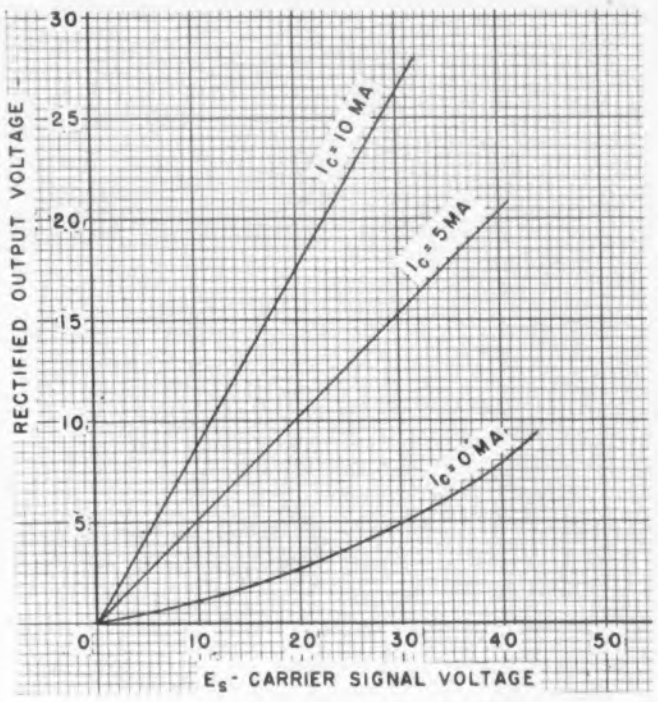


Fig. 12. Rectified characteristics of type *ATC1T*.

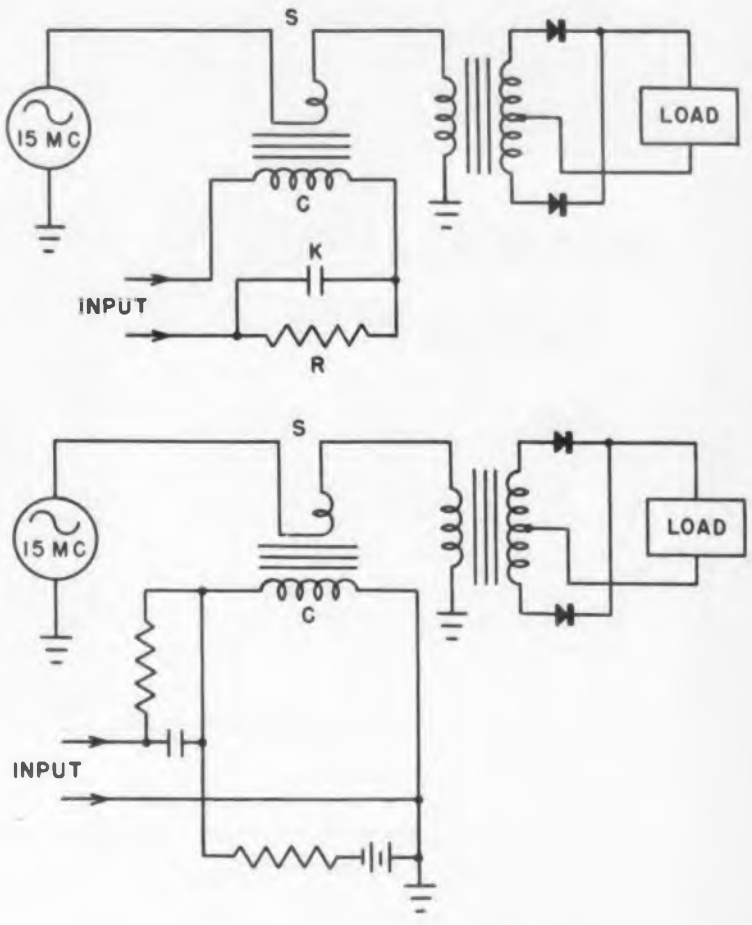


Fig. 11 (top). General Magnistor amplifier circuit. Typical audio amplifier, Fig. 13, (lower).

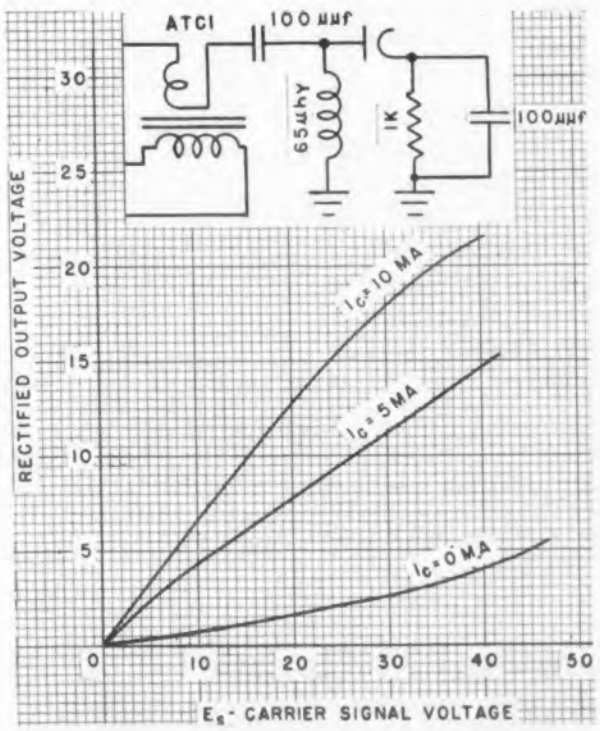


Fig. 14. *ATC1* Magnistor characteristics with a single diode rectifier.

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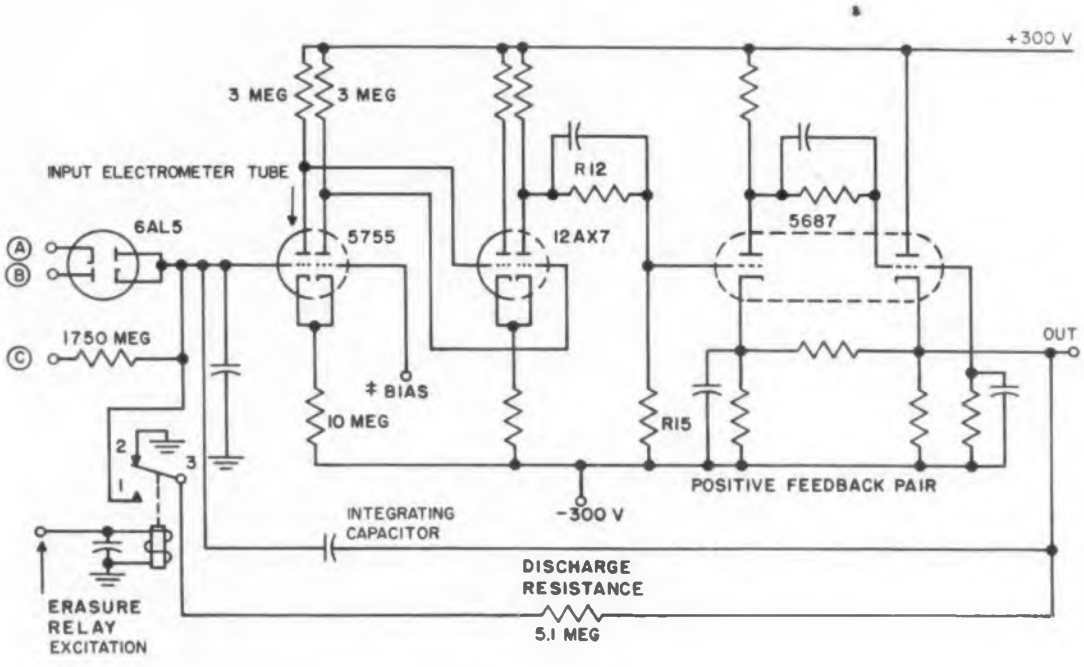
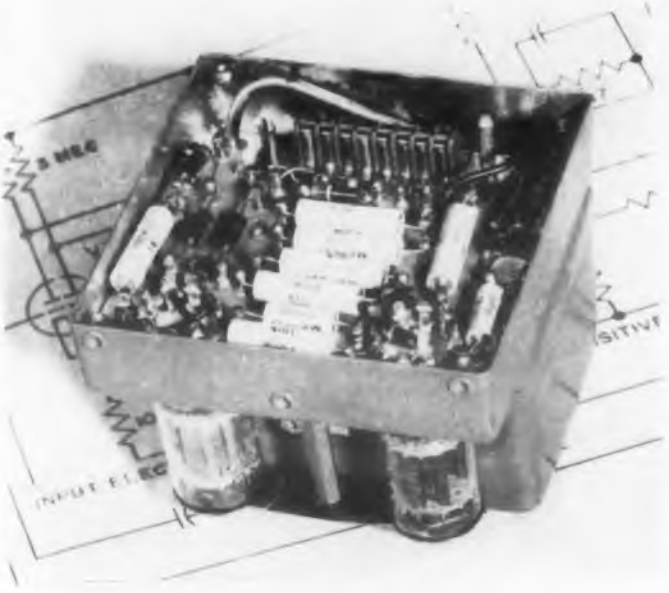


Point *A* is the negative input, point *B* is the positive input, and point C is the high impedance input in this circuit of the amplifier.



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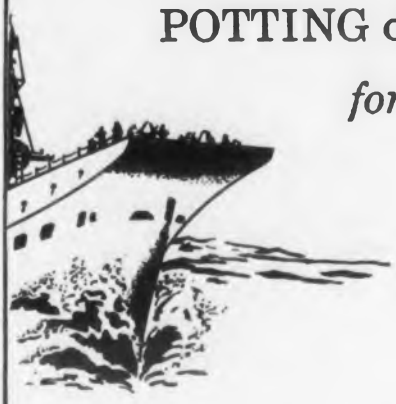
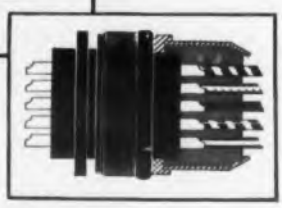


for...

1. ***Positive sealing*** against moisture, dirt, and other foreign matter.
2. ***Weight saving*** because of elimination of end bell and cable clamp.
3. ***Space saving*** due to shorter overall length.
4. ***Prevention of wire fatigue*** under extreme vibration.
5. ***Improved dielectric characteristics.***

Typical completed potted connector



Individual wires and elements are thoroughly sealed

CANNON offers these Connectors for Potting

CAO6BS Plug • Plastic Inserts 12S to 48 Sizes
CAO6BR Plug • Plastic Inserts 12S to 48 Sizes
CAO6ES Plug • Resilient Inserts 8S to 36 Sizes
CAO6ER Plug • Resilient Inserts 8S to 36 Sizes
CA3106BS Plug • Plastic Inserts 12S to 48 Sizes*
CA3106BR Plug • Plastic Inserts 12S to 48 Sizes*
CA3106ES Plug • Resilient Inserts 8S to 36 Sizes*
CA3106ER Plug • Resilient Inserts 8S to 36 Sizes*

**less grounding means*

Receptacles also available for potting.

Plugs and receptacles available with either pin or socket assemblies.

Please Note: Many other connectors may be potted by devising proper potting techniques.

CANNON Potting Molds

Nylon potting cup

Aluminum end bell

How It's Done...

Potting is a newly developed method of obtaining complete protection, covering, and sealing around the solder cups and wires at the rear of electric connectors by means of a sealing compound applied at the time the connectors are wired into their assemblies. The terminal area enclosed by the plug or receptacle end bell is filled or potted with a free flowing high solids synthetic rubber compound. This cures at room temperature to form a firm, resilient, moisture and vibration resistant rubber seal.

Clean the Connector...

The connector should be free of grease, oil and wax in order to insure good adhesion. Do not expose insulating materials to the cleaning solvent beyond the time necessary for adequate cleaning. *See the new Cannon Manual on Potting for complete information.*

Mixing the Compound...

Compounds are usually furnished as a basic sealant compound and an accelerator. Mixing must be done carefully, either by hand or with power equipment. *This subject is covered fully in new Cannon Manual on Potting.*

Applying the Sealant...

Application of the sealant can be made with a small paddle-shaped tool, spatula, putty knife

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

or a flow gun. However, the flow gun is the preferred method where larger quantities of the plugs are to be sealed. *Methods are discussed fully in the new Cannon Manual on Potting.*

Potting Machines...

Large quantity runs can be handled economically by potting machines. Typical equipment of this nature is illustrated here.

Potting machine in use

Potting by hand

Curing Time...

Curing time and the methods used are very important. The length of time that it takes for the sealant to harden and cure varies with the material used. Generally, the length of cure time depends upon the work life of the compound. A longer work life increases and short work life decreases the cure period. *See the new Cannon Potting Manual for complete details.*

MIL-S-8516 (Aer) is basic specification on sealing compounds for electric connectors and electric systems. BuAer Bulletin Aer-EL-35 covers electric connector sealing to prevent contamination, improve reliability.

Cannon's engineering experience is available to you on your potting problems. Write TODAY for assistance and for new 12 page, 2-color, Potting Manual No. PM-1.

40th YEAR 1915-1955 CANNON ELECTRIC

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FORMATION

Miniature Bias Supply

Fig. 1. Cylindrical bias supply shown actual size.

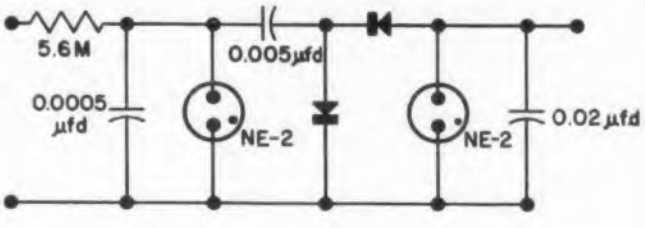

Fig. 2. Schematic of the standard bias supply.

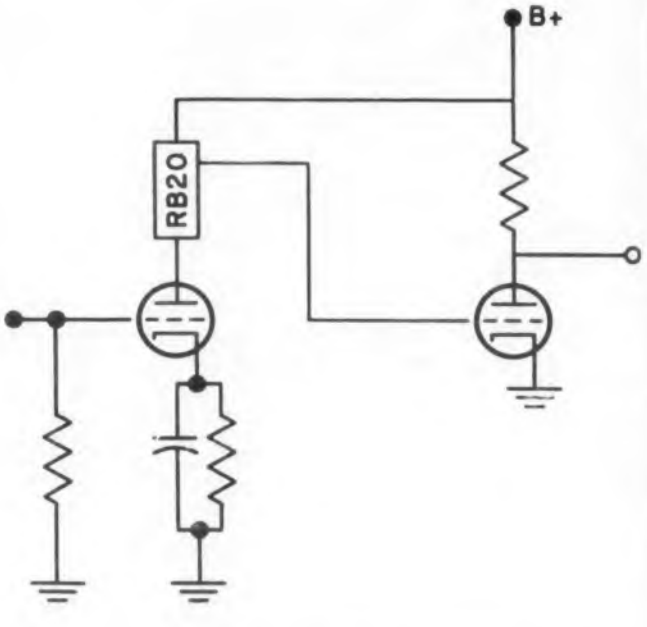

Fig. 3. The unit acts like a coupling battery in this amplifier with low-frequency response.

ESSENTIALLY a regulated power supply, the miniature bias supply, series RB 20, illustrated on these pages, can be wired directly into a circuit. It can be employed to apply a bias voltage to a high-impedance potentiometer or for plate-to-grid coupling in amplifiers.

Referring to Fig. 2, the unit operates as follows: The 5.6megohm resistor, the 500$\mu\mu$fd capacitor, and the first *NE-2* gas diode operate as a relaxation oscillator. The peak-to-peak voltage of this oscillator is essentially the difference between the firing and extinction voltages of the gas diode. This difference is about 20v, regardless of the amplitude or polarity of the input voltage, provided it is above the firing voltage and not so high as to be able to maintain a continuous discharge through the tube and the resistor. This a-c voltage is coupled through the 5000$\mu\mu$fd to the half-wave voltage doubler consisting of two selenium diodes. The 0.02μfd capacitor is a filter, while the second *NE-2* functions simply to protect the selenium diodes from any excess voltage that may be applied to the output circuit.

The input voltage to the supply can vary from 100 to 250v, either polarity, with an input resistance greater than 6megohm. Output voltage into a 10megohm load is 20v, either polarity. Output ripple at 100v input for standard models is 70mv at 1500cy. These bias supplies are made by Marine Electric Corp., 600 Fourth Ave. ,Brooklyn, N. Y.

The supply is particularly useful when used as a coupling battery in amplifiers that must have an extended low-frequency response. In such applications, large capacitors with slow transient response and possible high leakage can be avoided. In multivibrator circuits with a relay output, it is possible to avoid placing cathode resistors in the relay coil circuit by using these supplies.

The bias supplies are encapsulated in a modified epoxy resin in the shape of a cylinder 1″ diam x 2-1 4″ long. They weigh 1.7 oz each, and can operate at temperatures ranging from 0 to 200°F. They resist high humidity, shock, and vibration. They are available in many variations, including 40, 50, and 60v outputs, and with the output circuit isolated from the input. The low-ripple model, Type RB-20F, has an added r-c filter section. Some of these units have been in almost continuous operation for three years without apparent aging. For more technical data on this device, turn to the Reader's Service Card and circle **ED-23.**

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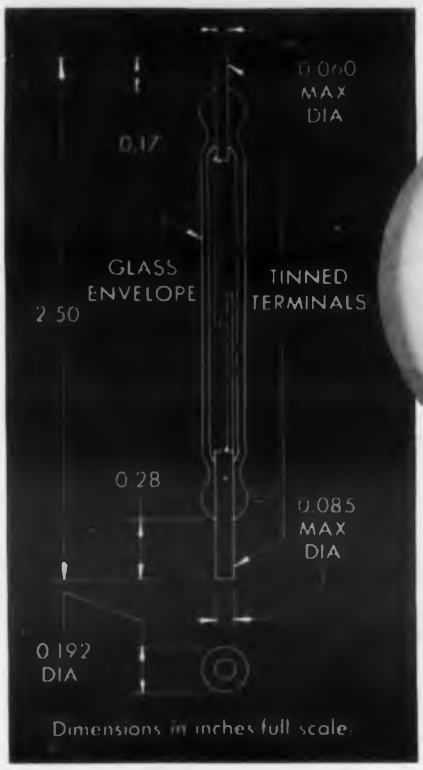

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Operating Rate—Up to 400 cycles per second
Contact Surfaces—Electroplated Rhodium
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D.C. Loads at 28 volts
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0.5 amps inductive (L/R—0.026)
A.C. Loads at 115 volts, 60 cycles
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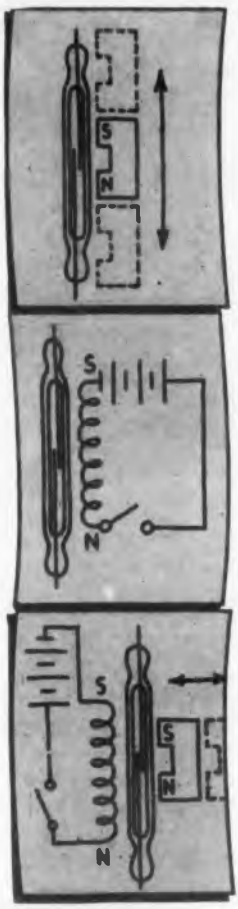

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Analog-to-Digital

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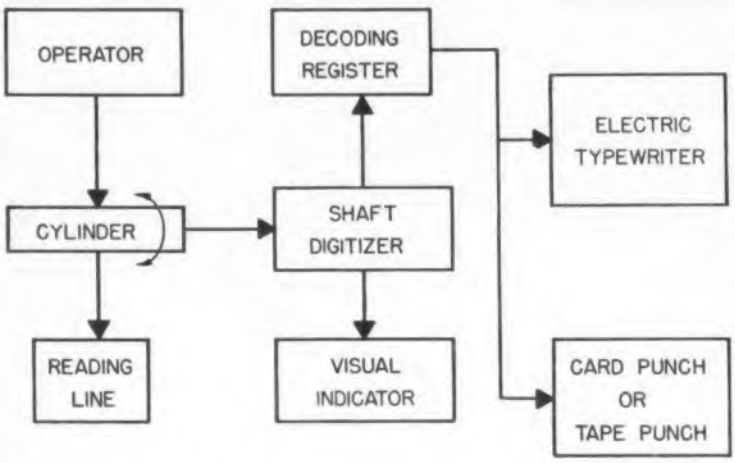
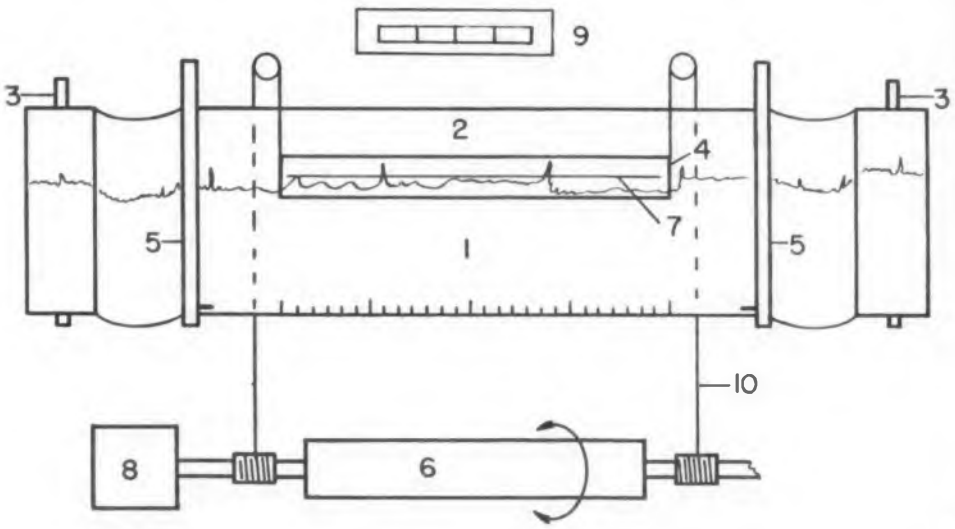


Shaft digitizer is set as reading line is adjusted. Decoding register (and storage) is located below typewriter in illustration above.



Oscillogram 1, held taut by rods 5, passes over ground-glass screen 2 as spools 3 are rolled. Cable 10 connects cylinder 6 to read head 4. As cylinder is revolved to position read line 7, shaft digitizer 8 converts measured amplitude to a numerical value. Result appears on light bank 9.

Translator

OSCILLOGRAM recordings appearing either on film or paper can be readily analyzed with the Model N OSCAR (Oscillogram Analyzer and Reader). This device functions as an analog-to-digital converter and is particularly applicable where digital computation is to be performed on raw data. It makes optimum use of human operators in converting information into convenient forms for making decisions or taking action (such as feeding inputs into a high-speed computer). Costly automatization is minimized.

This reading machine, built by Benson-Lehner Corp., 2340 Sawtelle Blvd., Los Angeles 64, Calif., is particularly applicable where emphasis is placed on the objective of converting trace displacement into digits with maximum speed and minimum equipment. The output of the OSCAR, Model N, is in decimal digits from 000 to 999 (0000 to 3999, optional), or in straight binary form from 0000 to 4095 counts. The decimal unit includes output to a light bank and provision for connection to a Electrotyper, Flexowriter, IBM Key Punch, and/or Paper Tape Punch. The binary unit includes an output to an IBM Key Punch, type 024.

To make an amplitude, or Y displacement reading, the operator simply rolls the positioning cylinder (*6*) in either direction to position the horizontal reading line (*7*) to coincide with the height of the curved trace of the recording for a specific time line. The foot-operated readout switch is then depressed and the measured amplitude is converted to a numerical value by the coded shaft digitizer (*8*) and the storage and decoder unit. The answer appears as a decimal value on the light bank (*9*) and is automatically typed and punched into cards or paper tape. Once the readout switch is pressed the operator is free to position the reading line to the next point to be measured. The positioning cylinder is coupled directly to the coded digitizer and to the reading line by a flexible cable (*10*).

The accuracy of the measuring and readout unit is ±0.1% of full scale deflection, although the actual system accuracy is a function of the quality of the record and the operator's ability. Records up to 12-1/2″ in width may be accommodated. As an optional feature, 16, 35, and 70mm film can be projected. For more data about this translator, turn to the Reader's Service Card and circle **ED-26.**

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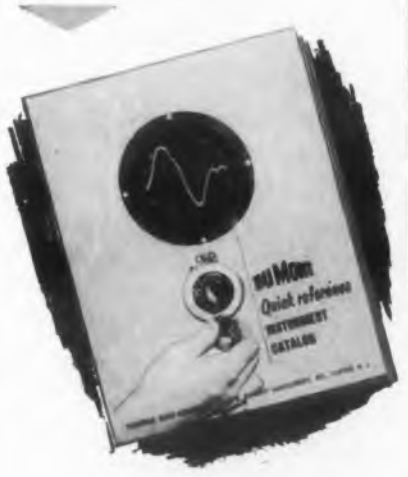

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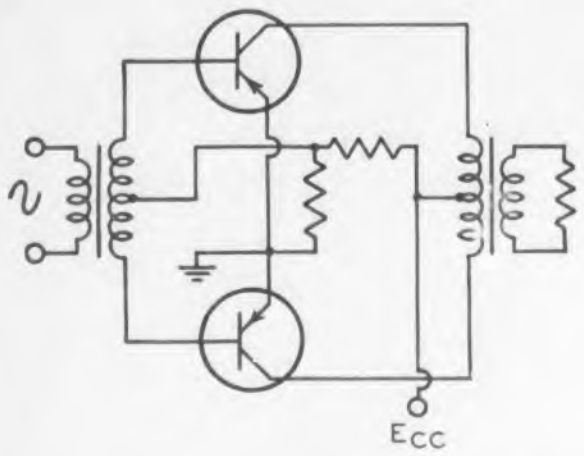
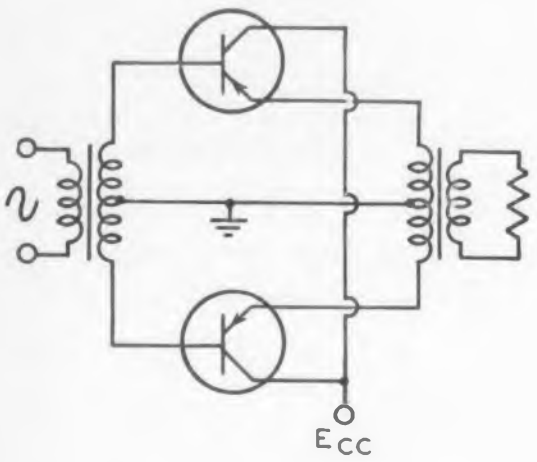


Fig. 1. Both the common-emitter Class B circuit at the top and the common-collector circuit at the bottom have base input.



Class B Operation of Transistors

II—Basic Circuits

K. E. Loofbourrow

Tube Div., Radio Corp. of America, Harrison, N. J.

CHARACTERISTICS of junction transistors in Class B operation and other considerations in the design of such circuits were discussed in part I of this article (*July, 1955, pp. 28-31*). Actual audio amplifiers are extensively analyzed in this part.

Basic Circuits

Several circuit configurations can be used to advantage in the design of large-signal junction-transistor audio amplifiers. Two of the most useful basic circuits are shown in Fig. 1. Although the base-input, common-emitter circuit offers the highest power sensitivity, transistors used in this circuit must have fairly well-matched large-signal characteristics and relatively low values of collector back currents. The average input resistance in this circuit is very low and is extremely nonlinear over the operating range. If the distortion requirements of the amplifier are severe, some negative feedback will be required. Because the optimum bias voltage for minimum distortion varies with changes in temperature, the use of temperature-compensating elements such as diodes or thermistors in the bias supply is desirable. The greatest practical advantage of the common-emitter circuit is its high power sensitivity.

The base-input, common-collector circuit, in which the load is in series with the emitter, has "built-in" d-c and a-c degeneration which greatly improves both the temperature stability and the distortion characteristics of the amplifier. The input resistance in this circuit is relatively high and is more linear with excitation than that of the common-emitter circuit. As a result, high input voltages are required to develop the necessary driving power, the maximum value of which is limited by the supply voltage. This circuit accommodates a much wider variation in transistor characteristics than the common-emitter circuit, and does not require temperature compensation to correct for variations in collector reverse current. The improved stability at higher temperatures and dissipations permits operation of a given transistor in the common-collector circuit at higher dissipation than in the common-emitter circuit. This circuit is also suitable for use with higher-power junction transistors. Because cross-over distortion is minimized without application of external base bias, better distortion performance is obtained at low power-output levels. Considerable power sensitivity is sacrificed, however, for these improved characteristics, and it is necessary in many amplifier applications to add an additional driver stage.

When either of the basic circuits shown in Fig. 1 is used, the maximum power output is a function of the load impedance and supply voltage, as shown in Fig. 2. Maximum power output is essentially independent of all transistor characteristics except the collector peak current capabilities. If the supply voltage is low, very low values of load impedance must be used to produce appreciable power output. The minimum value of load impedance is determined by the maximum peak-collector-current rating of the transistor. As the supply voltage is increased, greater power output can be developed with the same load. If the common-emitter circuit is used, higher load impedances may be employed at higher supply voltages to provide the same maximum power output with a significant increase in power sensitivity.

The power sensitivity of junction-transistor class B amplifiers is a function of the input resistance, the load impedance, and the large-signal α of the transistors. Because the input resistance over the required operating range is not linear, the calculation or measurement of input resistance and power gain can be made most conveniently for peak values. The peak input resistance is equal to the peak input voltage divided by the peak base current. The peak power gain is equal to the peak power output divided by the peak input power.

Referring to Fig. 3, in the common-emitter circuit, the peak input resistance is very nonlinear, increases with higher values of α, and is independent of the low values of load impedance. In the common-collector circuit, however, the input resistance is more linear and, for all practical purposes, is equal to the product of the load impedance and the peak current amplification factor.

Peak power gain, PG', is expressed as follows:

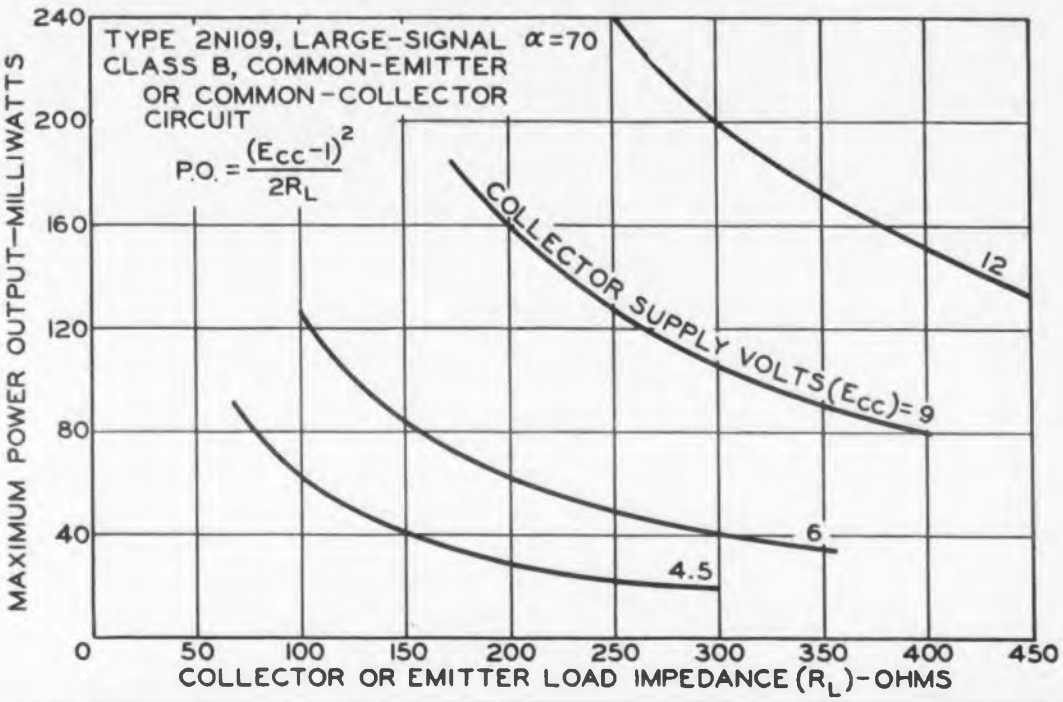
$$PG' = \frac{P'_o}{P'_{in}} = \frac{(I'_o)^2 R_L}{(I'_{in})^2 R'_{in}} = \frac{(\alpha')^2 R_L}{R'_{in}}$$

Referring to the chart of Fig. 4, (right) the power gain of the common-emitter circuit depends to a large extent upon load impedance and large-signal current amplification factor. The power gain of the common-collector circuit, however, is nearly independent of the load because the input resistance increases proportionally with the load. Because the power gain of the common-collector circuit is approximately equal to the peak current amplification factor of the transistors, the gain varies very little with changes in load impedance and only slightly for wide variations in large-signal α. The change in slope of the curves at low values of load is a result of the decrease in α at the resulting higher peak currents.

Efficiency

The efficiency of either the common-emitter or the common-collector circuit has a maximum theoretical value of 78%. In practice, the actual efficiency depends upon the quiescent value of collector current, the supply voltage, the efficiency of the output trans-

Fig. 2. Maximum power output is calculated by the expression shown in the upper left-hand corner of the chart.



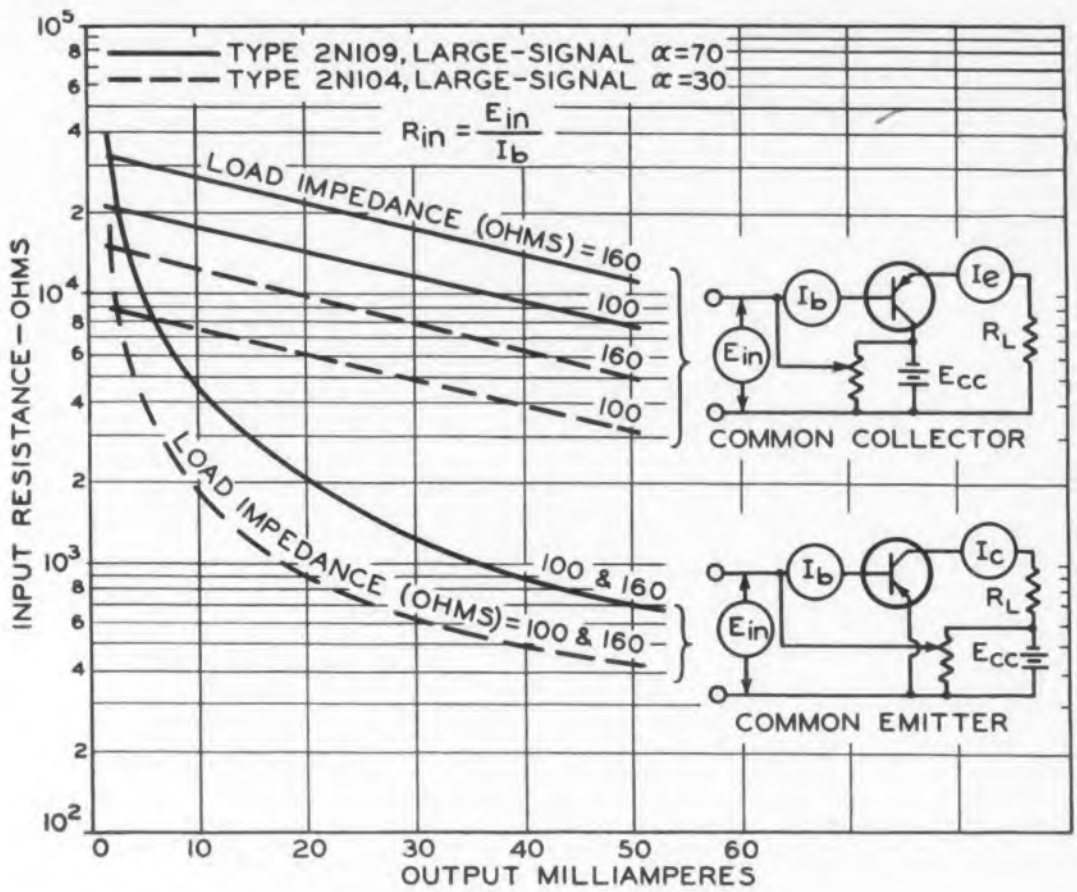
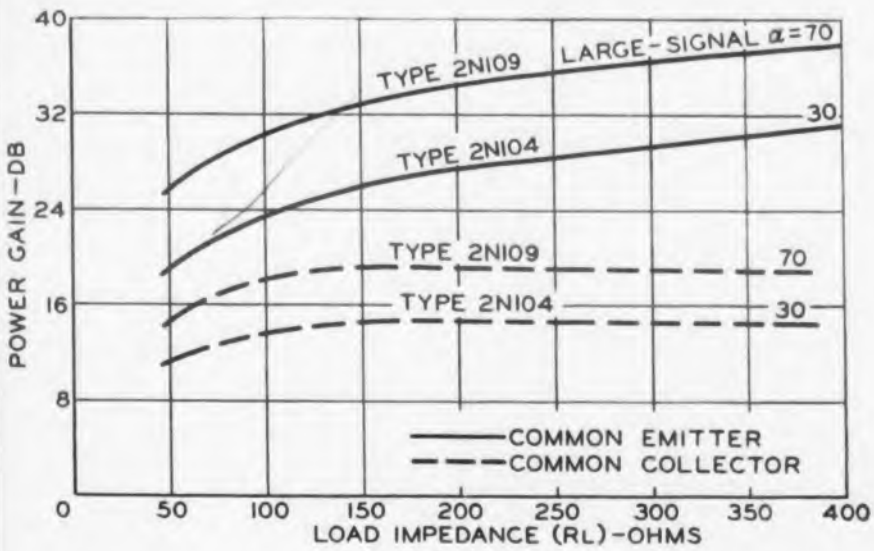


Fig. 3. Input resistance vs. output current for two types of transistors in both common-collector and common-collector circuits.

Fig. 4. Power gain characteristics of the two transistors considered in Fig. 3 in Class B push-pull circuits. For both circuits collector supply voltage is 9v, and signal is 1000cy.



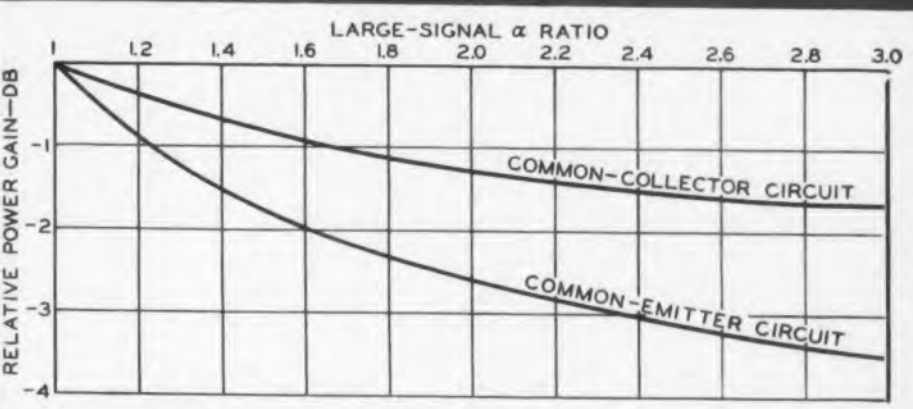


Fig. 5. Characteristics of class B amplifier pairs having mismatched α and matched R_{in}.

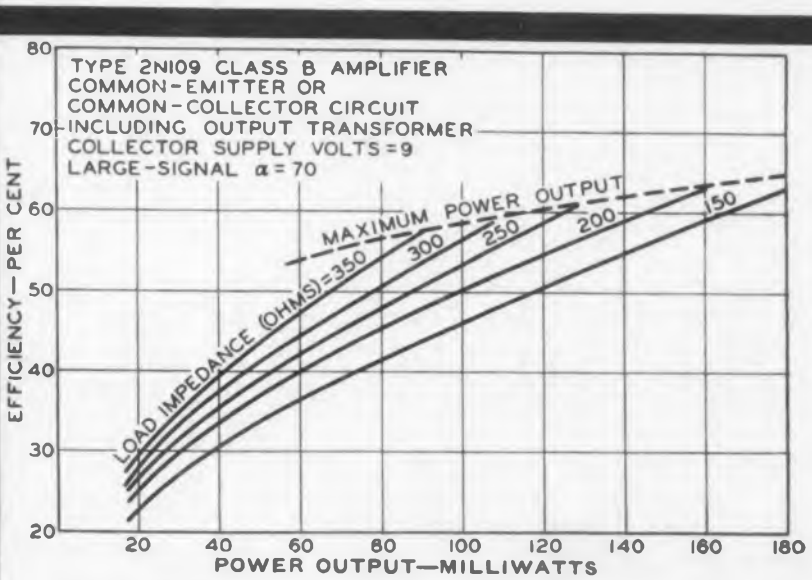


Fig. 6. Efficiency decreases as power level is reduced.

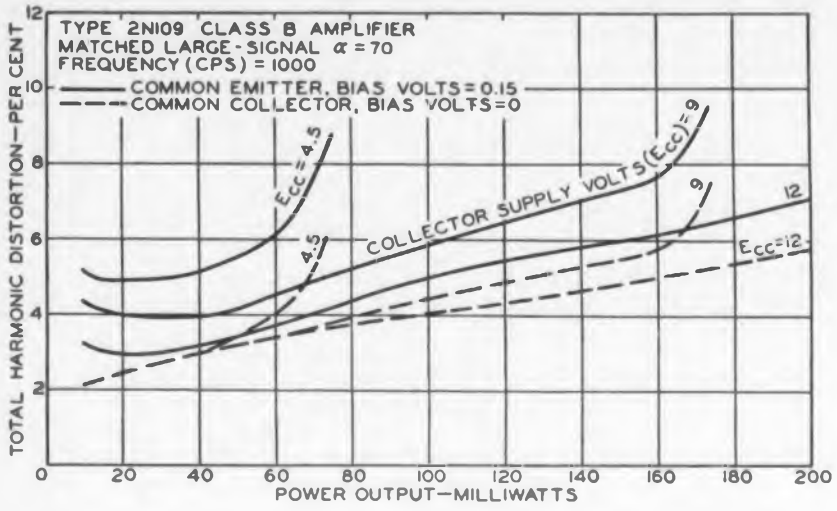


Fig. 7. The common-emitter circuit has less distortion under each operating point.

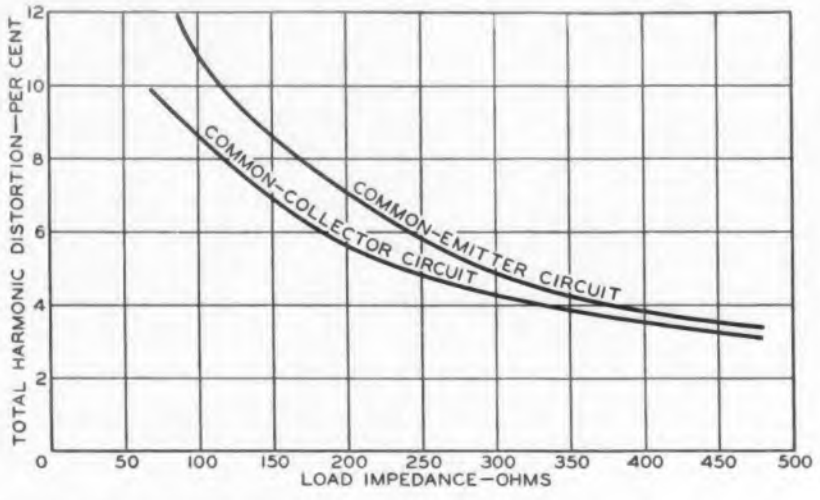


Fig. 8. The class B circuits considered in this chart utilize 2N109 transistors operating with E_{cc} equal to 9v and at frequency of 1000cy.

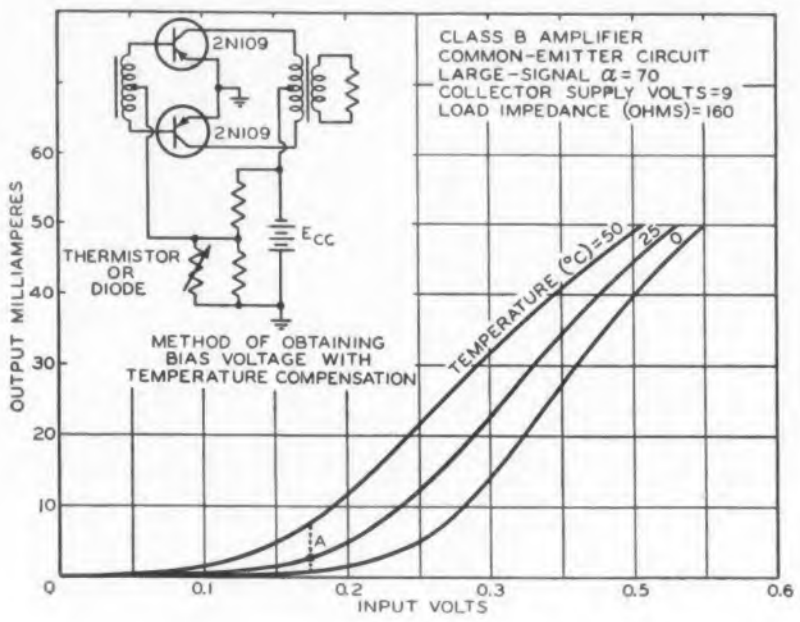
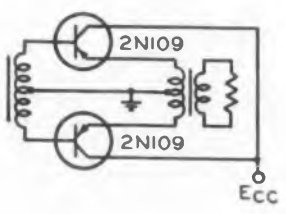


Fig. 9. Temperature characteristics for the circuit enclosed in the chart.



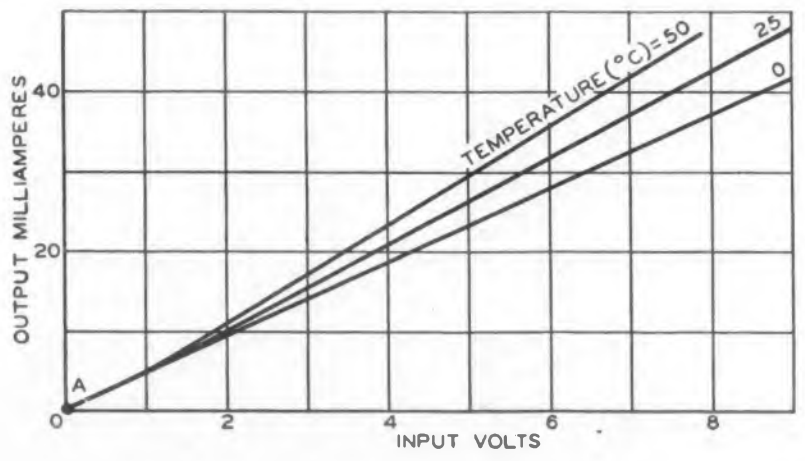


Fig. 10. Temperature characteristics for the circuit shown above. E_{cc} equals 9v, the load impedence is 160 ohms, and the primary d-c resistance is 10 ohms.

former and the level of power output. The efficiency of the two circuits is nearly the same for equal peak power output. In general, the choice of a high supply voltage results in slightly higher efficiencies because the "knee" voltage then becomes a smaller percentage of the total supply voltage. For example, the efficiency can be increased by 5 to 10% at rated output if supply voltage is increased from 4.5v to 9v.

The efficiency is greatest at full rated power output, and decreases as the power level is reduced, as illustrated in Fig. 6. For constant values of power output, the efficiency decreases for decreasing values of load. However, the efficiency at maximum power output increases as the load is decreased. It is possible, therefore, to design the amplifier with an optimum value of load impedance to give the required power output at maximum efficiency.

Low d-c primary resistance of the output transformer and tight coupling between the primary and secondary windings are required if the high efficiency is to be fully realized at the load. The variation in large-signal current amplification factor with matched or mis-matched transistors has no significant effect upon circuit efficiency because the maximum peak power is essentially unaffected by changes in large-signal a or mis-match in a. The variation in efficiency due to variations in a is only 2 to 3% at peak powers.

Distortion

Distortion in junction-transistor class B amplifiers is a function of the power output, the supply voltage, the input and load impedances, and the a characteristic of the transistors. The effect of these factors is more severe in the common-emitter circuit, which employs no internal degeneration and, consequently, is more sensitive to circuit and characteristic variations. The common-collector circuit has less distortion under each operating condition, as shown in Fig. 7, and shows the greatest significant improvement at low power-output levels, where cross-over distortion is effectively minimized without the use of external bias. For the common-emitter circuit, the curves show distortion at low power levels for the optimum value of bias. Distortion values would be considerably higher for this circuit (because of increased cross-over distortion) if the proper bias were not used. The change in the slope of the curves at high values of power output is due to "hard clipping", i.e., exceeding the point of maximum power as determined by the load impedance and supply voltage.

The increase in distortion as the load is decreased, as illustrated in Fig. 8, is caused primarily by the decrease in a of the transistor at the higher peak currents. A mis-match of 2 to 1 in the large-signal a characteristic results in about 2% additional distortion; a three-to-one mis-match causes approximately 5% additional distortion.

The over-all distortion of transistor class B ampli-

fiers can be reduced, therefore, by the use of transistors that have well-matched large-signal characteristics, by an increase in the supply voltage and the load impedance, and by the use of negative feedback. The final amplifier should be designed to provide the desired balance between distortion and power sensitivity for the given application.

Temperature Effects

The transfer-characteristic curves shown in Fig. 9 illustrate the effects of ambient temperature upon transistors in common-emitter class B circuits. The operating point is designated by point *A* on the 25°C curve. If the common-emitter circuit is operated with a constant bias voltage, an increase in temperature causes an appreciable increase in quiescent output current and a consequent decrease in the maximum power output and output-circuit efficiency. A decrease in temperature reduces the quiescent collector current almost to zero, thereby increasing the maximum power output and the efficiency slightly, and introduces cross-over distortion because the transistor is then operating over the nonlinear portion of its transfer characteristic. For optimum performance in the common-emitter circuit over a wide temperature range, temperature-sensitive elements should be used in the bias network so that the bias voltage changes with temperature and the quiescent collector current remains constant. This bias may be obtained conveniently by using a thermistor or germanium diode in a resistive network, as shown in Fig. 9, to provide a curve of network resistance vs temperature having a slope approximating that of the transistor characteristics over the required operating range. In many applications, however, it is practical to use the common-emitter circuit over reasonable temperature ranges without the use of temperature compensation if a higher operating point is selected with a slight sacrifice in efficiency.

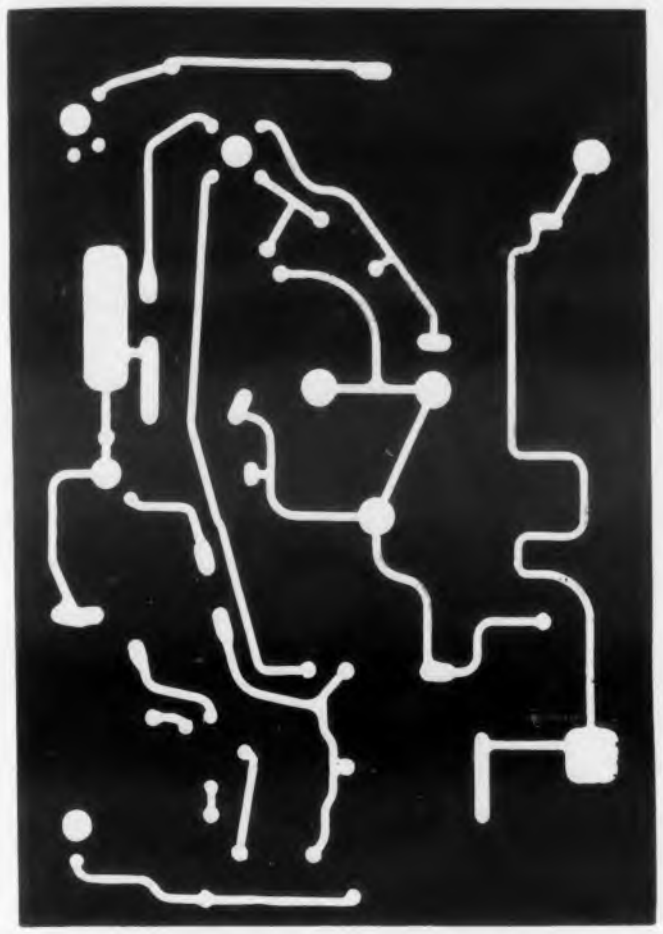
The effect of temperature variation on the transfer characteristic for the common-collector circuit is shown in Fig. 10. Because the load impedance is in series with the input signal in this circuit, high input voltages are required to drive the transistor to its rated peak current. The curves of Fig. 10 are reasonably linear, even in the low-current region. As a result, the trasistors may be operated at zero bias without introducing the problems of low-level distortion at room temperature or with temperature variations. In this circuit, therefore, no bias supply or temperature-compensating network is required for optimum performance. The shift of the curve with temperature at the high-current end of the scale causes a slight variation in the maximum power and the power sensitivity of the circuit. This variation may be reduced by the use of an output transformer having increased d-c primary resistance in series with the emitter load, resulting in increased d-c stability.

Material for Stamped-Out Printed Circuits

An electronic component made with the material. At the left is the "preform" before the metal inserts are molded in.

LOWER production costs and unusual three-dimensional designs in printed circuits are possible with a new plastic material known as RM 2035. The printed circuit is simply stamped into the plastic by a die instead of being formed by the more complicated process of etching a copper-coated laminate. Various projections, holes, or metal inserts can be molded into the printed circuit board at the time it is formed. In addition, the material has better electrical and mechanical properties than XXXP laminate.

To form a printed circuit, the material is first heated as a sheet or special pre-form, the two forms in which it is available. A roll of copper foil, coated on the back with an adhesive, is then fed over the material and the circuit is punched through the copper by the die. The material is then molded to the desired configuration. The die can be made from the master printed circuit drawing by a photoengraver. The copper foil pattern can be made in any thickness down to 0.002" and with lines as narrow as 1/32". RM 2035 was developed by the Rogers Corp., Rogers, Conn., from their RM 9725 plastic material.



Example of a stamped-out printed circuit. The copper foil is flush with the surface of the RM 2035.

The peel strengths of the copper foil average 12 lb, and immersion into molten solder at 235°C does not cause blistering. In addition, patterns with foil of different thickness can be placed on the same or opposite sides of the board by using more than one die. It is also possible to sandwich-mold several different printed circuits in layers into a single part.

Increased thickness at mounting corners, insulation barriers, terminal pins, socket pins, eyelets, and other hardware can be molded into the board, eliminating other production steps such as drilling, mounting, and stacking. The molding process also reduces moisture absorption because of the formation of a resin skin covering all edges and hole walls. Another advantage of using this material is that the copper foil not stamped into the board can be salvaged for scrap.

This material can be used for other applications besides printed circuits. Such applications include plastic parts that require metal inserts, stand-off insulators, and other electronic components. For more information on this unusual material, turn to the Reader's Service Card and circle **ED-30.**

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The RD1 is a SPST relay, available with either normally open or normally closed contacts. A similar relay (Type RE2) has SPDT contacts and slightly larger models (Type RM2 and RM4) are made with 2PDT and 4PDT contact arrangements. These units have peak working voltage ratings up to 12,000 volts and continuous RF current ratings of 10 amperes rms at frequencies up to 30 mc. It is also possible to make and break under load with fast break times of less than 10 milliseconds. Switch capacitances are as low as 0.1 mmfd and contact resistances are as low as .005 ohms. As their contacts are sealed in a vacuum, contact resistance does not increase with usage. This factor makes them excellent general purpose relays for DC switching.

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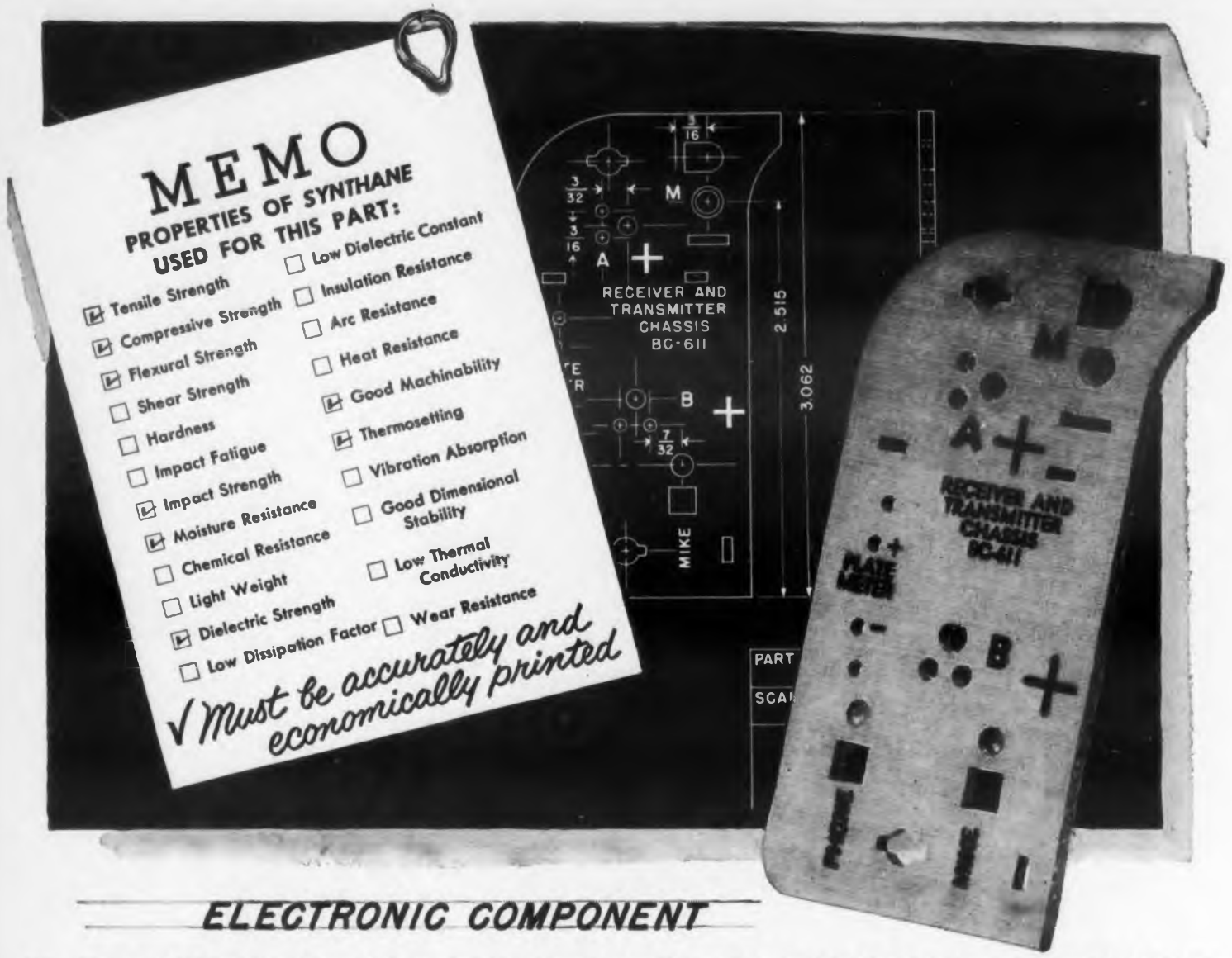

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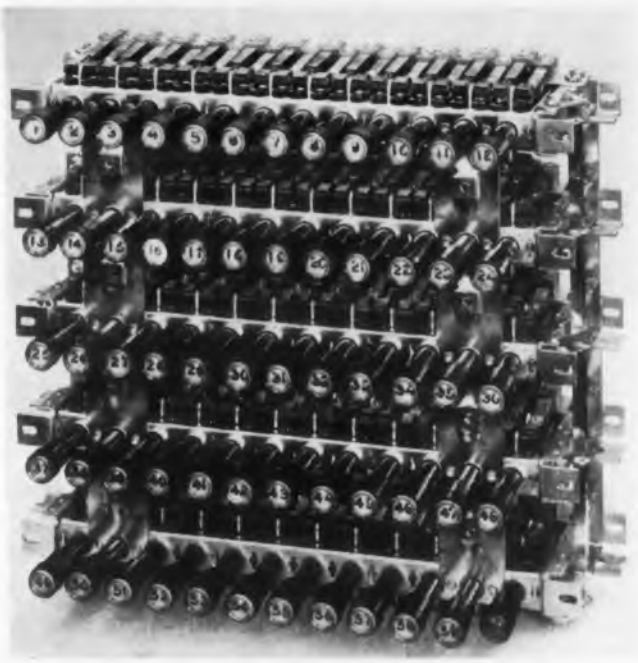
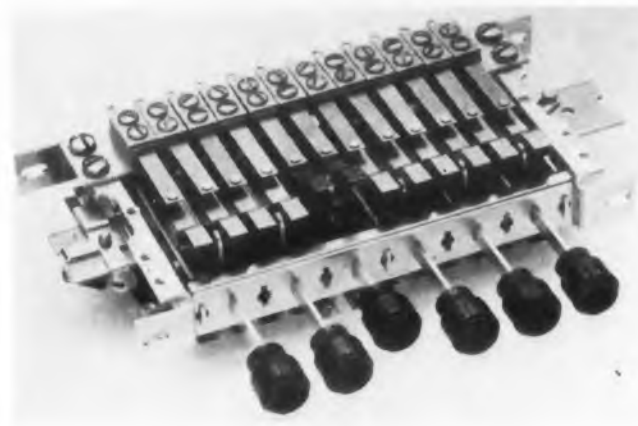
Multiple Pushbutton Switches



The above bank of 60 illuminated pushbutton switches can perform many functions.



A six-switch frame of the interlock type.

CHANNEL switching, electronic process or machine controls, production test equipment, and laboratory test set-ups are some of the applications for the multiple pushbutton switches illustrated on these pages. The switches can be provided with a number of different interrelations and in both illuminated and non-illuminated models. Since the function of the basic switch unit can be changed by accessory hardware, the user need not stock many parts to assemble switch banks that can perform a variety of functions.

The following arrangements are available: (1) Interlock, in which pressing one switch restores to normal the switch previously actuated. (2) Non-locking, in which each button has momentary action. (3) All locking, in which there is cumulative locking of buttons, all restored to normal by pushing the release button. (4) Interlock and non-lock combinations, in which certain stations will interlock and others non-lock. (5) All-lock and non-lock, in which certain stations have cumulative locking feature and others will not lock. The release button restores the locked stations. A modification of the all-locking version is available in which any number of stations can be actuated and then by pressing the end button locking in all the previously operated stations and locking out the other stations. The release button is pulled out to release the stations. Another modification for interlock types prevents more than one switch from being actuated at once or in other than a prescribed sequence.

These switches are available in four standard frame sizes: 4, 6, 8, and 12 stations. The frames can be mounted in banks as illustrated. Center distance between switches is 5/8″, but this distance can be reduced to 1/2″. These switches are manufactured by Switchcraft, Inc., 1328-30 N. Halstead St., Chicago 22, Ill., as the "Multi-Switch".

The illuminated switches can be furnished to light in either the "in" or "out" positions. The 6v screw-base lamps are replaced from the front of the switch. The color of the light can be varied. These switches can handle currents in the order of amperes. They are ruggedly designed for resistance to shock. For more data on these switches, turn to the Reader's Service Card and circle **ED-33.**

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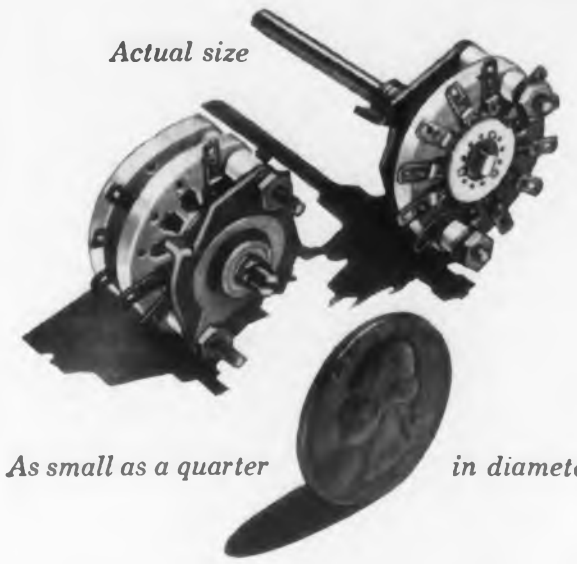

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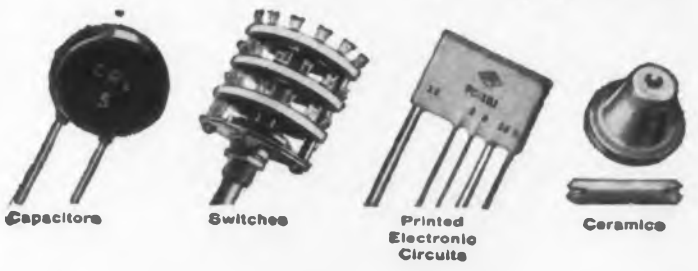

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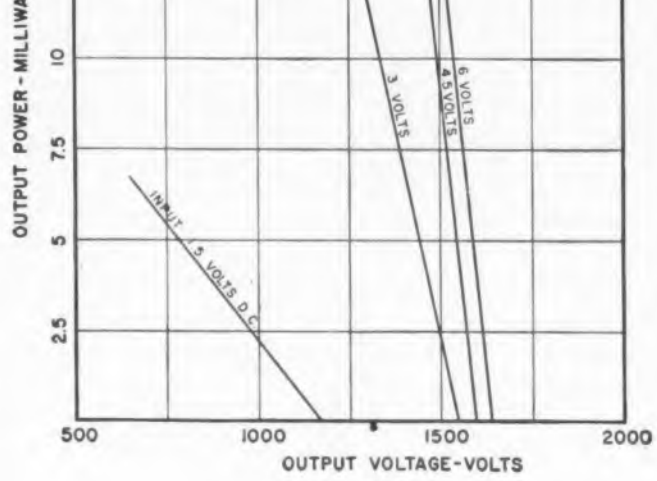

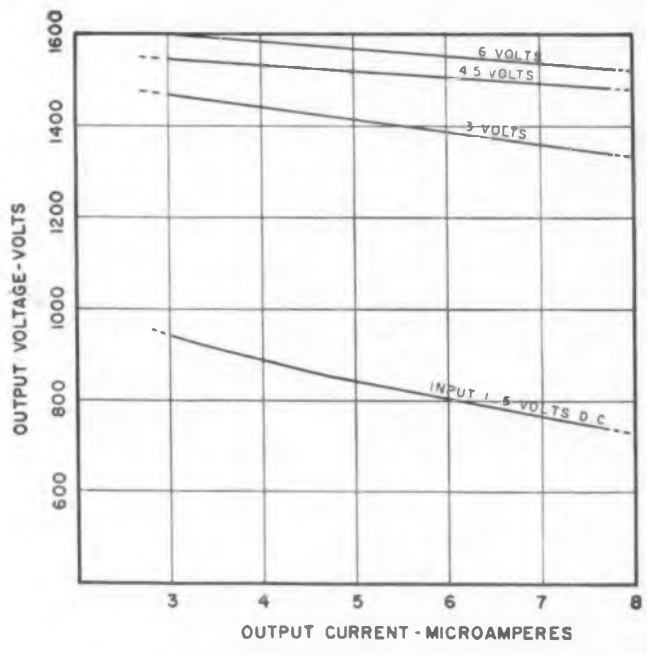

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COMPACTLY packaged, this high-voltage transistorized power supply can be plugged into conventional octal or miniature tube sockets. Filtered d-c voltage up to 1500v can be obtained from a single 1-1/2v flashlight cell at output currents as high as 50μamp. Voltages of 3000v or more can be obtained from additional cells. By paralleling transistors, additional output current can be supplied. These 1-3/4, by 1-3/8 by 1-1/2" high high-voltage units are designed especially for cathode-ray tubes, all types of Geiger-Mueller counter tubes, photomultiplier tubes, and bolometers.

The circuit for the power pack, manufactured by Universal Atomics Corp., 19 East 48 St., New York 17, N. Y., operates as a blocking oscillator. An efficient transformer produces fast rising pulses, resulting in high output voltage ratings. By replacing general-purpose transistors with power types, output power can be increased several times.

A selenium rectifier is used. Because of the high frequency involved, the filter was designed to take advantage of printed circuit techniques. The filter is a low-pass pie circuit. An external potentiometer can be added for a variable output of approximately 400 to 1500v. Voltage regulation can be included within the unit.

The power packs are completely potted in resin and are available in rectangular or cylindrical forms. Operation for practically the shelf life of the battery is possible; the current drain is less than 20ma. The units have a uniform output regardless of temperature; the voltage changes less than 10v over a range of 30 to 80°C. Output is normal after cycling through 125°C. The units weigh approximately 6 oz. For more information about these converters having no moving parts, turn to the Reader's Service Card and circle **ED-36.**

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Discrete-Position Servomechanism Applications

Max Hoberman, Chief Engineer
Bergen Laboratories, Fair Lawn, N. J.

The discrete-position servo can control a fuel line, as illustrated, in addition to many other liquid flow systems. Fig 7 is the block diagram.

ROTATING in steps rather than continuously, the discrete-position servomechanism is a simple and inexpensive device that offers the electronic engineer many unusual design opportunities. Many operations that require human intervention or expensive equipment can be done automatically with it. The nature of this stepping servomechanism and its application in measuring instruments, process control, communications, quality control, and function generation are given in this article.

In order to understand the device, it must be compared with the conventional servomechanism. Most definitions of servomechanisms state that the system be an error-sensitive follow-up permitting the input command to be remotely located from the element being controlled. The requirement that the servo be error sensitive implies that there shall be a continuous comparison between the command and the element being controlled. The discrepancy between the two signals is called the error signal, and it is used to control the output. Fig. 1 shows such a simple position servomechanism. If it is desired to vary a mechanical shaft position to correspond to an input voltage, a potentiometer may be coupled to the shaft and a motor used to drive both of these in response to the output of an amplifier. The input to the amplifier, shown as point *P*, is the sum of the input voltage and a voltage obtained from a potentiometer ganged to the output shaft. If at any shaft position a residual voltage is obtained at point *P*, this voltage is amplified to drive the motor *M* around until a point is found on the potentiometer that "bucks out" the input voltage—leaving zero volts at point *P*. Of course, since the motor requires a small but finite voltage to operate it, a stable position can usually be found where the residual voltage at point *P* is small, but not quite zero. The stability of this system involves the electrical and mechanical gains in the loop and the attendant phase shifts.

The existence of a residual error signal, which often can be made arbitrarily small, leads us to inquire from whence it arises. Several of the factors determining this signal include the small starting voltage necessary to turn the motor, and the voltage gradient between turns in the follow-up potentiometer. Since this latter voltage occurs in discrete steps, it is obvious that an input voltage may be applied that is not exactly bucked out by any voltage obtained from the follow-up potentiometer, thereby leaving a residue at point *P*. This phenomenon may be utilized to gain considerable simplification and cost reduction of the servo loop.

It can be seen from Fig. 2 that the follow-up voltage may be obtained from a discrete position tap switch. This arrangement suggests the use of simple motors or stepping relays to drive the tap switch. In conventional servos, the driving motor must be capable of providing at least the resolution (through a gear train) of the follow-up potentiometer or sychro. If the follow-up is provided by the discrete taps of a rotary tap switch, an ordinary stepping relay or relay actuated a-c or d-c motor has ample resolution to accommodate the steps between taps. This fact enables the design of a simple, cheap, compact servomechanism that extends the use of closed-loop systems to many applications from which they have been excluded because of limitations of size and cost.

One form of this discrete-position servomechanism is already available. Known as the "Step-Servo", it is a self-contained unit including power supply, stepping relay, amplifier, and voltage reference. *(Editor's Note: Technical details of this device are given on p 73 in this month's "New Products" department.)*

The curve of angular position versus input voltage for a typical Step-Servo is shown in Fig. 5. This curve shows how the device remains at a fixed position over an input voltage range of about two volts. Thus, the servo would remain at the 5 o'clock position over the range of 4 through 6v. This characteristic points up a consideration in the use of these servos, and that is the ambiguity that occurs with all staircase functions of this type. With an input of say 4v into the unit, the angular position may be at either 5 o'clock or 6 o'clock with a rectangular hysteresis loop exhibited at precisely 4v input. That is to say, when the input potential is decreasing through 4v, the shaft will remain at 5 o'clock until slightly less than 4v is reached at which time it goes to the 6 o'clock position, and when the input voltage is increasing, the shaft will remain at 6 o'clock until slightly more than 5v is reached. The size of this loop or region of indeterminancy is established by the gain of the amplifier, stability, and other considerations, and may be made arbitrarily small. This indeterminancy is usually no problem since the steps are adjacent in level.

Several points must be kept in mind in the use of discrete position servos. Among these are the need for providing a "dead zone" corresponding to the voltage between steps on the tap switch over which range the motor or stepping switch should not operate. Too small a dead zone would lead to instability, and too large a dead zone would lead to considerable ambiguity between steps.

By proper design this large ambiguity can be eliminated, but an inherent feature of the discrete position servo is that the shaft position will remain stationary over an arbitrarily small input voltage range. Considerations in the design include the need to compensate for line voltage changes, temperature effects, and also elimination of the possibility of the unit having so small a "dead zone" that hunting

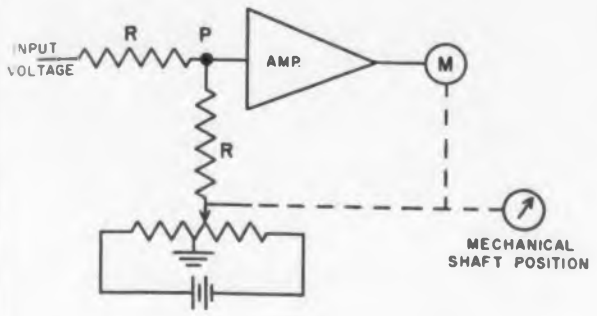


Fig. 1. The conventional servomechanism.

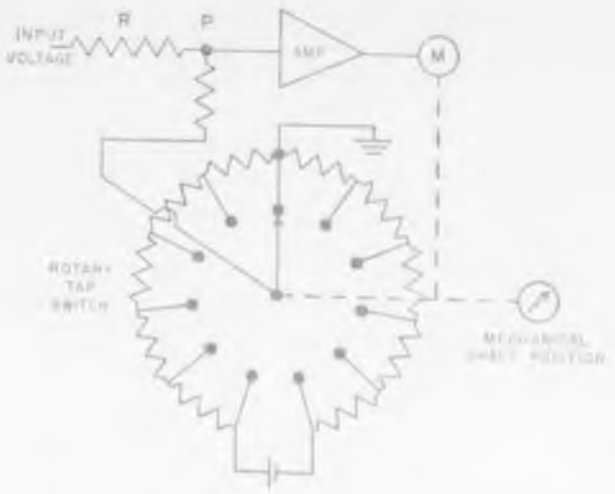


Fig. 2. The discrete-position servomechanism.

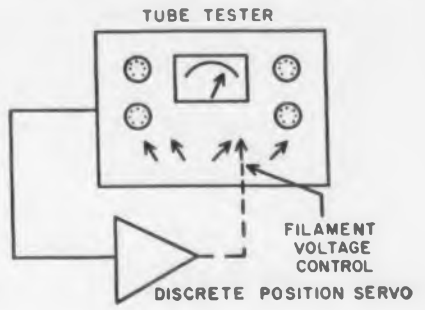


Fig. 3. Tube filaments can not be accidentally overloaded in this unusual tube tester.

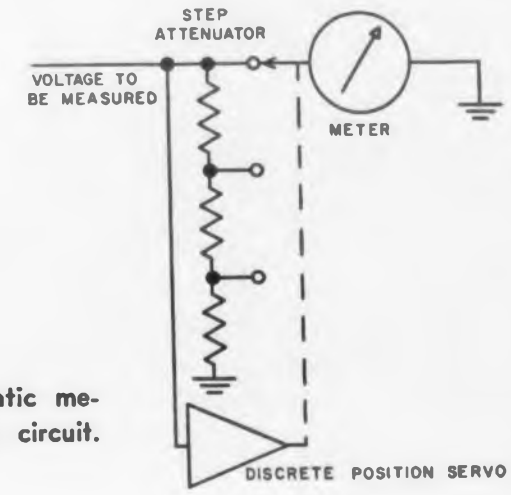


Fig. 4. An automatic meter range switching circuit.

occurs at extremes of line voltage and ambient temperature. The range of one to two volts between steps is safe for the simple amplifiers employed. If very sensitive discrete position servos are required, it is essential that the additional gain be stable with respect to temperature, time, and line-voltage variations to avoid instability or ambiguity. This feature compares with the "tightness" of conventional servos of the continuous-linear variety. If the gain of the amplifier of Fig. 1 is very great, the voltage between adjacent turns of the potentiometer may be sufficient to cause the drive motor to hunt in one direction and then the other. If the voltage between turns is so small that the pot must turn through numerous turns of the resistance element before sufficient voltage is provided to actuate the motor, the servo will respond very slugglishly.

Quality Control

In quality control applications illustrated in Fig. 3, and applicable to resistor, capacitor, or entire unit testing equipment, the stepping servo may be used to automatically set up the instrument switches to correspond to the filament voltage needed by the tube, or more important, to reduce the voltage to a safe value if for example a 6.3v tube is plugged into the socket when the instrument is set up for 12.6v filaments. This action may be accomplished by utilizing the voltage drop across a one-ohm resistor placed in series with the filament leads. For a 0.3a, 6.3v filament, 0.3v would be developed across the one-ohm resistor. When 12.6v are mistakenly supplied to a tube with a 6.3v filament, the greater voltage developed across the resistor would be used to switch the transformer tap by means of a discrete

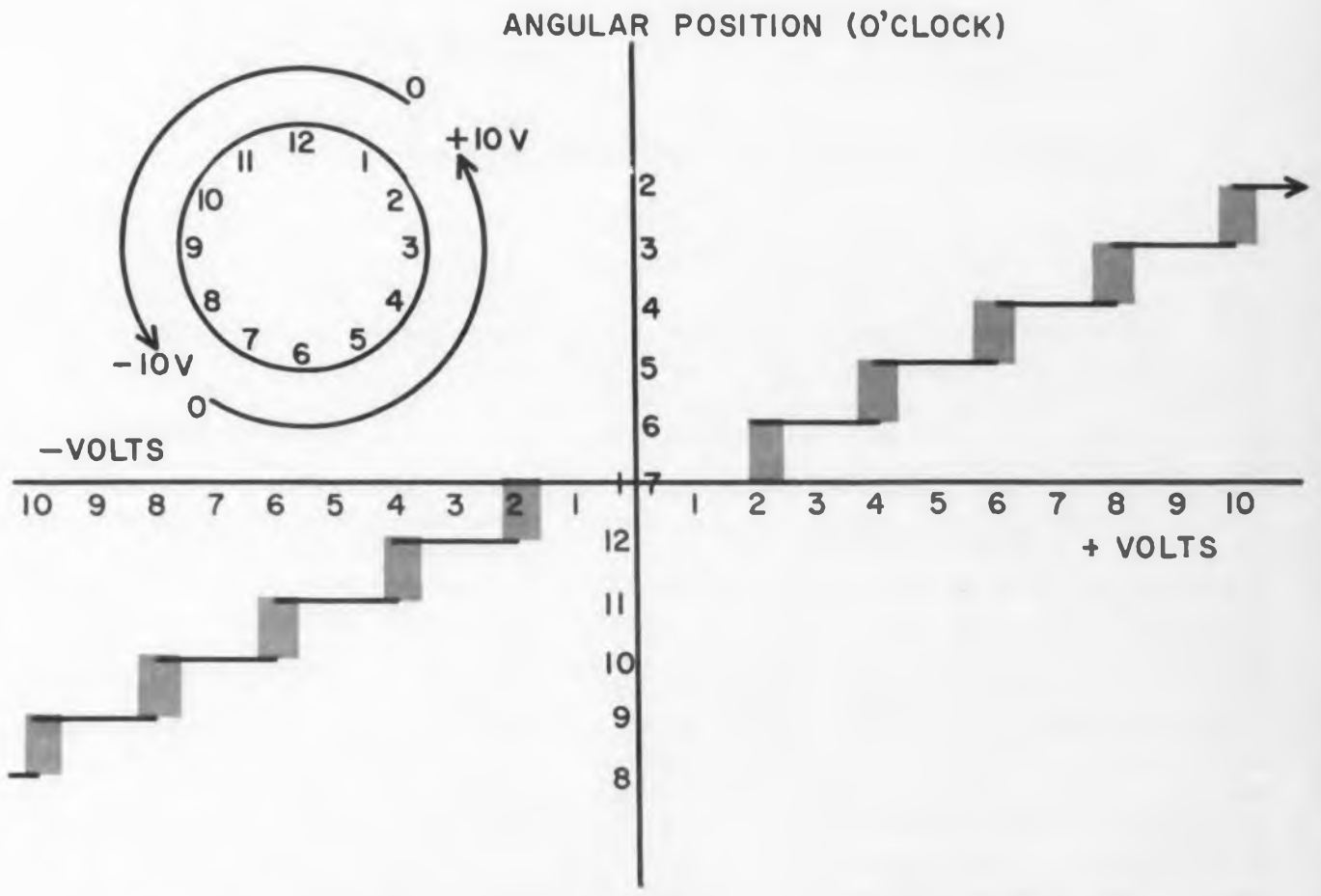


Fig. 5. Voltage input plotted against angular position for a commercially available form of the discrete-position servo. The step does not occur at an exact point, as indicated by the color.

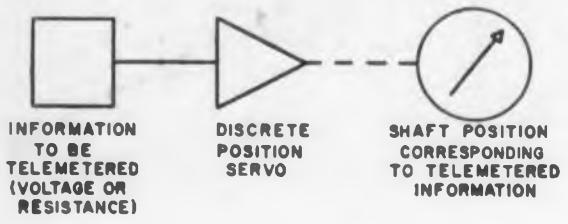


Fig. 12. A telemetering arrangement.

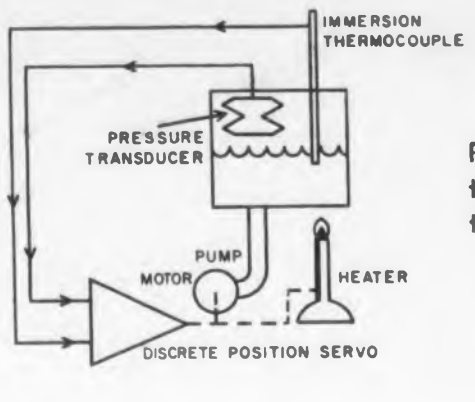


Fig. 8. Controlling an electrical circuit and a valve at the same time.

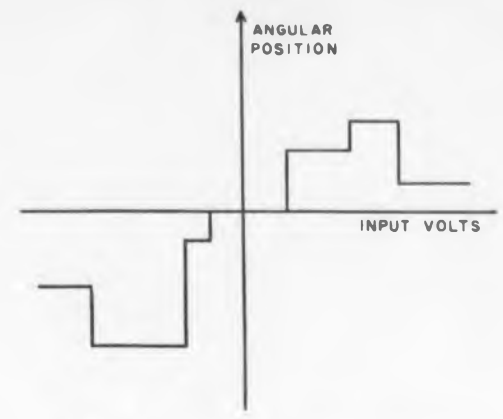


Fig. 9. The steps in this function can be specified in any order by means of the stepping servo.

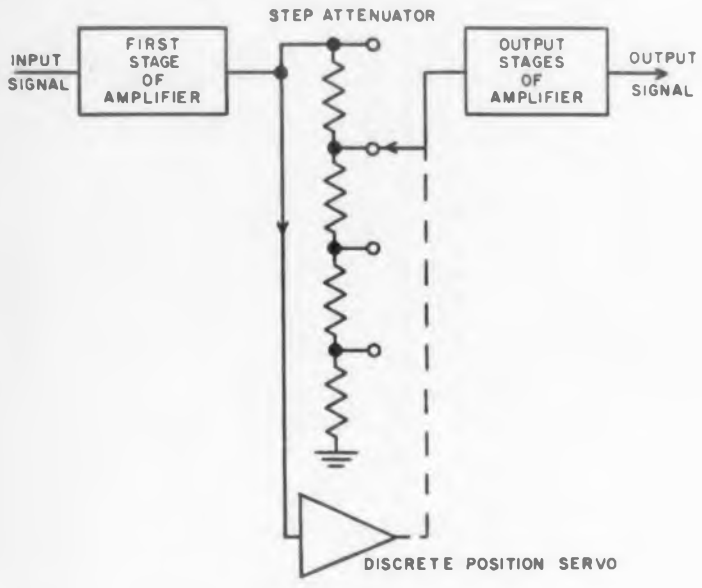


Fig. 11. An automatic-gain-control circuit.

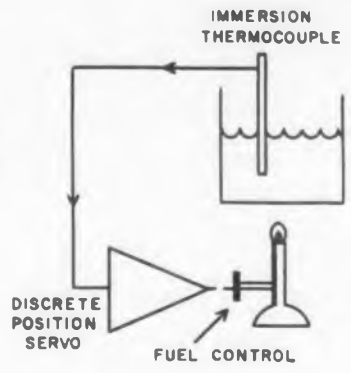


Fig. 7. A fuel control suitable for automatic process control in many plants.

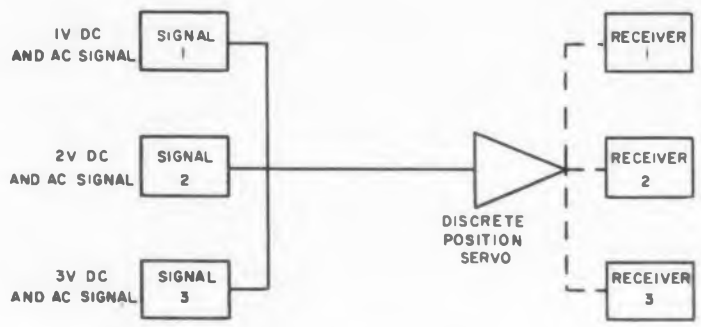


Fig. 10. An inexpensive multiplexer for communications equipment.

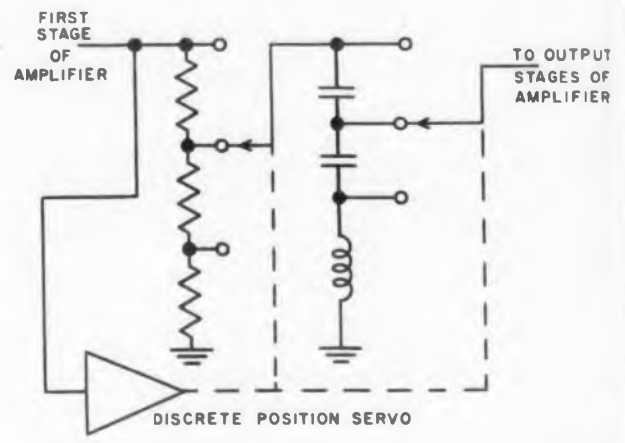


Fig. 6. In this a-g-c circuit, capacitive phase-shift is provided to a certain limit, with inductive phase-shift beyond.

position servo. This arrangement is easily extended with such servos to multi-voltage inputs due to the large number of circuit positions available.

In a similar fashion in a production part or component tester, a faulty part may cause an excessive current to be drawn. The servo would quickly switch the input voltage to a safe level while simultaneously giving an alarm to operating personnel.

Process Control

The stepping servo is a cheap and simple controller for "closing a loop" in process control. An example of this use to control a fuel valve to maintain a preset average temperature in a process is shown in the photo and in Fig. 7. The simplicity inherent in the unit due to the fact that it can control both an electrical circuit (input to a pump motor) as well as a mechanical shaft position (heater) is demonstrated by Fig. 8. Both of these may be controlled simultaneously and according to arbitrary predetermined conditions, that is: the motor speed can be reduced while the heater fuel flow is increased in discrete steps, or both may be increased as the shaft position changes. Most such processes have sufficient inertia (lag) such that the length of time needed to rotate the shaft is small compared with the resulting steady state effect.

Measuring Instruments

Some comprehension of the utility of discrete position servomechanisms in measuring instruments may be obtained by looking around the laboratory and noticing the many uses of switches. Each such switch is an element in an existing "closed loop" system. In most cases the loop is closed by the human operator who activates the switch in response to some stimulus or desire; for example, if an amplifier is overloaded due to too high an input signal, he switches the attenuator at the input, if the voltmeter is on the wrong scale, he switches the range switch until the deflection falls within a desirable range on the meter. In most of these applications there is no reason why the machine itself cannot make the decision to switch ranges, scales, or positions. (See Fig. 4.)

The automatic switching principle has already been applied to a vacuum-tube voltmeter *(ED, May, 1955, pp. 48-49)*. In this application, appropriate multiplier resistors are switched into the meter circuit depending upon the voltage to be measured. The servo system may be used for voltmeters, ammeters, ohmmeters, and any other meter that can be arranged to give a signal proportional to the quantity to be measured. Multi-range meters heretofore required that the operator close the loop by switching ranges in response to a visual stimulus of the pointer on the scale. Since the meter itself has all the information concerning the position of the pointer in the form of an electrical signal applied to its input terminals, an instrument can be designed to utilize this signal to switch its own range until a proper scale is found.

Automatic A-G-C

Many amplifiers are required to operate over a very wide range: that is, they must operate equally well for an input of 0.1v as for an input of 100v. A vacuum-tube a-g-c circuit for such a dynamic range

would be a most difficult and costly unit. Nothing could substitute for a step attenuator in this application. A discrete position servo whose input is connected to an early stage of the amplifier could position a step attenuator depending upon the strength of the signal at that point to prevent overload of the subsequent output stages of the amplifier, as shown in Fig. 11. The step attenuator shown is resistive, but this specification need not be a limitation; if for example it is desirable to provide capacitive phase-shift for signals below one volt and inductive phase shift for signals above one volt, this arrangement can be accomplished by cascading step-switch units, all operated by the same discrete position servo as shown in Fig. 6. Amplifier stages may be switched in or out of the circuit to correspond to signal levels that require more or less amplification just as easily as the resistance attenuator in the above example.

Function Generation

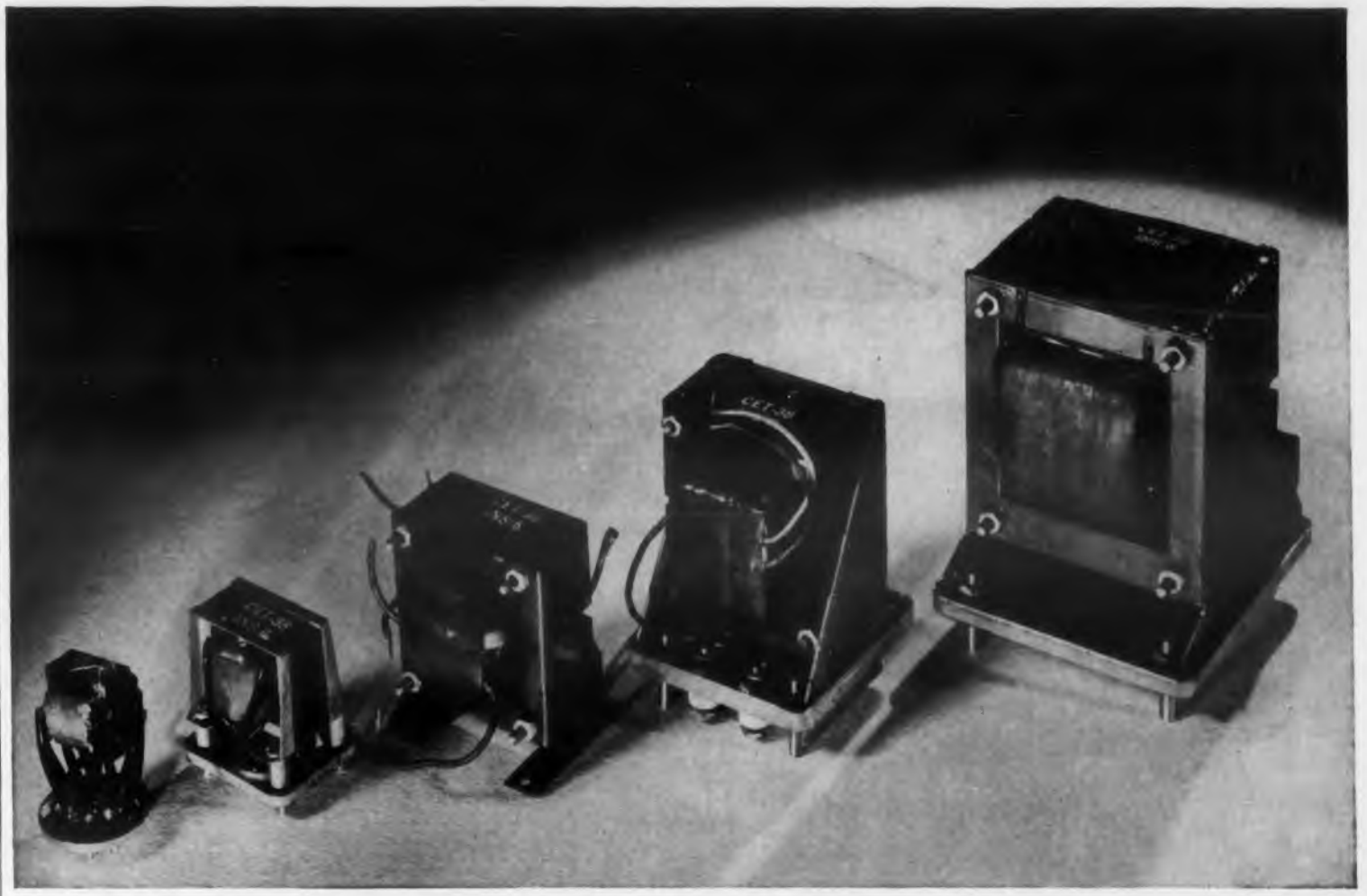
A unique possibility with the stepping servo is the ability to obtain a non-monotonic input-output function, as shown in Fig. 9. Unlike an ordinary servo, it is very simple to obtain steps that go up and down in prescribed fashion to accommodate unusual requirements in the controlled system. This characteristic means, of course, that arbitrary resistors, capacitors, or other passive or dynamic circuit elements may be switched in simultaneously.

Multiplexing Unit

Frequently it is desirable to share a common line or radio channel among several transmitting stations and receivers. This arrangement is called multiplexing, and elaborate systems exist for handling communications by this method. A simple, inexpensive, multiplexer that can be used when the transmitted signals need not be commutated very rapidly (as for example meter readings from a remote station) would utilize a discrete position servomechanism whose shaft position (and thereby the particular receiver) is determined by a d-c bias signal corresponding to the particular transmitter function. The servo rotates to the appropriate shaft position and simultaneously connects the appropriate receiver and excludes all others from that channel until the d-c bias signal changes, as shown in Fig. 10.

Telemetering

A convenient telemetering system is obtained when the input to the servo is in the form of a voltage or resistance to be telemetered. Thus, when one volt is applied to the link, the remote shaft position turns to the first position. When two volts are applied, to the second position, and so on. This system can have a built-in "memory" in that the output shaft position remains at its last position until the application of a subsequent voltage. It is shown in Fig. 12.



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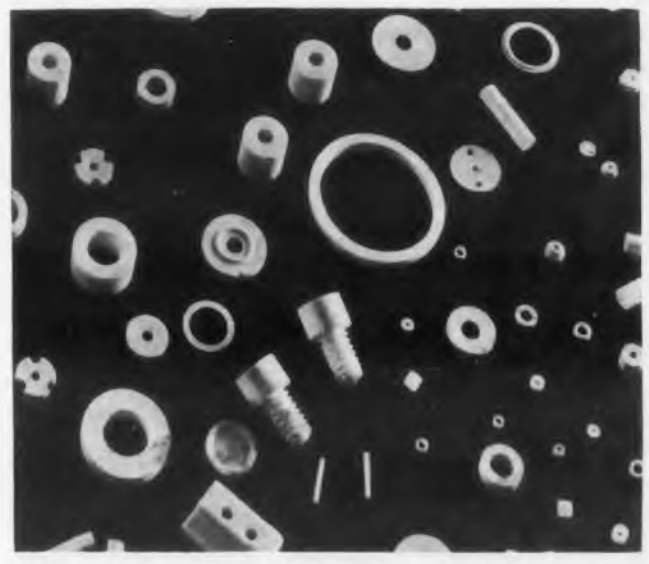
CIRCLE ED-36 ON READER-SERVICE CARD FOR MORE INFORMATION

Pure, Metallized Ceramic

Typical examples of ceramic-to-metal bonding.



Cap screws and other tough parts can be made.

Transformer case, center, for fluorine filling.

VACUUM-tight ceramic-to-metal seals can be readily made with this high alumina type ceramic. Because of its temperature resistance (up to 1700°C), bakeout temperatures during sealing can be high for complete degassing. Impurities have been removed and contamination is virtually eliminated even over a period of years. Because of this purity and its exceptional mechanical strength, the insulator is being used as bases or envelopes in the manufacture of ruggedized vacuum tubes. The material is well suited to the design of stacked tubes, *ED July 1954, p. 5.* Microwave energy does not soften this ceramic, as is the case with glass, and there is no danger of imploding.

The development and production of this R95 high alumina material (95% $A1_2O_3$) by Raytheon Manufacturing Co., Foundry Ave., Waltham, Mass., with its ceramic-to-metal sealing feature, has been a decided advantage in the manufacture of megawatt magnetrons. High uniformity and imperviousness to gas permits thin, but strong, magnetron windows to be used. The dielectric constant is 8.61 at 1000Mc and 8.45 at 8600Mc. It remains high down to d-c. The loss tangent rating is equally good. Water absorption is 0.0% making it suitable as a high-voltage dielectric in spite of severe environmental conditions. R95 ceramic can be ordered to customer's shape specifications with certain areas metallized for subsequent soldering.

As can be noted in the illustrations, a variety of sizes and shapes can be made. Tolerances of 1% but not less than ±0.005 can be specified. Special tolerance can be achieved, if necessary. The hardness for R95 approaches that of diamonds; tensile, flexural, and compression strength is many times that of conventional ceramics. Durable radomes the Reader's Service Card and circle **ED-39.** *This product can be seen at the Wescon Show, Booth 727-728.*

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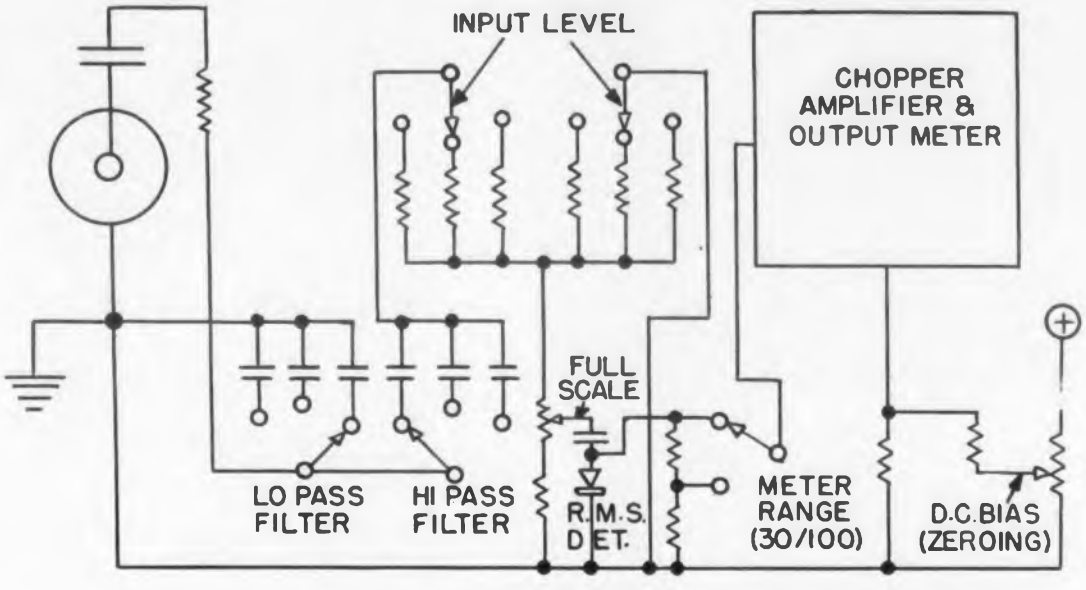
CIRCLE ED-42 ON READER-SERVICE CARD FOR MORE INFORMATION

Noise Voltmeter



Simplified block diagram of Noise Voltmeter.

MEASUREMENT of the rms signal-to-noise ratio over a frequency range of 20cy to 200Mc is made directly with this voltmeter. With a calibrated signal generator supplying the signal to the amplifier under test, the Noise Voltmeter makes relative measurements. The percentage of noise is determined by establishing a reference signal level at "100", turning off the signal generator, and reading the residual noise. The inner meter scale gives the ratio reading corresponding to the percentage of noise indicated. An adjustable input divider reduces amplified signals and amplified noise to a sufficiently low level so that the input rectifier-diode operates strictly within its square law region. Thus, both signal and noise are amplified proportionately. A sensitive chopper-type d-c amplifier amplifies the weak signals of the square-law rectifier. Built-in bandpass limits can be set for analysis of noise within the frequency range of 20cy to 200kc.

Since noise is random, amplitude versus frequency is a vital measurement. Noise may be nearly constant in amplitude over wide frequency ranges (such as thermal or resistor noise), or it may increase with frequency (u-h-f amplifier tubes); in other instances the noise may decrease with frequency (typical transistor noise). For measurements below 200kc, the model MV-19A Noise Voltmeter, manufactured by Millivac Instrument Corp., P. O. Box 997, Schenectady, N. Y., permits bandpass limits to be set on an 11-position high-pass and 11-position low-pass frequency se-

lector switch. For noise measurements above 200kc, special capacitor-divider probes are provided. No bandpass limiting is provided above 200kc since most amplifiers in this range are narrow band types.

The low-pass frequency limit position switch also makes it possible to separate noise from hum by taking successive readings first at the 20cy position and then the 300cy position. If the noise reading does not noticeably change for these two positions, hum can be disregarded.

The instrument measures true rms voltages and not averages of even peaks. The measuring accuracy depends entirely upon signal generator accuracy since frequency response and voltage calibration of the MV-19A can be verified at any time by feeding generator signals of varying frequencies into it. Measurement is not based on wide-band attenuators, nor upon the frequency spectrum of noise generators.

In reality, the device measures signal + noise-to-noise ratio. However, if the reference signal is selected so that this ratio is at least 3.3:1 the error can be neglected. The input level setting and scale are designed so that the user is forced to select suitable reference signals. Generally, it is easy to set the reference between 5 and 10 times the noise level and errors will be well below 3%.

Voltage range is 50mv to 50v below 200kc, and 50mv to 5v above. Input impedance is 10k and 50mmf below 200kc, and 50k and 10mmf above. For further information on this noise meter, turn to the Reader's Service Card and circle **ED-43.**

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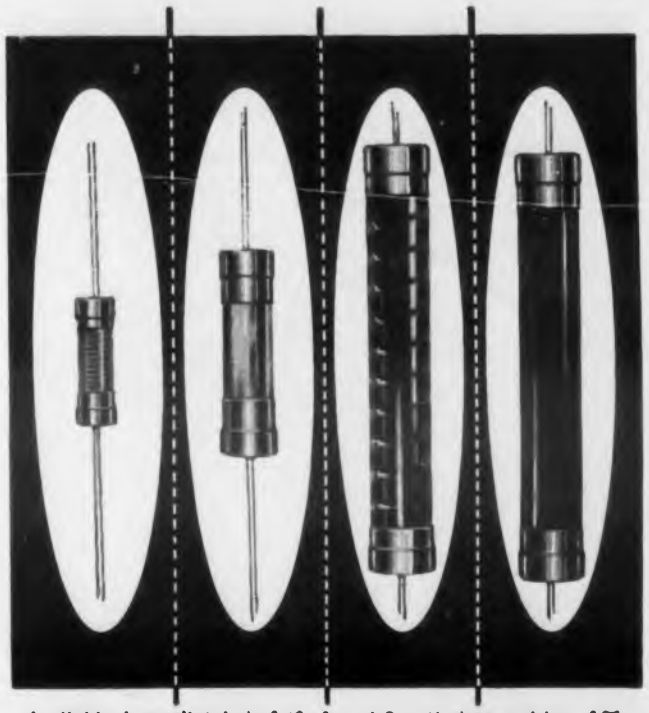
Effect of Soldering	0.5%	0.02%
Moisture Resistance	5.0%	0.08%
Voltage Coefficient	0.002%	0.00%
Load-Life (per 1000 hours)	1.0%	0.20%
Temperature Coefficient (PPM/°C)	±500	+370 ±20



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Cascading Magnetic Core Units

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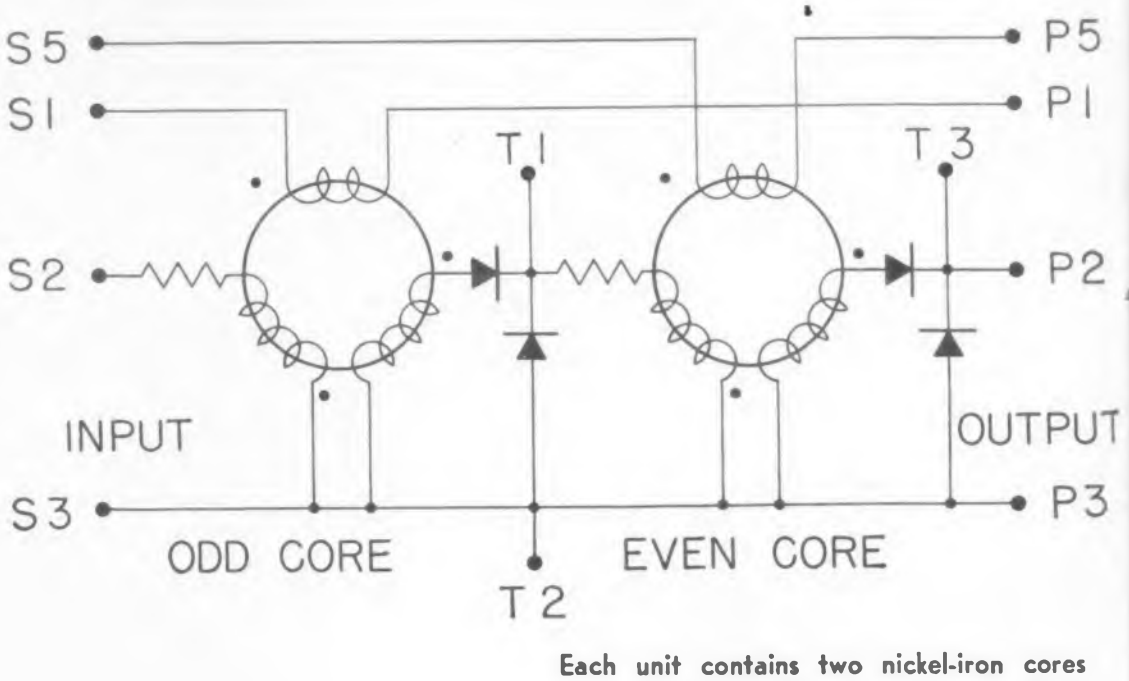


Each unit contains two nickel-iron cores and four diodes; operates from 0 to 20 kc.

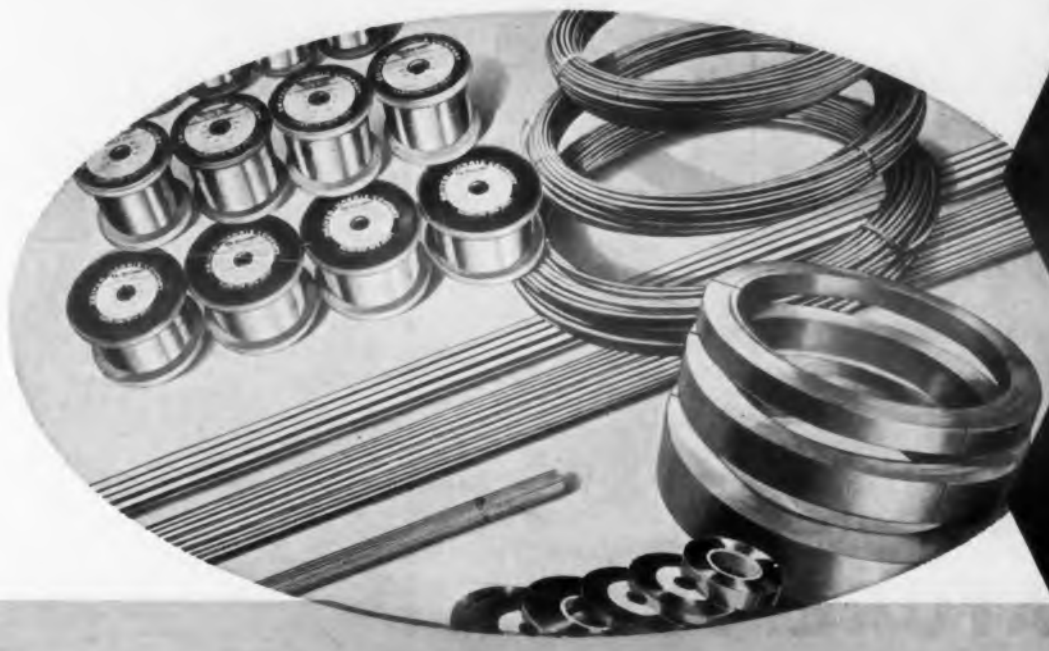
UNIQUE package design and careful control of core uniformity make possible the production of these interchangeable shift-register elements. Because of their inherent reliability, the magnetic core units offer decided advantages over vacuum tubes for use as logical elements and memory devices. Careful control of the quality of the core makes it possible to employ large groups of cores without danger of the register failing to hold. Amplitude deviation and noise is minimized by proper magnetic circuit design.

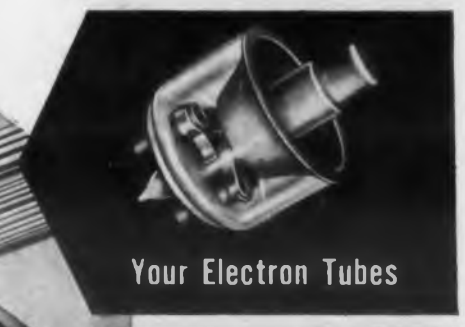
The basic circuit of the Bi-Magstat magnetic core shift-register element, produced by Butler Manufacturing Corp., 5516 Dorsey Lane, Washington 16, D. C., was developed by An Wang at Harvard University. As shown in the schematic, each unit contains two toroidally wound cores and four diodes. The resistance is built into each coil by using resistance wire for the input winding. A single unit can store one binary digit of information, or can be used as two stages of a ring for accounting or sequencing. Over 100 units can be connected in series for operation from a common driver circuit such as a pair of *6L6's*. Drive current can vary as much as ±15%.

The packaging of the Bi-Magstat is designed so that individual units can be quickly snapped together to form a complete shift register assembly. Sockets *S1* through *S5* mate with the corresponding pins of the preceding unit. Terminals at the top of each unit provide taps for parallel reading or loading of the register. The size of the package is 1-5/8" square by 9/16" thick.

The type C model, a low frequency unit for use at rates up to 10kc, was originally designed for telegraphic terminal equipment. Operating experience indicates that an average life in excess of 10 years can be expected. Replacement is almost exclusively due to deterioration of the diodes. Impending failure is easily detected by marginal checking before the unit malfunctions under operating conditions. For more data on these cores, turn to the Reader's Service Card and circle **ED-46.**

These DRIVER-HARRIS alloys do most to improve the quality of





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NICHROME* V (Nickel-Chrome) Essential for resistor elements in the higher temperature applications such as electric furnaces, electric ranges, radiant heaters, etc.

KARMA* (Nickel-Chrome-Aluminum-Iron) Permits the manufacture of miniaturized wire wound precision resistors of best temperature coefficient of resistance at low cost per ohm; also resistance standards.

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ADVANCE* (Copper-Nickel Series including MIDOHM*, 95 ALLOY, LOHM*, 30 ALLOY) Possess a number of properties which make them useful for winding heavy duty industrial rheostats, precision resistors, thermocouples, and thermocouple leads. Specific resistance range of this series is from 294 to 30 ohms/cmf.

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142 ALLOY (Nickel-Iron). For sealing glasses such as Corning 776, also 8160.

52 ALLOY Contains 50% nickel. It provides a slightly higher coefficient of expansion than 142 Alloy and seals successfully with 0120 glass.

146 ALLOY Contains 46% nickel. It offers special expansion properties, permits seals with ceramic coated resistors.

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Raytheon Reliable Subminiature Tubes Now Available

TYPE	DESCRIPTION	Vibration Output mVac* (max.)	TYPICAL CHARACTERISTICS								
			Heater		Plate		Grid Volts	Screen		Amp. Factor	Mut. Cond.
			Volts	mA.	Volts	mA.	or R_k	Volts	mA.		
CK5639	Video Amplifier.Pentode	100	6.3	450	150	21	100 ohms	100	4	—	9000
CK5702WA	RF Amplifier Pentode	50	6.3	200	120	7.5	200 ohms	120	2.6	—	5000
CK5703WA	High Frequency Triode	10	6.3	200	120	9.4	220 ohms	—	—	25.5	5000
CK5744WA	High Mu Triode	25	6.3	200	250	4.2	500 ohms	—	—	70	4000
CK5783WA CK5783WB	Voltage Reference	50	Operating voltage approximately 86 volts between 1.5 and 3.5 ma.								
CK5784WA	RF Mixer Pentode	100	6.3	200	120	5.2	-2	120	3.5	—	3200
CK5787WA	Voltage Regulator	50	Operating voltage approximately 98 volts between 5 and 25 ma.								
CK5829WA	Dual Diode	—	6.3	150			Max. I_o = 5.5 ma. per plate				
CK6021	Medium Mu Dual Triode	50	6.3	300	100	6.5	150 ohms	—	—	35	5400
CK6111	Medium Mu Dual Triode	50	6.3	300	100	8.5	220 ohms	—	—	20	5000
CK6112	High Mu Dual Triode	25	6.3	300	100	0.8	1500 ohms	—	—	70	1800
CK6152	Low Mu Triode	25	6.3	200	100	10.0	270 ohms	—	—	17.5	5100
CK6247	Low Microphonic Triode	2.5	6.3	200	250	4.2	500 ohms	—	—	60	2650
CK6533	Low Microphonic Triode	1.0	6.3	200	120	0.9	1500 ohms	—	—	54	1750

*At 40 cycles, 15 g. Note: All dual section tube ratings (except heater) are for each section.

Get This RAYTHEON Transistor Application Book!

116 pages — over 50 practical circuits including timers, receivers, oscillators, etc. all using low cost Raytheon Transistors. For your copy send 50¢ to Department P12, Raytheon Manufacturing Co., Newton 58, Massachusetts.

RAYTHEON

Excellence in Electronics

RAYTHEON MANUFACTURING COMPANY

Receiving Tube Division — Home Office: 55 Chapel St., Newton 58, Mass., Bigelow 4-7500

For application information write or call the Home Office or: 9501 Grand Avenue, Franklin Park (Chicago), Illinois, TUxedo 9-5430

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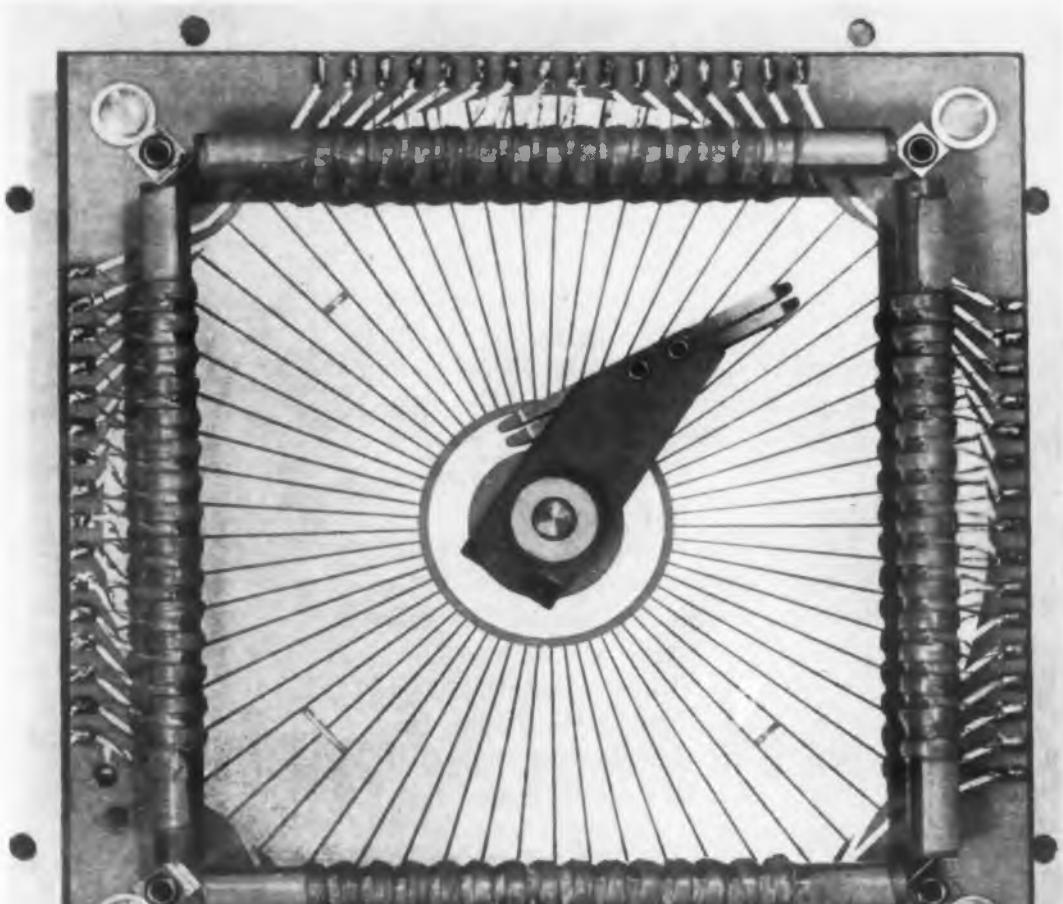
RAYTHEON MAKES ALL THESE

RELIABLE SUBMINIATURE AND MINIATURE TUBES • SEMICONDUCTOR DIODES AND TRANSISTORS • NUCLEONIC TUBES • MICROWAVE TUBES • RECEIVING AND PICTURE TUBES

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

Printed Circuit Delay Line

SIXTY conventional capacitors and a separate 60-contact switch have been replaced by a unique printed circuit wafer in this variable delay line. The 60 capacitors, 60 switch segments, slip ring, and associated solder points are all produced in a single printed circuit wafer. The switch segements also serve as capacitor plates and are made as radial pie-shaped sections in order to cover the largest uniform area possible. The ground side of the capacitors is printed on the reverse side of



Because of the shorting-type switch, resolution is 1/120.

the plate. This design technique has enabled a quality delay line to be manufactured at a very reasonable price. Labor of testing and soldering 60 capacitors to the switch contacts and to a ground strip is saved.

The circuit of the delay line, manufactured by Control Electronics Co., Inc., 1925 New York Ave., Huntington Station, N. Y., consists of 60 L-C sections of 0.05μsec each for a delay range of 0 to 3.1μsec. A delay range of 0 to 1.2μsec is also available. The assembly conists of 60 conventional coils, pi-wound on 4 sticks of 14 coils each. The delay is selected by a 60-position shorting-type rotary switch. The shorting feature provides an intermediate delay of one-half step so that the resolution is one part in 120. The characteristic impedance of the lines is 2700 ohms. To provide the desired capacitance value and the necessary quality, a low-loss high-dielectric-constant material of uniform thickness is required. A silicon fiber-glass material supplied by the National Vulcanized Co. as G7-830, although not ideal in every respect, proves satisfactory. The dielectric material is 0.015" thick with copper on both sides. The copper circuit is plated for long switch life and has been tested mechanically for 200,000cy of operation with no sign of wear. The switch wiper is an alloy which provides low noise and low contact resistance for long life.

These variable delay lines are designed as laboratory instruments or as components to be incorporated into equipment. They have been extremely useful in adding a variable delay to the trigger circuit of an oscilloscope. For more information on the design and application of these delays, turn to the Reader's Service Card and circle **ED-49.**

Pie-shaped segments are both switch positions and capacitor plates in this L-C printed circuit delay line.

NUMBER 3 OF A SERIES

INTEGRATED

ELECTRONICS

THE IMAGINATION FOR RESEARCH PLUS THE SKILLS FOR PRODUCTION

Hoffman Laboratories maintains a highly specialized group of engineers whose entire efforts are devoted to the complex problem of developing and producing specialized tactical test equipment for airborne navigation radar, fire control, missile guidance systems, and other advanced electronic gear. To meet the high standards of quality and reliability set by Hoffman Laboratories, this test equipment group is an integral part of the engineering staff.

For the past 13 years Hoffman Laboratories has been successfully solving advanced design and development problems in electronics. During this time Hoffman Laboratories has never undertaken a development program that has not successfully gone into production. Write the Sales Department for your copy of "Report From Hoffman Laboratories."

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Challenging opportunities for outstanding engineers to work in an atmosphere of creative engineering. Write Director of Engineering, Hoffman Laboratories, Inc., 3761 S. Hill St., Los Angeles 7, California.

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

New Products

You can preview in a few minutes most of the brand new products that will be exhibited at the Wescon show. Over 40 products that will be displayed are grouped in the first pages of this department, and booth numbers are included to help you plan your visit.

Some clever ideas are reflected in the design of equipment such as an airborne tape recorder, booth 1503-1504; a high-speed servo motor, booth 705; a miniature 1"-cube rate gyro, booth 1711-1712; a tiny electronic counter, booth 1721; and a function generator, booth 239.

Ferrites for microwaves will be shown at booth 727-728. Booth 206 will exhibit a line of highly-stable enamel-dielectric capacitors. Two booths, 1701-1702, are necessary to house the 30kw variable frequency oscillator which supplies power to a vibration tester.

Important new additions to standard lines are also being exhibited for the first time.

☐ Airborne Tape Recorders

Plug-in Amplifiers

The Series 800 airborne magnetic tape recorders are lightweight, shock-resistant units available in versions ranging from models designed to record two channels of information on 1/4" tape to models intended for recording 28 tracks on 2" tape. Plug-in amplifiers permit recording, on any channel, of pulse-width modulation data, high accuracy transient information (by means of wide-deviation frequency modulation), or wide-band data including mixed RDB/FM subcarriers. These various recording techniques can be used in any combination by the simple expedient of plugging in the correct type amplifier. Instrumentation Div., Ampex Corp., Dept. ED, 934 Charter St., Redwood City, Calif. *This product will be displayed at the Wescon Show, Booth 1503-1504.*

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

☐ Electronic Counter

Lightweight Portable Unit

The model WE-610 is a portable, four decade electronic counter featuring small size and lightweight construction. Combining glow transfer tubes and simplified circuitry, the unit is reliable despite its small size and relatively low cost. Response is 0 to 5000pps and the maximum indicated count is 10,000. Sensitivity is 50mv rms. The unit measures 7" x 3" x 6" and weighs 6 lbs. Westport Electric, Dept. ED, 149 Lomita St., El Segundo, Calif. *This product will be displayed at the Wescon Show, Booth 1721.*

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

☐ Rate Gyro

1" Cube

This cubic inch rate gyro weighs 1-1/4 oz. Because of its "floated gimbal" construction, it has excellent shock and vibration resistance. The unit is hermetically sealed with a damping ratio of 0.7 ±0.4 over temperature range of —55 to 75°C. Gyro uses 3w of 400cy power. It is capable of measuring very low angular rates. Gyroscopes, Inc., Dept. ED, 15 Birch Drive, Huntington Station, L. I., N. Y. *This product will be displayed at the Wescon Show, Booth 1711-1712.*

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

☐ Voltage Ratio Transformers

Offered in Standard Line

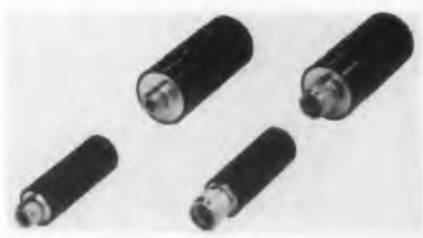
A cataloged line of miniature precision voltage ratio transformers is now available from this firm. Previously, only custom-designed units were offered.

These precision transformers are especially useful where voltage division or multiplication is required, with accuracies to 0.01%. Miniature types, they are available in plastic encapsulated form or in hermetically sealed cases. Units having up to 10 ratio taps are available. Accuracies are maintained with moderate output loading. Hycor Co., Inc., Dept. ED, 11423 Vanowen St., North Hollywood, Calif. *This product will be displayed at the Wescon Show, Booth 167.*

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

☐ R-F Loads

Handle 1-250w



A line of r-f loads available from this firm features stable operation over a wide frequency range and up to high ambient temperatures. Typical power handling capabilities range from 1 to 250w. These loads feature a very low vswr from d-c to above 3kMc. They will be supplied with either male or female type N connectors, or other types of connectors on special orders. Compact and light in weight, they have efficient radiation characteristics because of a high surface-to-volume ratio. Sierra Electronic Corp., Dept. ED, 1050 Brittan Ave., San Carlos, Calif. *This product will be displayed at the Wescon Show, Booth 1114.*

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

☐ Tap Welder

For Constant Work

The electronic TW-1 welder is a precision instrument for welding resistance wire of 0.0007" to 0.025". The TW-1 is designed for prototype construction or production line use where consistent direct wire to wire and wire to element welds are demanded without applying pressure. The unit contains a sensitive ohmmeter for measuring tap resistances and other resistances independent of welding operations. An automatic switching arrangement removes ohmmeter from welding circuit when foot switch is depressed. A sensitive voltmeter facilitates accurate adjustment of welding current. The welding circuit has extra high current capacity to protect against "dead short" welds. Wm. I. Mann Co., Dept. ED, 104 E. Foothill Blvd., Monrovia, Calif. *This product will be displayed at the Wescon Show, Booth 1702.*

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

☐ Corrosion-Resistant Motors

For High Temperature Applications

This series of corrosion-resistant low-inertia servo motors is designed primarily for applications involving accelerated environmental conditions. The units will operate under load conditions for 300hr at a maximum ambient of +163°C, or they can be cycled for 1000hr in a range of −55 to +163°C without relubrication of the bearings. They are designed for use up to an altitude of 80,000′ at maximum ambient, and they also meet the humidity requirements of MIL-E-5272A.

The motors include various speed/torque combinations, and may be procured with an integral generator if desired. Stator winding is 2-phase, 6-pole, 400cy. Rated voltage for 13.0w input at stall is 115v (each phase). Stall torque is 3.0 oz-in. No-load speed is 7000rpm. Weight is 20 oz, and is 2" diam x 2.421" long; pilot diameter is 0.6299". Eclipse-Pioneer Div., Bendix Aviation Corp., Dept. ED, Teterboro, N. J. *This product will be displayed at the Wescon Show, Booths 1417-1418.*

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

Look closely at this little black box

...IT'S LOADED!

NO MATTER WHO YOU ARE or what you do, the chances are good that this little black box will have a far-reaching effect on your way of life within the very near future.

For this is "TRANSAC"*—*the smallest, lightest, and fastest "electronic brain" yet announced*—and its development by Philco scientists finally unlocks the door to mass production and widespread use of electronic computer and control systems in industry, science, business, and the Armed Forces.

And a well-locked door it was—

Because the demand for the benefits of automatic computation mushrooming out of World War II has, until now, put a breaking strain on computer design. As they have grown more complex they have grown more cumbersome and harder to produce.

Their thousands of vacuum tubes have generated not only heat and the need for bulky air-conditioning, but also problems of power consumption and maintenance. And their size and weight have barred their use in many urgent military applications.

To this dead-end situation Philco engineers brought a fresh outlook and combined it with their experience from pioneering the "Surface Barrier" Transistor.

By utilizing the unique high frequency properties of the Philco "Surface Barrier" Transistor, they evolved an entirely new concept in computer design—the Philco *Direct Coupled* Transistor Circuits.

This "direct coupling" of transistors is the key that unlocks the door.

By one basic stroke, it cuts sharply the number of elements in a circuit, pares down the bulk and weight, slashes cost and production time . . . and speeds up computation!

"TRANSAC", for example, is one-third smaller and lighter, and 10 times *faster* than any transistorized computer announced to date. It operates on one small battery, with less than 1/1000th of the power needed by a comparable vacuum tube computer, and generates less heat than a Christmas tree bulb.

Yet it performs all computer functions—multiplies, divides, compares, and "carries" for 19 binary digits and algebraic sign, and also performs 416,000 complete additions or subtractions per second!

The civilian applications for this system are limitless. And the military uses—with the emphasis on lightweight portability, low power consumption, and high accuracy—are only to be hinted at.

Thus "TRANSAC" becomes one more example of the teamwork of Research, Engineering, and Application that has made "Philco" synonymous with "leadership" in Electronics.

*"TRANSAC"—Trademark of Philco Corporation for Transistor Automatic Computer

For further information, write Philco, 4700 Wissahickon Avenue, Phila. 44, Penna.

ANOTHER FIRST FROM THE PHILCO LABORATORIES

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

When No Other Material Can Meet Your Electrical Requirements

New tube cap connector made of KEL-F Plastic insures high insulation resistance, and excellent dimensional stability over a wide temperature range (—320° to 390°F.) for critical installations.

KEL-F® PLASTIC *IS* UNIQUE. A polymer of trifluorochloroethylene, its molecular construction produces a combination of outstanding properties headed by excellent electrical characteristics, resistance to chemical attack and negligible deformation under load.

KEL-F Plastic is dense, tough, and readily moldable. It has an operational temperature range of approximately 710° F. (—320° F. to 390° F.) KEL-F Plastic is non-wettable, and moisture absorption is zero! In electrical applications it can be used structurally as well as dielectrically—particularly in the critical electronic applications encountered in sub-miniaturization, automation, servo-mechanisms, etc. And, as wire insulation, KEL-F Plastic offers outstanding abrasion resistance, so important in aircraft and other critical installations.

KEL-F Plastic is available as a molding compound, or in extruded film, sheeting, rods and tubing from independent fabricators. KEL-F Dispersions for bake-coating of metallic surfaces are also obtainable. The complete story of KEL-F Plastic should be in your "ready" file. Write for special bulletins.

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

☐ Wow and Flutter Meter

Provides Own Test Signal

This portable Wow and Flutter Meter is expressly designed to meet the recently adopted IRE-SMPTE-ASA standards on sound recording and reproducing methods for determining flutter content. Applications include measurement of both high and low frequency variations in the speed of phonograph turntables or other mechanical, optical, or magnetic recording or reproducing equipment. Another application is the measurement of time displacement and frequency errors in telemetering and data recording systems.

Accuracy of the readings obtained is not affected by errors in center frequency of the 3kc test signal within the ±5% tuning range of the discriminator. A 3kc test signal is available from the input terminals for use in making recordings; this feature makes possible the measurement of wow and flutter in recorder reproducer systems without the need for any auxiliary equipment. Donner Scientific Co., Dept. ED, 2829 7th St., Berkeley 10, Calif. *This product will be displayed at the Wescon Show, Booth 239.*

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

☐ Oscilloscope

Good Square-Wave Response

High sensitivity of 15-mv/in. makes this wideband oscilloscope ideal for setting resonant traps, signal tracing in low level stages, as a general null indicator, and for phase characteristic measurement.

Known as Model 983, it contains identical vertical and horizontal push-pull amplifiers with a choice of a-c or d-c coupling without affecting either sensitivity or bandwidth. Both amplifiers have compensated step attenuators and cathode follower input. It has excellent square-wave reproduction with overshoot of only 2 to 5%, with a rise time of 0.1μsec. The response is essentially flat throughout the specified range of 4.5Mc and is usable to 6Mc. Weston Electrical Instrument Corp., Dept. ED, 614 Frelinghuysen Ave., Newark 5, N. J. *This product will be displayed at the Wescon Show, Booths 408-409.*

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

☐ Galvanometer

Null Indicator Type

The No. 1965 Galvanometer is especially suited for fast laboratory or production testing. The extremely high sensitivity detects the balance point in bridges and potentiometers immediately and minute deflections are registered instantaneously. The meter becomes balanced in less than 1sec.

Current sensitivity is greater than 2 x 10^{-10}amp. Voltage sensitivity is greater than 1μv/scale division.

The instrument withstands 1.5v continuously at maximum sensitivity. Shalleross Mfg. Co., Dept. ED, Jackson & Pusey Aves., Collingsdale, Pa. *This product will be at the Wescon Show, Booth 1220.*

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

☐ Time Measuring System

Accurate to ±2milliμsec

The B-4 Time Measuring System will measure short time intervals to an accuracy of ±2-milli-sec. It is particularly designed to measure the delay time of delay lines and networks and the rise time, fall time, and widths of pulses. It consists of an interconnected marker generator, repetition rate oscillator, pulse and scope synch delay, and pulse former.

The system provides marker signals of 0.1 and 1μsec spacing for Z axis display on a synchroscope. Also provided is a delayable scope synchronizing pulse. A main pulse for application to the network under test is variable in widths from 0.1 to 10μsec, in amplitudes from 0 to 40v, and in rise times from 0.025 to 1μsec. The time delay of the main pulse is variable by a coarse control and an incremental control which is calibrated in 1milliμsec intervals.

Auxiliary equipment such as work holders and test fixtures are available. Rutherford Electronics Co., Dept. ED, 3707 S. Robertson Blvd., Culver City, Calif. *This product will be displayed at the Wescon Show. Booth 357.*

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

marion

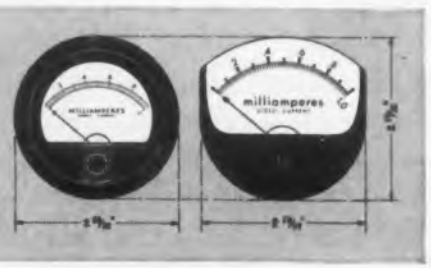
advancement in instrument design

new marion *MEDALIST** meters

Model MM2 MEDALIST
Actual Size

Handsome, modern design and a choice of various colors to enhance the styling of your equipment. Up to 50% longer scale in the same space as ordinary type greatly increases readability. Interchangeable with ASA/JAN 2½ and 3½ inch sizes. Delivery now in all standard ranges.

Comparison of Medalist and Standard Style



marion meters

marion electrical instrument company

*Trademark Patents Pending.
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GRENIER FIELD, *New Hampshire's NEW Air-Industry Area*
MANCHESTER, N.H., U.S.A.

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

magnesium

Extruded, Cast, Drawn, Welded and Machined

. . . it's all magnesium

Make it with magnesium if it must be *light in weight*. Make it with magnesium if you want *easier fabrication*, too!

In this ballistics control housing the advantages of magnesium are being utilized. Extruded, cast and drawn parts are welded into a composite unit, then machined and painted. This is common practice—magnesium provides these same plus values for many manufacturers who consider it a *typical production metal*.

Start your product on its way to better design—and production—with magnesium. Complete engineering and fabrication facilities are available at Dow's Bay City Division as well as from other fabricators located throughout the country. THE DOW CHEMICAL COMPANY, Magnesium Sales Department MA 305E, Midland, Michigan.

you can depend on DOW MAGNESIUM DOW

☐ Vinyl Sleeving

Resistant to Oil, Varnish, Pitch

Resinite Super-Heat 125 is compounded especially for electrical applications requiring tubing flexibility, cut-through resistance, and dielectric strength after prolonged immersion in oil, varnish, or asphaltic pitch, at temperatures even higher than 221°F (105°C) or as low as —40°F (—40°C).

Tubing is available in all standard sizes ranging from 0.018″ ID to 2″ ID with corresponding wall thicknesses for both 300 and 600v ratings. Non-standard size tubing is available on special order. Resin Industries, Inc., Dept. ED, P. O. Box 1589, Santa Barbara, Calif. *This product will be displayed at the Wescon Show, Booth 232.*

CIRCLE ED-69 ON READER-SERVICE CARD

☐ Carbon Resistors

With 1% Tolerance

Original Radell precision resistors are now being manufactured by this firm. The resistors are of the deposited carbon type and range in resistance from 25 to 300 million ohms, in ratings 1/2, 1, and 2w sizes with 1% tolerances. There are three lines: hermetically sealed, MIL, and industrial. Texas Instruments, Inc., Dept. ED, 6000 Lemmon Ave., Dallas 9, Tex. *This product will be displayed at the Wescon Show, Booth 301-304.*

CIRCLE ED-70 ON READER-SERVICE CARD

☐ Fuses and Fuseholders

Fuse Has Ears

Matched fuses and fuseholders for specific size ranges safeguard against wrong sizes or types of fuses being used. Each fuse cap has two ears which match slots in the holder. Fuseholder and fuse cap are marked for easy identification. Both type N time delay types and type C quick blowing types are available. Bussman Mfg. Co., Dept. ED, University at Jefferson, St. Louis 7, Mo. *These products will be displayed at the Wescon Show, Booth 1203.*

CIRCLE ED-71 ON READER-SERVICE CARD.

◀ CIRCLE ED-72 ON READER-SERVICE CARD

☐ Miniature Coaxial Cable

Has Low Capacitance

New coaxial cable types 93-3913 and 93-3914, distinguished by low capacitance, have been added to this company's line of microminiature cables and connectors. With capacitance of just 12mmf/ft, the OD of these cables is held to 0.132″ max so that three of these cables occupy equivalent space to one RG 62/U.

Their characteristic impedance is 98 ohms. Velocity of propagation, 80%, is related to their unique construction with cellular polyethylene dielectric. A thin wall of nylon under the braid permits soldering both center conductor and braid. Temperature rating is —65 to 120°F. Microdot Div., Felts Corp., Dept. ED, 1826 Fremont Ave., South Pasadena, Calif. *This product will be displayed at the Wescon Show, Booth 230.*

CIRCLE ED-73 ON READER-SERVICE CARD

☐ Bantam Soldering Irons

With Short Casings

These new soldering irons are identical with previous models except in the length of the casings which are shorter. Pencil type handles are available. Inputs of 30 or 40w may be specified. Tip diameters are 1/8 or 3/16″. Overall length is nominally 8″. American Electrical Heater Co., Dept. ED, 6110 Cass Ave., Detroit, Mich. *This product will be displayed at the Wescon Show, Booth 1824.*

CIRCLE ED-74 ON READER-SERVICE CARD

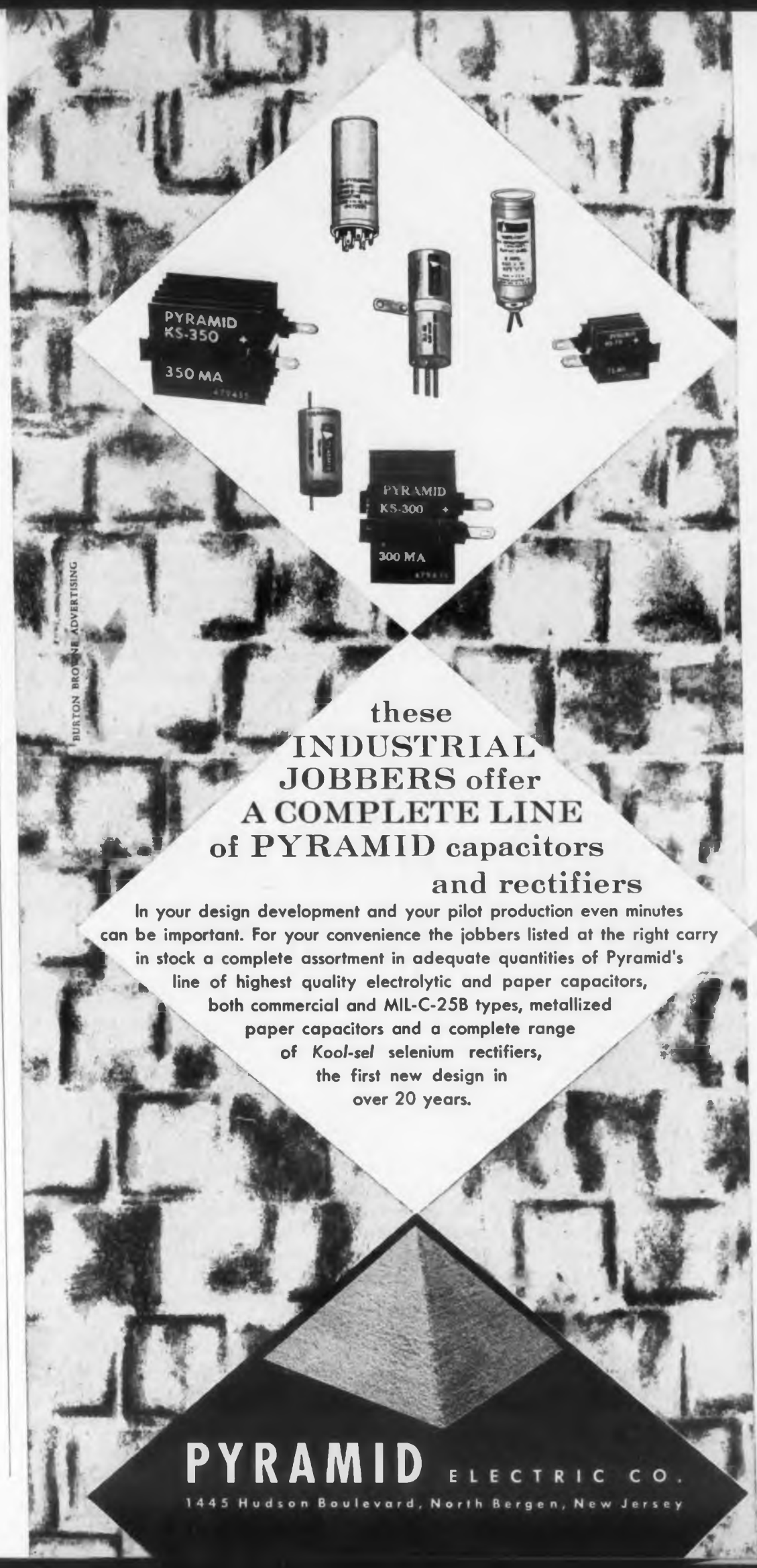
☐ X-Band Isolator

Permanent Magnet Type

Model TX-200 isolator is useful in the 8500-9600Mc range. Peak power is 300kw. Isolation is 10 to 25db depending on frequency range. Insertion loss is 0.5 to 0.7db. Input vswr is less than 1.05. It is intended for R55/U waveguides. No cooling is required. Raytheon Manufacturing Co., Dept. ED, Ceramic Sales, Foundry Ave., Waltham 54, Mass. *This product will be displayed at the Wescon Show, Booths 727-728.*

CIRCLE ED-75 ON READER-SERVICE CARD

CIRCLE ED-76 ON READER-SERVICE CARD ➤



these
INDUSTRIAL
JOBBERS offer
A COMPLETE LINE
of PYRAMID capacitors
and rectifiers

In your design development and your pilot production even minutes can be important. For your convenience the jobbers listed at the right carry in stock a complete assortment in adequate quantities of Pyramid's line of highest quality electrolytic and paper capacitors, both commercial and MIL-C-25B types, metallized paper capacitors and a complete range of *Kool-sel* selenium rectifiers, the first new design in over 20 years.

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1445 Hudson Boulevard, North Bergen, New Jersey

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Arrow Electronics, Inc.
65 Cortlandt Street, New York 7, New York

Art Electronic Supply Co.
145 South Park Street, Tucson, Arizona

Burstein-Applebee
1012-14 McGee Street, Kansas City 6, Missouri

California Electronic Supply, Inc.
11801 W. Pico Boulevard, West Los Angeles 64, Calif.

Capitol Radio Wholesalers, Inc.
2120 Fourteenth Street, N.W., Washington, D. C.

Cramer Electronics, Inc.
811 Boylston Street, Boston 16. Massachusetts

Dalton-Hege Radio Supply Co.
924 W. Fourth Street, Winston-Salem, North Carolina

Dean's Electronics
969 American Avenue, Long Beach, California

Durrell Distributors
222 Mystic Avenue, Medford, Massachusetts

East Coast Radio & Television
1900 N. W. Miami Court, Miami 36, Florida

Electronics Center, Inc.
211 West 19th Street, New York, New York

Electronic Equipment Distributors
1228 Second Avenue, San Diego, California

Federated Purchaser, Inc.
66 Dey Street, New York, New York

Herbach & Rademan, Inc.
1204 Arch Street, Philadelphia 7, Pennsylvania

Hughes-Peters, Inc.
111 East Long Street, Columbus, Ohio

Interstate Electronics Co.
227 Fulton Street, New York, New York

Kann-Ellert Electronics, Inc.
9 South Howard Street, Baltimore, Maryland

Kierulff Electronics, Inc.
820 West Olympic Boulevard, Los Angeles, California

Lakke Sales Corp.
5024 West Irving Park Road, Chicago, Illinois

Milgray Electronics, Inc.
120 Liberty Street, New York, New York

Milo Radio & Electronics
200 Greenwich Street, New York, New York

Newark Electric Co.
233 West Madison Street, Chicago, Illinois

Niles Radio & Phonograph Co.
1254 Arapahoe Street, Denver, Colorado

Olive Electronics Supply Corp.
6711 Olive Boulevard, University City 5, Missouri

Peerless Radio Distributors
92-32 Merrick Road, Jamaica 33, New York

Fred P. Purcell Company
1221-27 N. Washington Ave., Scranton, Pennsylvania

Radio & Electronic Parts Corp.
3235 Prospect Avenue, Cleveland, Ohio

Radio Specialties Company
1946-56 South Figueroa Street, Los Angeles, California

Srepco, Inc.
314 Leo Street, Dayton, Ohio

Standard Electronic Sales Corp.
1505 Main Street, Buffalo 9, New York

Albert Steinberg & Co.
2520 North Broad Street, Philadelphia, Pennsylvania

Sterling Radio Products Co.
1616 McKinney Avenue, Houston 1, Texas

Walder Radio & Appliance Co.
1809 North Second Avenue, Miami 32, Florida

G-E TOTALLY ENCLOSED MOTOR FOR GUIDED-MISSILE WARHEAD FUZES, rated .0024 hp, 4500 rpm, 24 volts d-c for intermittent duty is discussed by (l to r) Dr. W. W. Eaton, Industrial Consultant, Dr. C. A. Crowley, Director of Engineering and Development Division, Given Manufacturing Company, and E. Finkle, Given's Chief Project Engineer, Engineering and Development Division.

G.E. adapts motor for missile warhead fuzes, helps Given Company meet deadline, cut costs

"When our Company was selected by the Picatinny Arsenal for pilot production of fuzes for guided-missile warheads," says Dr. C. A. Crowley (center), Director of Engineering and Development, Given Manufacturing Company, "we were confronted with a design that called for a specially built motor to be used for the fuze gear train. Because of previous satisfaction, our first step was to consult General Electric.

"G-E engineers, working in co-operation with our own engineers, were successful in redesigning an existing G-E armament motor to our exact needs. This action not only helped us cut costs, but put us in production on schedule. We're sold on service like this," concludes Dr. Crowley.

As a component of these guided-missile warhead fuzes, the G-E motor is exposed to extremes of temperature from −65 to +160F, and must stand severe vibrations and high humidity. As a part of G.E.'s development work, these conditions were simulated by G-E testing facilities, and the motor passed all tests.

TO SERVE YOU, General Electric offers engineering experience like that provided the Given Engineering and Development Division—experience gained through years of helping solve hundreds of difficult aircraft and armament motor problems. Contact your local G-E Apparatus Sales Office early in your planning. Or write giving details to Section 704-55, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

☐ Voltage Regulator

Tubeless Magnetic Type

Type TMs are the newest addition to this company's complete line of voltage control apparatus. Without tubes or moving parts it provides constant voltage regardless of line voltage or load changes. Both cabinet and rack models are offered. Input is 95 to 135v. Output is nominal 115v but can be adjusted from 110 to 120v. It is held within a 1v band. Speed of response is less than 1.0sec for full range correction. Maximum load is 1.0kva. Superior Electric Co., Dept. ED, Bristol, Conn. *This product will be displayed at the Wescon Show, Booths 1026-1027.*

CIRCLE ED-77 ON READER-SERVICE CARD

☐ Epoxy Resins

For Casting and Impregnating

New resins and formulations known as Araldite 6010 and Epocast 9, 10, 12, and 13 having a variety of cure characteristics, are offered by this company. Characteristics of some of these different resins are mass castings with very low exotherm generation and overnight cure at 165°F; room temperature setting; very high heat distortion point; very low viscosity; long pot-life. Furane Plastics, Dept. ED, 4516 Brazil St., Los Angeles 39, Calif. *These products will be displayed at the Wescon Show, Booth 129.*

CIRCLE ED-78 ON READER-SERVICE CARD

D-C Power Rectifiers

0.5% to Voltage Regulation

Improved circuitry now makes it possible for this manufacturer to offer their standard line of rectifiers with voltage regulation accuracy of ±0.5%; d-c ripple of 1%; and a recovery time of 0.1sec. This is achieved without any increase in size, weight or cost.

Eleven standard 28 volt production models with capacities up to 1500 amperes, in either mobile or stationary types are available. They meet MIL-E-7894 specs. McColpin-Christie Corp., Dept. ED, 3410 W. 67th St., Los Angeles 43, Calif.

CIRCLE ED-79 ON READER-SERVICE CARD

◀ CIRCLE ED-80 ON READER-SERVICE CARD

☐ Ferrites

For Microwave Uses

Ferrite types R20 and R22 are intended for microwave applications. Type R22 has the higher Curie point (590°C) and is stable over wide temperature ranges. It is useful as a transverse field isolator. Type R20 has a 215°/in. rating for Faraday rotation effect on plane of polarization. It is suited for gyrators, isolators, switches, etc. Raytheon Manufacturing Co., Dept. ED, Ceramic Sales, Foundry Ave., Waltham 54, Mass. *These products will be displayed at the Wescon Show, Booths 727-728.*

CIRCLE ED-81 ON READER-SERVICE CARD

Insulation

Effective to 1000°F

This "ceramoplastic" electrical insulation material can withstand the effects of radiation and 1000°F temperatures without losing its properties. Called "Supramica" ceramoplastic, it consists of pulverized synthetic mica bonded with high-grade electrical glass. It is expected to find wide use as an insulator for electronic components in high speed aircraft and missiles where extreme temperatures are often encountered. Mycalex Corp. of America, Dept. ED, Box 311, Clifton, N. J.

CIRCLE ED-82 ON READER-SERVICE CARD

Protective Coating

Prevents Deterioration

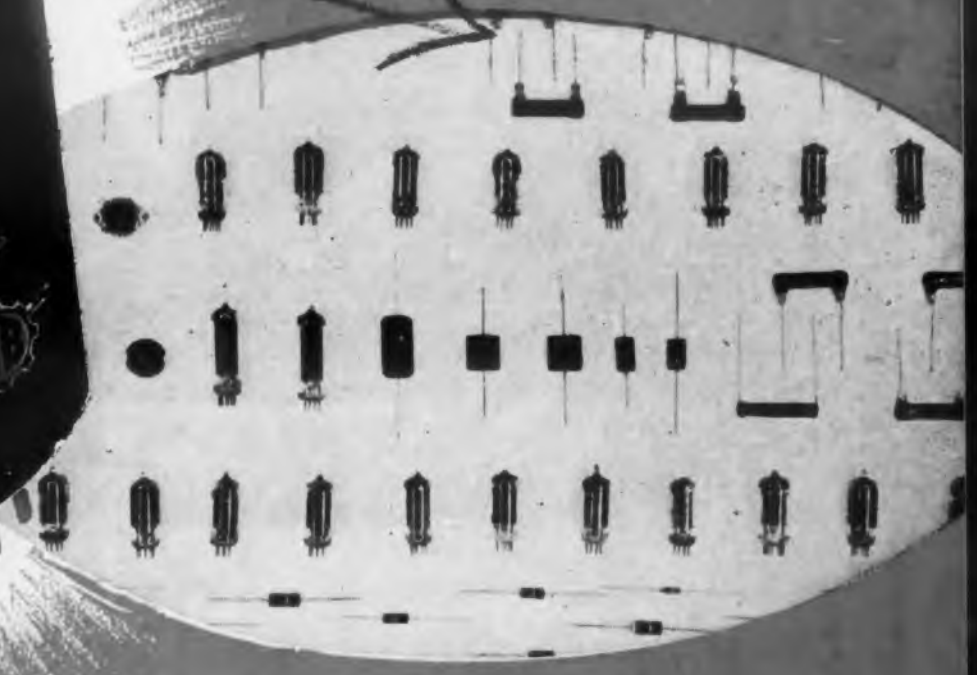
"Corrocote" No. 362, a neoprene base protective coating guards surfaces of many materials against moisture, oils, chemical fume and splash, salt air and fungus corrosion. Applied by roller, brush, spray or dip, the film dries quickly and self-vulcanizes to form a firm rubbery barrier. It has good adhesion to metal, concrete, wood and fabric. Coatings can be exposed to continuous air temperatures up to 250°F and intermittently to 300°F. Films of 0.003 to 0.005" thick can be applied per coat. It is available in gray, black, aluminum and red. Chemical Coatings & Engineering Co., Dept. ED, Broomall, Pa.

CIRCLE ED-83 ON READER-SERVICE CARD

CIRCLE ED-84 ON READER-SERVICE CARD ➤

LOOK!

here's what it takes



THE HAYDU BEAM SWITCHING TUBE offers these other unique advantages for various equipment including:

VARI COUNT
complete versatility...can use arbitrary numbers of positions

COUNTER DISTRIBUTOR
operate singly...or one tube will operate others in unlimited combinations

BEAMPLEXER
can be operated by DC, sine wave or pulsed inputs

RADAR and LORAN
reduce overall circuitry and related costs

AIRCRAFT CODER
decrease space, weight and heat—a new standard in high vacuum reliability

SEND FOR COMPLETE INFORMATION
Write today for copies of illustrated technical literature and applications data on Haydu Magnetron Beam Switching Tubes.

TO EQUAL
ONE BEAM SWITCHING TUBE!

20 pentodes—2 triodes—22 sockets—10 condensers—98 resistors. *152 separate components plus related circuitry* are required to duplicate all the functions of a standard MBS Tube circuit!

The Haydu Magnetron Beam Switching Tube* permits drastic reductions in the total number of tubes and other components required in most electronic systems. It is compatible with transistors and magnetic core circuitry ... while performing a greater number of functions at much higher frequencies! In an unlimited number of electronic applications, the new Haydu MBS Tube switches between multi-outputs many times faster, more simply and more reliably than standard vacuum tubes, diodes or transistors ... and in any sequential, simultaneous or random switching pattern. Each position is capable of producing a functional output able to operate relays *without amplification.*

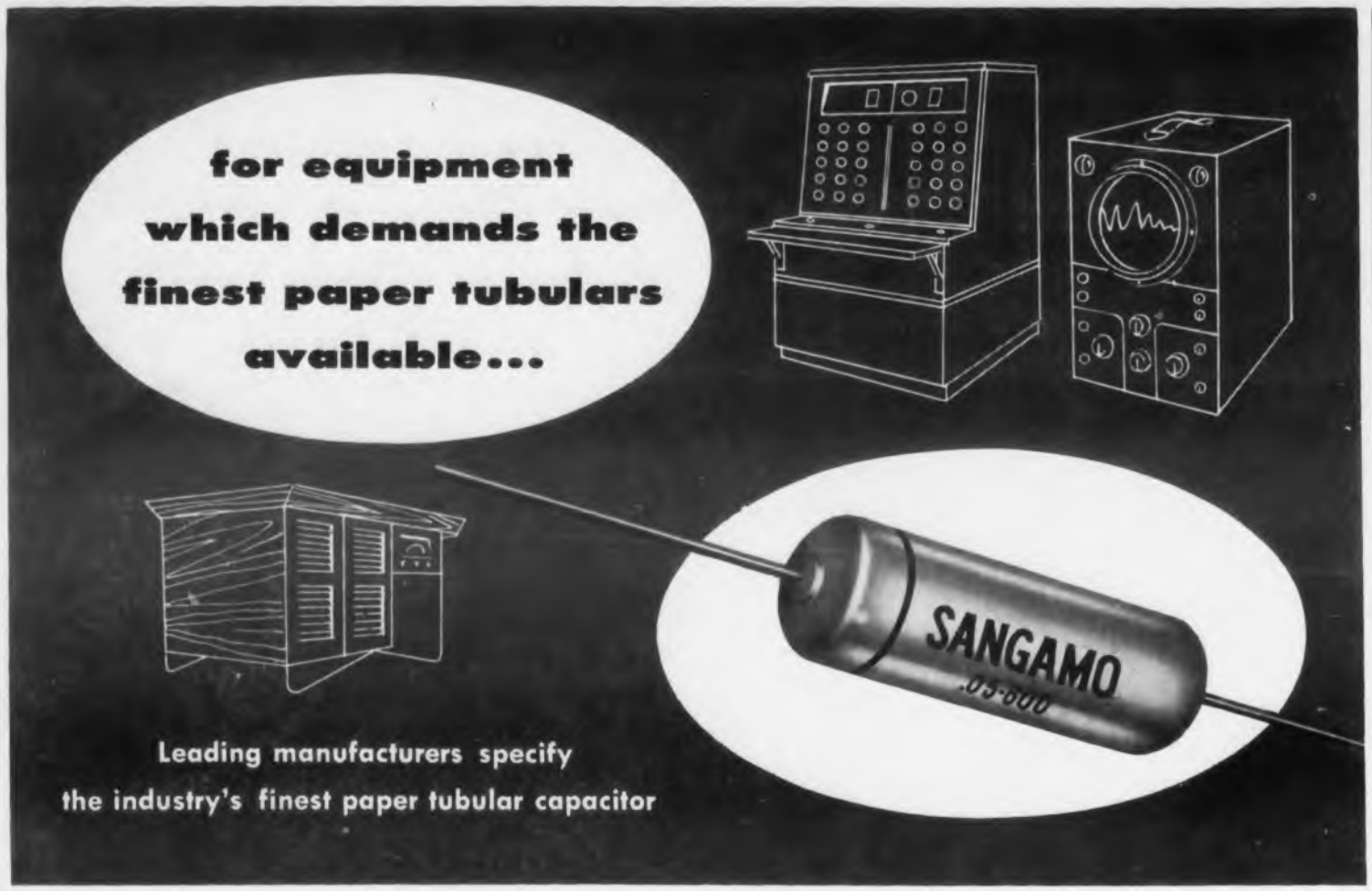
*MBS (Trademark)

HAYDU

See us at booth 230
August Wescon Show

BROTHERS OF NEW JERSEY
PLAINFIELD, NEW JERSEY

SUBSIDIARY OF BURROUGHS CORPORATION



... the Sangamo Telechief

For critical applications such as hi-fi equipment, computers and other electronic gear . . . applications which require exceptionally high insulation resistance and unusual stability at high temperatures, your best bet is a Sangamo Telechief.

It is the molded paper tubular which, tests by leading manufacturers show, outperforms all other paper tubulars in . . .

MOISTURE RESISTANCE
Sangamo paper tubulars are molded in Humiditite, the remarkable plastic molding compound which gives them moisture resistance properties far superior (10 to 15 times greater) than any other molded tubular capacitor.

HIGH TEMPERATURE OPERATION
The resistance qualities of Humiditite also make Telechief the winner over other paper tubulars in this department. (Tests show top performance in temperatures up to 125° C.)

HOLDING RATED CAPACITY
The exclusive Sangamo solid dielectric impregnant enables the Telechief to hold its rated capacity under all conditions . . . makes it a really rugged paper tubular.

Because the Telechief outperforms other paper tubulars in all of these areas, you can be sure that here is a paper tubular which will deliver long, trouble-free capacitor life.

SC55-11

SANGAMO ELECTRIC COMPANY
MARION, ILLINOIS

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

☐ Highly Stable Capacitors

Vitreous Enamel Dielectric

These low loss highly stable capacitors are laminates of porcelain and fine silver. They are completely insulated and have a unitized lead/electrode structure. The capacitors give predictable performance over wide temperature limits (—55 to +200°C). Temperature coefficient is 120 ±5ppm/°C as defined by MIL-C11272A from —55 to +85°C. Capacity drift as defined by MIL-C-5 and MIL-C-11272A is less than 0.05%, essentially absolute retrace.

Dielectric loss of a typical capacitor is extremely low; at 25°C, for instance, the dissipation factor is only 0.00033 at 1Mc. Inversely, Q of any capacitor when measured at 1Mc at 25°C exceeds 2500. Insulation resistance is greater than 10,000 megohms, when measured under standard conditions. Vitramon, Inc., Dept. ED, Box 544, Bridgeport 1, Conn. *This product will be at the Wescon Show, Booth 206.*

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

☐ D-C Regulated Power Supply

For Transistors

Model C-22 regulated d-c power supply has been designed especially for use in transistor work. The unit has a range of 0-50v, 0-1amp, and is entirely electronically controlled. There is an internal reference, using a 2-stage amplifier for an internally regulated power supply and a type *5651* tube for a stable reference. The output is controlled by a bank of five *6AS7G* tubes with a 2-stage amplifier, using a low-drift comparator circuit. Regulation is 0.1% and ripple is less than 1mv. There is a 7" x 19" panel, and a 4-1/2" voltmeter.

An internal load compensating potentiometer allows regulation to be adjusted for either plus or minus output impedance for load changes. Universal Electronics Co., Dept. ED, 1720 22nd St., Santa Monica, Calif. *This product will be displayed at the Wescon Show, Booth 235.*

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

☐ Panel Meter

Offered in Four Types

The 4-1/2" "Custom" Panel Meter is available in four types: with or without chrome trim, and with or without 5000hr self-contained lamps for scale illumination. All units are housed in magnetically shielded "unbreakable" metal cases with large easy-to-read scales (readable from 8 to 10 feet) and front zero adjustments. A 2% accuracy is insured. Phaostron Co., Dept. ED, 151 Pasadena Ave., South Pasadena, Calif. *This product will be displayed at the Wescon Show, Booth 220-221.*

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

☐ A-C Instruments

Withstand Rough Usage

These a-c "Ruggedized" Instruments are shockproof, vibration-proof, and moisture-proof. Available in 2-1/2" and 3-1/2" hermetically sealed cases, they conform to MIL-M-10304 (Sig. C).

The line is designed to match other Roller-Smith panel instruments and provide maximum readability, accuracy, and maintenance simplicity. A "wrap-around" shroud with gasket seal is employed. Instrument Div., Roller-Smith Corp., Dept. ED, Bethlehem, Pa. *This product will be displayed at the Wescon Show, Booth 111.*

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

☐ Miniature VOM

Can Be Carried in Pocket

The Model 310 is a miniature VOM which can be carried in the pocket. It has a wide variety of a-c and d-c voltage, d-c ma and μamp, and ohms and megohms ranges. It provides 20,000 ohms/v d-c and 5000 ohms/v a-c. Size of the unit is only 2-3/4" x 4-1/4" x 1-3/16". The Triplett Electrical Instrument Co., Dept. ED, Bluffton, Ohio. *This product will be displayed at the Wescon Show, Booth 1401.*

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

DOW CORNING CORPORATION

Silicone News

FOR DESIGN ENGINEERS

SUNBEAM "FRYPAN": CASE HISTORY OF AN ADVANCED DESIGN MADE PRACTICAL BY DOW CORNING SILICONES

Ingenious design and resourceful use of materials is reflected in the Sunbeam Automatic Frypan, an attractive and original new household appliance, which combines the appeal of a built-in source of controlled heat with the convenience of easy, thorough washability.

These ideal features were made practical through use of Dow Corning silicones. The completely enclosed lead and thermocouple wiring, for instance, is insulated with Silastic, the Dow Corning silicone rubber. Silicone-glass sleeving is also slipped over the wires to assure maximum dependability at operating temperatures in the range of 450 F. And the terminal block to which they are connected is a heat resistant silicone-glass laminate.

Although the Frypan may be almost totally immersed in water, the electrical connections at the base remain dry and easily accessible inside a terminal box sealed with molded Silastic. Extensive research and testing, including several thousand actual immersions, have proved that this gasket maintains a watertight seal even after prolonged exposure to temperatures in the range of 450 F. *No. 42*

Silicone Fluid Improves Dashpot Timing Device

The nitrogen impact fishing jar developed by Houston Oil Field Materials, Inc., presents a new approach to the problem of loosening tools jammed in the depths of oil wells. On impact, old style jars shake and strain derricks and pipe strings. The new Homco unit eliminates wear and tear on equipment by concentrating all its 208 ton kick inside the jar attached to the jammed tool.

Another valuable feature of the new Homco jar is regulated impact time. By means of a unique dashpot timing device containing Dow Corning 200 Fluid, the hammer blow can be delayed while the jar is moved into a new postition. By varying the quantity and viscosity of the silicone fluid, the impact time may be varied from a few seconds to half an hour.

Dow Corning 200 Fluid was selected as the dashpot oil after tests proved it to be the most heat-stable fluid available. Organic oils thin out rapidly when subjected to well temperatures and to the heat generated by successive impact blows. But Dow Corning 200 Fluid with its relatively flat viscosity-temperature slope, thins only slightly even after 10 to 15 hours' continuous operation. This change is so slight that it is more than compensated for by expansion of the metal parts and fittings. *No. 44*

Silastic Insulates, Protects Flexible Woven Heater Pad

Proof of the effectiveness of Silastic* encapsulation is found in the performance of this 115-volt flexible heater woven and insulated by the Haddam Manufacturing Co., Haddam, Connecticut, for a classified aircraft use. The combined thermal stability and conductivity of Silastic is so great that the heater will operate indefinitely at temperatures high enough to boil the water in which it is totally submerged. *No. 43*

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

Silicone products most widely used are indexed by type of application, in the 1955 Reference Guide to Dow Corning Silicone Products. A brief but comprehensive 8-page summary is given of the properties and applications. With increasing effort devoted to product improvement and cost reduction, such a reference guide to this remarkably stable group of engineering materials becomes increasingly important to design, production and maintenance engineers. *No. 45*

"What's a Silicone?" is the title of a 32 page booklet which answers that often asked question in semi-technical terms. Indexed and illustrated, this booklet has earned an international reputation as the most interesting and informative description of silicones ever published. *No. 46*

Design Edition 11

DOW CORNING CORPORATION - Dept. 4708
Midland, Michigan

Please send me 42 43 44 45 46

NAME _____

TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE ___ STATE _____

ATLANTA • CHICAGO • CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEW YORK • WASHINGTON, D. C. (Silver Spring, Md.)
Canada: Dow Corning Silicones Ltd., Toronto; **Great Britain:** Midland Silicones Ltd., London; **France:** St. Gobain, Paris

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

Silicon Mixer Diodes

With Reversible Polarity

The 1N415 and 1N416 Series, for X-Band and S-Band respectively, are described as the first silicon diodes to have selective polarity. Polarity is indicated by the letters "REV" stamped on one end of the diode. To change the polarity, the position of the end cap is reversed. With the end cap on the unmarked end, the polarity is normal; when attached to the other end, it is reversed.

The complete assembly, with either polarity, is electrically the same as its equivalent type of regular silicon diode. Bomac Laboratories, Inc., Dept. ED, Salem Rd., Beverly, Mass.

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

Audio Shift Network

For Single Sideband Applications

The Model 350 Type 2Q4 audio phase shift network is especially designed for single sideband receiving and transmitting applications. It provides a constant 90° phase shift, ±1.5°, over the audio range of 300cy to 3000cy, yet requires no more space than a 6J5 tube. Barker & Williamson, Inc., Dept. ED, 237 Fairfield Ave., Upper Darby, Pa.

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

Tube Socket

For Safe High Voltage

This deep shell high-voltage tube socket maintains a maximum continuous d-c voltage without arc-over to metal chassis. It is molded of natural mica-filled phenolic material and can be supplied for octal, miniature, and noval tubes. Industrial Hardware Mfg. Co., Inc., Dept. ED, 109 Prince St., New York 12, N Y.

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

RCA DATA FOR D

NEW TEST INSTRUMENT ENABLES ACCURATE MEASUREMENT OF ELECTRON-TUBE TRANSCONDUCTANCE

RCA-WT-100A MicroMhoMeter . . . unique in design, it makes possible the testing of tubes under actual operating voltage and current conditions. This feature permits direct correlation of test results with manufacturers' published data. Measures true transconductance, both control-grid-to-plate (gm) and suppressor-grid-to-plate. Also measures electrode currents: plate, suppressor-grid, screen-grid and control-grid; ac heater current; voltage drop across electron tubes, dry-disc rectifiers and crystal diodes.

RCA-WT-100A is a laboratory-quality instrument designed for production-line and laboratory testing, and circuit design engineering. The versatility and accuracy of the RCA-WT-100A closely approaches that of tube factory equipment for measuring transconductance.

The WT-100A features obsolescence-proof plug-in assemblies, switching for sockets with as many as 14 pins, burnout-proof metering, and electronically regulated, heavy-duty power supply.

RCA "PREMIUM" TUBES FOR CRITICAL MILITARY APPLICATIONS

RCA-OA2-WA (Voltage Regulator), OB2-WA (Voltage Regulator), 5751-WA (High-Mu Twin Triode), 5814-WA (Medium-Mu Twin Triode), 5727/2D21-W (Thyratron, Gas Tetrode), 5654/6AK5-W/6096 (Sharp-Cutoff Pentode) . . . six types recently added to the group of RCA "Premium" tubes produced under rigid quality-control standards. For government end use; supplied only against orders giving government contract number.

HIGH-MU TRANSMITTING TRIODE IS TIME-PROVED RCA ORIGINAL

RCA-833-A . . . improved version of the 833 originally developed by RCA more than 15 years ago. The outstanding and continuing popularity of this tube is typical of the many time-proved transmitting, receiving, and special-purpose types originated, developed, and sponsored by RCA. The RCA-833-A is designed for use as an rf power amplifier, oscillator, or class B modulator. It has a maximum plate dissipation rating of 450 watts under ICAS operating conditions with forced-air cooling.

FOR TECHNICAL INFORMATION . . .

Write RCA, Commercial Engineering, Section H-18-R, Harrison, N. J.
Use this coupon. *Circle types you are interested in.*

6161 6383 6448 3RP1-A 6CM7 833-A WT-100A

Name_____
Position_____
Company_____
Address_____

Call your RCA representative:

EAST_____ HUmboldt 5-3900
744 Broad St., Newark 1, N. J.

MIDWEST_____ WHitehall 4-2900
Suite 1181, Merchandise Mart Plaza, Chicago 54, Ill.

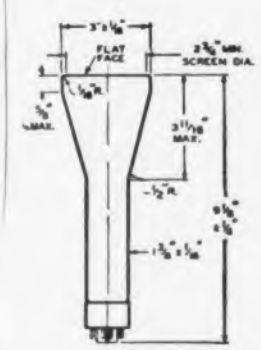
WEST_____ MAdison 9-3671
420 S. San Pedro St., Los Angeles 13, Calif.

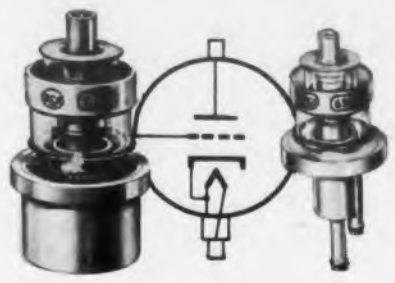
DESIGNERS

ELECTRON TUBES
SEMICONDUCTOR DEVICES
BATTERIES
TEST EQUIPMENT
ELECTRONIC COMPONENTS

GENERAL-PURPOSE
3" FLAT-FACE OSCILLOGRAPH TUBE

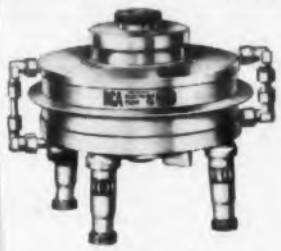
RCA-3RP1-A . . . has small, brilliant, focused spot and high deflection sensitivity for its relatively short length. The screen is of the medium-persistence, green-fluorescence type. This tube provides a trace having high brightness when operated with an ultor voltage near the maximum of 2500 volts, and good brightness at relatively low ultor voltage. The flat face facilitates use of an external calibrated scale and minimizes parallax in readings.





TWO UHF POWER TRIODES
FOR FREQUENCIES UP TO 2000 Mc

RCA-6383 . . . liquid- and forced-air-cooled for UHF transmitter service. Has 600 watts plate dissipation and can be operated at full input ratings at frequencies up to 2000 Mc. **RCA-6161** . . . forced-air-cooled, with radiating fin construction. For UHF service in TV and cw applications. Has maximum plate dissipation of 250 watts. Operates at full input ratings up to 900 Mc, reduced ratings up to 2000 Mc. Both types for circuits of the coaxial cylinder type. Particularly suited for cathode-drive circuits. For service in aircraft and other applications where light weight, compactness, and high power output are prime design considerations.



12 KILOWATTS
OUTPUT AT 900 Mc

RCA-6448 . . . a water-cooled beam power tube with a unique design—is intended for operation as a grid-driven power amplifier at frequencies up to 1000 Mc. In color or black-and-white TV service, it is capable of delivering a synchronizing-level power output of 15 Kw at 500 Mc or 12 Kw at 900 Mc. The 6448 is also capable of giving useful power output of 14 Kw at 400 Mc or 11 Kw at 900 Mc as a cw amplifier in class C telegraphy service.

NEW DUAL TRIODE WITH
TWO DISSIMILAR UNITS

RCA-6CM7 . . . a medium-mu dual triode of the 9-pin miniature type containing two dissimilar triodes in one envelope. Unit No. 2 is a high-perveance triode designed especially for use as a vertical deflection amplifier. Unit No. 1 is designed for use as a conventional blocking oscillator in vertical deflection circuits. The RCA-6CM7 also features a 600-milliampere heater with controlled warmup time, separate cathodes for the two units, and a basing arrangement which facilitates use in printed circuits.

RCA RADIO CORPORATION of AMERICA
TUBE DIVISION HARRISON, N. J.

Potentiometers

Weighs only 1/2 oz

The C078 series subminiature precision potentiometers weigh only 1/2 oz and have a diameter of only 7/8". These potentiometers are designed to combine features of full-size potentiometers with substantial savings in both weight and space, and they are for use in computers, trimmers, guided missiles, portable, and aircraft equipment.

The units have multiple-finger contact brushes, gold connectors for trouble-free contacts, and 320° electrical rotation. Housings are completely enclosed. Potentiometers can be ganged and independently phased. Despite their small diameter, they are also available with special torque ratings, ball-bearings, sealed housings, special tolerances, and other requirements for any linear or non-linear function. DeJur-Amsco Corp., Dept. ED, 45-01 Northern Blvd., Long Island City 1, N. Y.

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

D-C Power Rectifiers

In 10 Standard 28v Models

"C&C Stavolt" D-C Power Rectifiers are closely regulated by stable, long-life magnetic amplifier control. No tubes, lamps, carbon piles, or varistors are employed. Ten standard 28v production models with capacities up to 1000amp in mobile or stationary types are available.

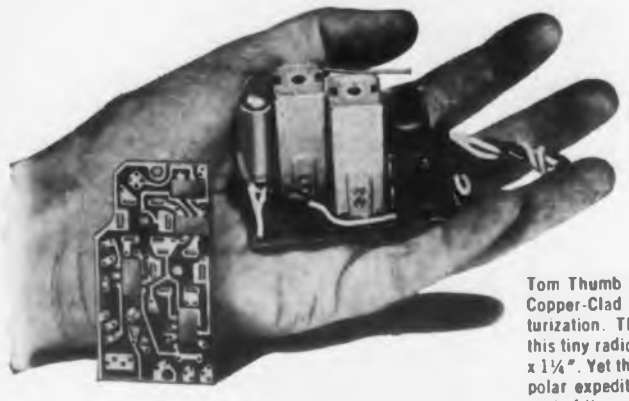
Important size and weight reduction has been accomplished by the use of latest core and insulation materials and aluminum construction throughout. All components are encapsulated for long, trouble-free service under severe environmental conditions, and have weatheproof construction. The rectifiers meet the requirements of MIL-E-7894.

The units are continuously variable between 25-29v d-c. D-c regulation is ±1.0% with ±10% change in the a-c input and any load variation from zero to full load. D-c ripple is 2.0% rms, and recovery time is 0.2sec. Units are available for parallel operation. Other ranges and closer tolerances can be furnished. McColpin-Christie Corp., Dept. ED, 3410 W. 67th St., Los Angeles 43, Calif.

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

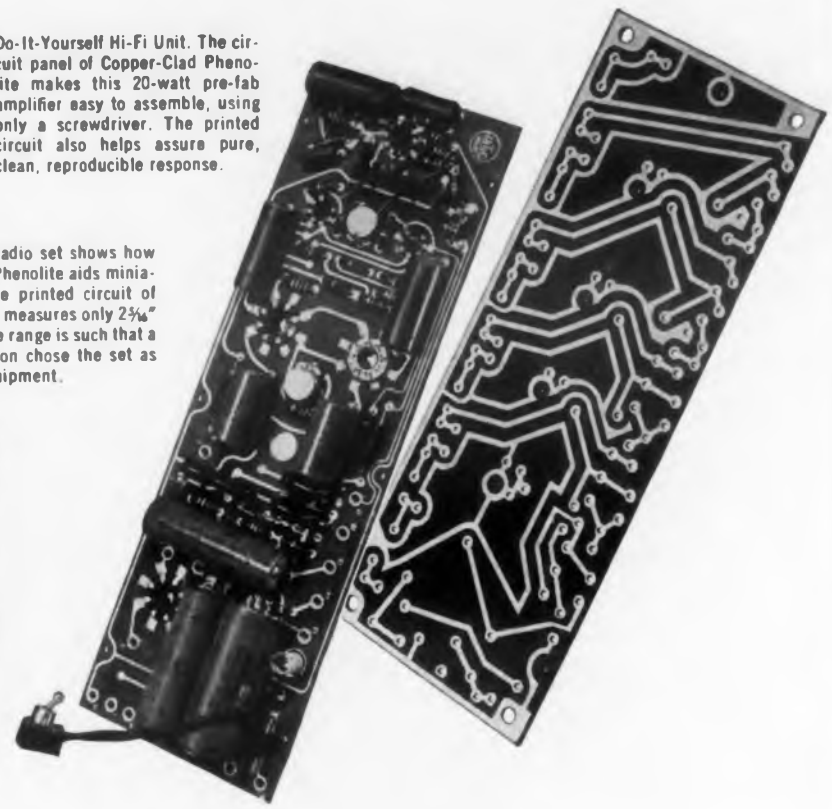
COPPER-CLAD PHENOLITE

When it proves itself in products like these...

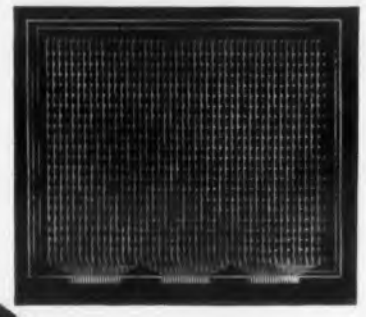


Do-It-Yourself Hi-Fi Unit. The circuit panel of Copper-Clad Phenolite makes this 20-watt pre-fab amplifier easy to assemble, using only a screwdriver. The printed circuit also helps assure pure, clean, reproducible response.

Tom Thumb radio set shows how Copper-Clad Phenolite aids miniaturization. The printed circuit of this tiny radio measures only 2 3/16" x 1 1/4". Yet the range is such that a polar expedition chose the set as part of its equipment.



Printed circuit—18" x 21"—for a modern computor. The panel contains more than 1,000 through-holes for connection soldering, all of which are pierced in one operation! This shows the fine workability of Copper-Clad Phenolite and its ability to eliminate complex wiring, costly operations, expensive components.



Switch plates, commutator discs, and drum commutators with printed circuits have proved themselves in many diversified applications. Low-cost printed circuit switches are ideal for simple switching, and show up to best economical advantage in complex switching functions.

You know it's best for any printed circuit

The most widely used foundation material for printed circuits is Copper-Clad Phenolite by National.

Reason? Copper-Clad Phenolite—in its many grades—possesses all the properties and characteristics demanded for the job. This scientifically compounded laminate has high dielectric and mechanical strength, resistance to heat, moisture, solvents, oils, acids, alkalies. Also, it's light in weight—easy to machine, punch, saw, drill and solder.

You can't buy a more dependable, versatile, cost-cutting material than Copper-Clad Phenolite. Write us today.

YOUR GUIDE TO PRINTED CIRCUIT SIMPLIFICATION. *You'll find this booklet a most helpful tool in achieving miniaturization or automation. Complete coverage of basic technical facts and design data related to applied printed circuitry. Methods of producing printed circuits and economies in design are fully treated. For your free, personal copy of "Mechanize Your Wiring," write Dept. AG-8.*

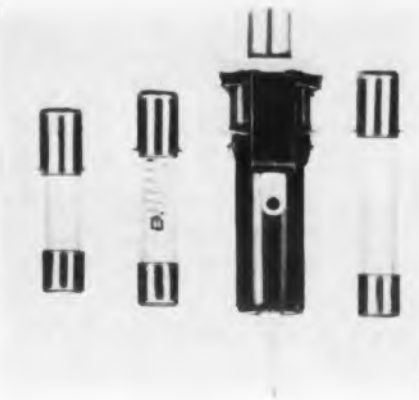
In Canada: **National Fibre Company of Canada, Ltd.** • Toronto 3, Ont.

NATIONAL
VULCANIZED FIBRE CO.
WILMINGTON 99, DELAWARE

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

☐ Fuses and Holders

Limited Current Types



This series of "LC" Limited Current Fuses and Fuse Holders eliminates the possibility of over-fusing, and provide positive electrical protection for such appliances as television and radio receivers. Approved by UL, these fuses are made in a combination of three different lengths and seven different widths of bayonet locking tabs on the fuse caps. They may not be replaced by standard fuses.

The fuse post is made to accept only the size amperage range and type (regular or slo blo) in its range. For example, a 1amp slo blo fuse is 1-1/4" long with 0.115" to 0.120" width tabs. The holder used with this will only accept a slo blo fuse (N type) above 3/4amp to 1-1/4amp.

The holder snaps into a predetermined chassis mounting hole and locks into place by means of a quick snap-in type lock washer. Littelfuse, Inc., Dept. ED, 1865 Miner St., Des Plaines, Ill. *These products will be at the Wescon Show, Booths 413-414.*

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

☐ Function Generator

Uses Diodes

The Variable Base Function Generator, Model 35, is normally used in conjunction with two operational amplifiers of Model 30 Analog Computer to approximate almost any desired single-valued function of the input voltage. As examples, trigonometric functions, stepped functions, reciprocals, and special functions to simulate "dead time" and backlash may be approximated with accuracies which approach 0.5%. The Model 35 is not restricted to the generation of monotonic functions, since biased diodes are incorporated in a bridge circuit, and functions generated for positive input voltages are independent of functions generated for negative input voltages. Both inputs and outputs may vary over a range of +100 to —100v. Donner Scientific Co., Dept. ED, 2829 7th St., Berkeley 10, Calif. *This product will be displayed at the Wescon Show, Booth 239.*

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

☐ Color Bar/Dot Generator

Shows Sequences Graphically

This test instrument has crystal controlled master oscillators, color sequences graphically portrayed on an illuminated panel, can be synchronized on any NTSC TV system or can serve as source in any NTSC system. The instrument has standard broadcast transmission levels, variable number and size of dots and bars, black and white linearity alignment, and has a modulated sound carrier for audio adjustment. Hycon Mfg. Co., Dept. ED, 2961 E. Colorado St., Pasadena, Calif. *This product will be on display at the Wescon Show, Booth 1812-1813.*

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

☐ Heat Detector Cells

For "Non-Contact" Uses

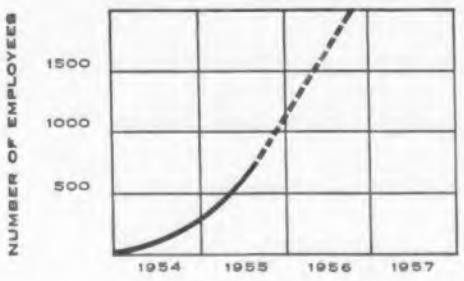
The 1317 is a low-cost, remote detector of far infrared energy designed specifically for use in commercial applications of "non-contact" heat detection measurement, and control systems. This thermistor contains both active and compensating flakes. Performance varies according to flake size. There are six standard flake sizes, and special sizes and configurations are available on special order.

Nominal characteristics for a 1mm x 1mm active flake are: 3 megohms resistance at 25°C; ±80v operating bias; sensitivity of 50v/w when shunted by 3.3 megohms amplifier input impedance; time constant of 12millisec; and spectral response of 1 to 12microns with standard "Servofrax" window, 1 to 25microns with other windows. Noise when biased is less than twice theoretical.

Also available is the 1340, a precision remote detector of far infrared energy for applications plagued by internal "swish" noise from air set in motion by high ambient variations. The problem is solved by an evacuated capsule. This unit is for advanced laboratory or military uses. Servo Corp. of America, Dept. ED, 2020 Jericho Turnpike, New Hyde Park, N. Y. *This product will be displayed at the Wescon Show, Booth 319.*

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

PROGRESS REPORT



PROJECTS

Our eight current military contracts support a broad range of advanced development work in the fields of modern communications, digital computing and data-processing, fire-control, and guided missiles. This work is supplemented by non-military activities in the fields of operations research, automation, and data-processing.

FINANCES

In 1954, our first full year of operation, we showed a good profit. Of greater importance, however, are the arrangements recently completed with Thompson Products, Inc., our corporate associate, whereby we are assured additional funds up to $20,000,000 to finance our expansion requirements of the next few years, and insure the long-range stability of the company.

The Future

Our first year and a half of corporate history encourages us in the belief that our future will be one of expanding productivity. But whether we remain a small company or grow large, we plan not to lose sight of the fact that the continued success of The Ramo-Wooldridge Corporation depends on our maintaining an organizational pattern, a professional environment, and methods of operating the company that are unusually well suited to the very technical, very special needs of modern systems development and manufacturing.

After Twenty-One Months...

RESEARCH AND DEVELOPMENT PERSONNEL

Total population figures, such as those displayed in the curve, tell only a limited story. Personnel quality factors are most important, in our kind of business. We believe we are doing well in this respect. Of the 90 Ph.D.'s, 65 M.S.'s and 75 B.S.'s or B.A.'s who today make up our professional staff, a gratifyingly high percentage are men of broad experience and, occasionally, national reputation in their fields.

FACILITIES

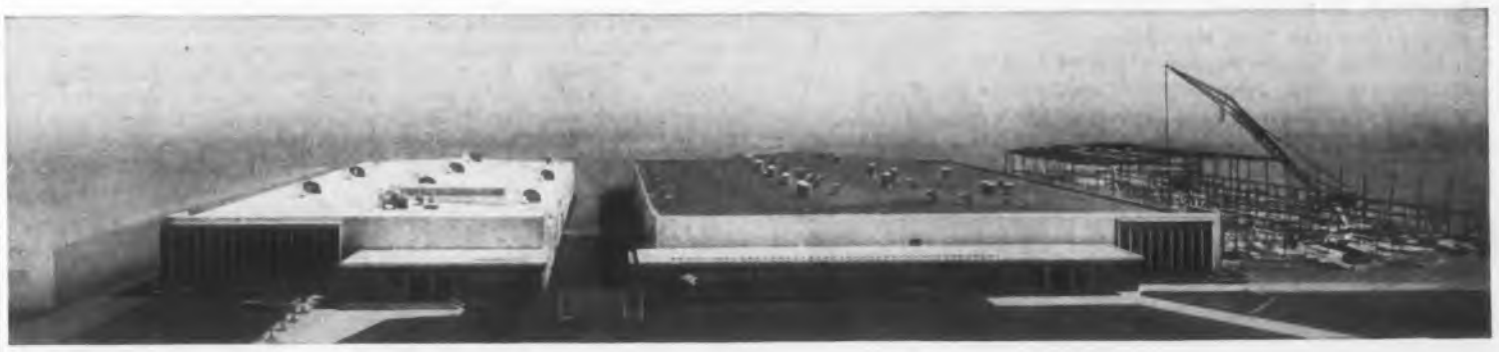
By mid-1956 our Los Angeles facility will consist of seven buildings totalling 300,000 square feet of modern research and development space. Two of the three buildings now complete and occupied are shown at bottom of this page; a fourth and fifth are presently under construction, the others are in the design stage.

MANUFACTURING

We are somewhat ahead of the usual systems development schedule, with some of our projects having arrived at the field and flight-test stages. We are now planning a facility for quantity production of electronic systems. Construction on the initial unit of 160,000 square feet (shown above) is expected to start in late 1955, with manufacturing planned for late 1956.

The Ramo-Wooldridge Corporation

8820 BELLANCA AVE., LOS ANGELES 45 CALIFORNIA.



Test for Electrical
LEAKAGE • SHORTS • BREAKDOWN
with
"HYPOT"
JUNIORS

HIGH POTENTIAL TESTING INSTRUMENTS

WRITE FOR BULLETIN 4A

- ONLY ONE instrument necessary to make high potential tests for leakage, breakdown or shorts!
- PORTABLE, with rugged steel case...Operates in any position!
- SAFE to use, with protected test leads, shielded high voltage, grounded case!
- SIMPLE—only three easy steps to make a complete test!
- VISUAL INDICATIONS from neon lights give positive test results. Audible test indication for leakage also available.
- RANGES 0-1500 to 0-6000 V.A.C. output. Other "Hypots" to 50,000 V.A.C. output at 5 K.W.
- WRITE for complete data on "HYPOTS" for your jobs.

ASSOCIATED RESEARCH, Incorporated
Precision Instruments Since 1936
3769 West Belmont Avenue, Chicago 18, Illinois

CIRCLE ED-303 ON READER-SERVICE CARD FOR MORE INFORMATION

Only Precision OFFERS YOU HIGHEST QUALITY, LOW COST PAPER TUBING

Round, square, rectangular, triangular, any shape, any size—Precision Paper Tube Co. can provide *all* your paper tubing needs. Your specifications are met to the most exacting tolerances. Precision Paper Tubes are sturdy, crush resistant, have high tensile strength and excellent dimensional stability.

Send in your specifications for samples. Request Arbor List of over 2000 sizes.

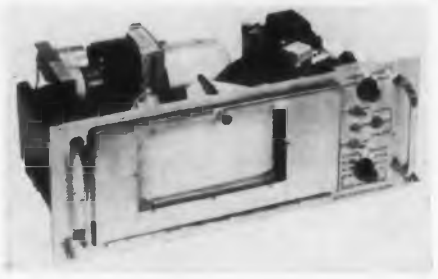
Sales Representatives in:

New England: Framingham, Massachusetts, Trinity 3-7091
Metropolitan New York, New Jersey: Jersey City, New Jersey, Journal Square 4-3574
Upstate New York: Syracuse, New York, Syracuse 4-2141
Northern Ohio, Western Penn.: Cleveland, Ohio, Atlantic 1-1060
Indiana, Southern Ohio: Logansport, Indiana, Logansport 2555
California: Pasadena, California, Sycamore 8-3919
Canada: Montreal, Quebec, Canada, Walnut 0337

PRECISION PAPER TUBE CO.
2055 W. CHARLESTON ST. CHICAGO 47, ILL.
Plant No. 2: 79 Chapel St., Hartford, Conn.
Also Mfrs. of Precision Coil Bobbins

CIRCLE ED-304 ON READER-SERVICE CARD FOR MORE INFORMATION

☐ Oscillographs
With Up to 16 Speeds



These one and two-channel direct-writing oscillographs are available with 8 or 16 recording speeds. The chart drive is electrically-controlled, permitting speed to be changed instantaneously from either local or remote locations. The chart-drive system is highly accurate, providing a linear time base at all speeds.

When used with Brush Amplifiers, the oscillographs give an extended frequency response from d-c to 100cy. The same basic unit can be obtained for either single or dual-channel recording; there is a choice of ink or combination ink and electric wiring.

Illustrated is the Dual-Channel Oscillograph Model BL-262 which provides internal chart take up. Time and event markers can be mounted. Brush Electronics Co., Division of Clevite Corp., Dept. ED, 3405 Perkins Ave., Cleveland 14, Ohio. *This product will be displayed at the Wescon Show, Booth 1111-1112.*

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

BRUSH "Countess"

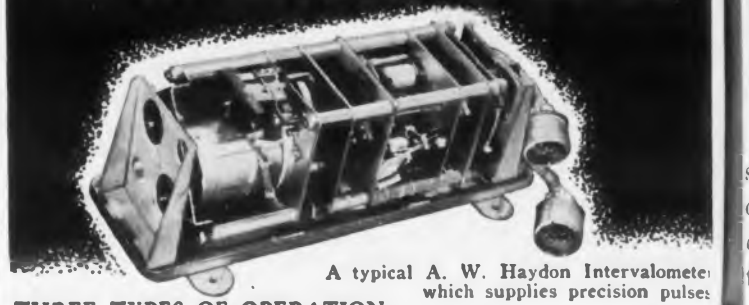
Lower Power • Lower Cost • Versatile Readout

New Digital Counter operates with *one-quarter* the power required by conventional counters. The result is less heat, greater reliability. It's more *versatile*, since data can be presented either electrically or visually. Yet, the Countess is the lowest-priced, high-quality counter available, thanks to advanced design and use of printed circuits. Specify the Countess in your equipment for testing, controlling, computing, etc. For complete information, write Brush Electronics Company, Dept. J-8, 3405 Perkins Avenue, Cleveland 14, Ohio.

BRUSH ELECTRONICS COMPANY
INDUSTRIAL AND RESEARCH INSTRUMENTS
PIEZOELECTRIC MATERIALS • ACOUSTIC DEVICES
MAGNETIC RECORDING EQUIPMENT AND COMPONENTS
Division of Clevite Corporation

CIRCLE ED-308 ON READER-SERVICE CARD FOR MORE INFORMATION

Short Interval Timing Your Problem?
A. W. HAYDON CAN HELP YOU.



A typical A. W. Haydon Intervalometer which supplies precision pulses

THREE TYPES OF OPERATION

The operator adjusts a selector switch to determine the type of operation

OPTION #1. When a starting pulse of 100 Milliseconds is applied this Intervalometer starts up and energizes 15 Pulsing Circuits at 50 Millisecond intervals. Each circuit is on for 30 Milliseconds. At the end of the period, the unit automatically resets to the starting position

OPTION #2. When a starting Pulse of 100 Milliseconds is applied this Intervalometer starts up and energizes 6 Pulsing Circuits, then shuts down. When the next starting pulse is applied, the balance of 9 pulsing Circuits are energized. The unit then resets to the starting position.

OPTION #3. When 1st starting Pulse is applied 5 Pulsing Circuits are energized. When 2nd starting Pulse is applied next 5 circuits are energized. When 3rd starting Pulse is applied next 5 circuits are energized.

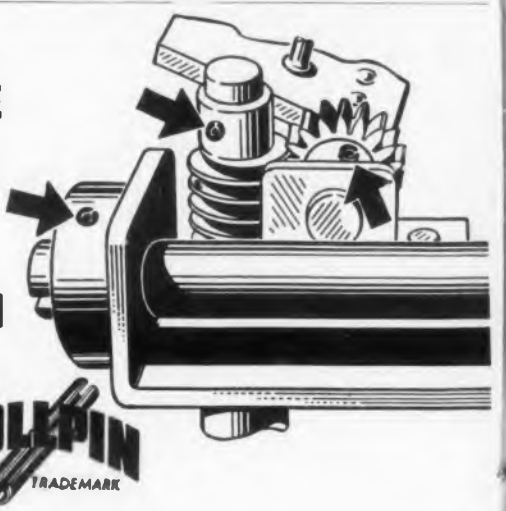
WHEN TIMING POSES A PROBLEM CONSULT

WRITE FOR GENERAL CATALOG OR SUBMIT DETAILED PROBLEM STATEMENT.

The A. W. HAYDON COMPANY
22 NORTH ELM STREET
WATERBURY 20, CONNECTICUT
Design and Manufacture of Electro-Mechanical Timing Devices

CIRCLE ED-413 ON READER-SERVICE CARD FOR MORE INFORMATION

FAST, ACCURATE PINNING OF PRECISION SHAFTS WITH ROLLPIN TRADEMARK



Rollpin speeds production alignment of close tolerance shafts. The slotted, hollow steel spring pin, with chamfered ends, is simply pressed or driven into holes drilled to normal production tolerances. It compresses as driven, is self-locking and vibration-proof. Rollpin is light, easily removable, reusable and has a shear strength greater than a solid pin of the same diameter. Diameters from 1/16" to 1/2".

Rollpin, in place of rivets, set screws, dowels and stop pins can cut production costs as much as 90%. For detailed information on any electronic fastening problem, write: Elastic Stop Nut Corporation of America, 2330 Vauxhall Road, Union, New Jersey. Address Dept. R26-857.

ESNA

ELASTIC STOP NUT CORPORATION OF AMERICA
2330 Vauxhall Road, Union, N. J.

DESIGN HEADQUARTERS FOR SELF-LOCKING FASTENERS

CIRCLE ED-310 ON READER-SERVICE CARD FOR MORE INFORMATION

☐ Motor Package

For Servo Actuation

This Motor Package is especially designed for servo-actuator purposes where exceedingly high speed in starting and stopping of the operating shaft without slip is required. It consists of a 1-1/4″ diam permanent magnet motor, 115v d-c; a specially designed clutch-brake mechanism; a clutch-brake actuating housing; and a suitable gear train.

When power is applied, the clutch instantly engages the gear train to the motor unit as the motor accelerates. Conversely, when power is interrupted the clutch-brake coil is de-energized simultaneously with the motor, the braking mechanism instantly stopping the input shaft to the gear train; thus the output shaft from the gear train is stopped practically instantly with the rupture of power to the motor package. The unit shown, Model 5012-166, is 1-1/4″ diam x 3-5/8″ long. Burton Manufacturing Co., Dept. ED, 11201 W. Pico Blvd., Los Angeles 64, Calif. *This product will be at the Wescon Show, Booth 705.*

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

☐ Oscillograph Recorder

Portable Direct-Writing

This direct-writing oscillograph, the Type P Portable "Dynograph", is housed in two carrying cases, and it can be set up for use in seconds. The recorder provides high, stable, d-c or a-c amplification. It may be used with reluctance type gages without auxiliary equipment, and it is for recording a wide variety of transient variable, such as strain, vibration, temperature, analog computer write-out, etc.

Performance includes: 15μv d-c per mm of pen deflection, with a response time of less than 1/120sec. High sensitivity is obtained with absolute stability; there is no zero drift. The pen excursion is over 8cm, giving large, easily read records.

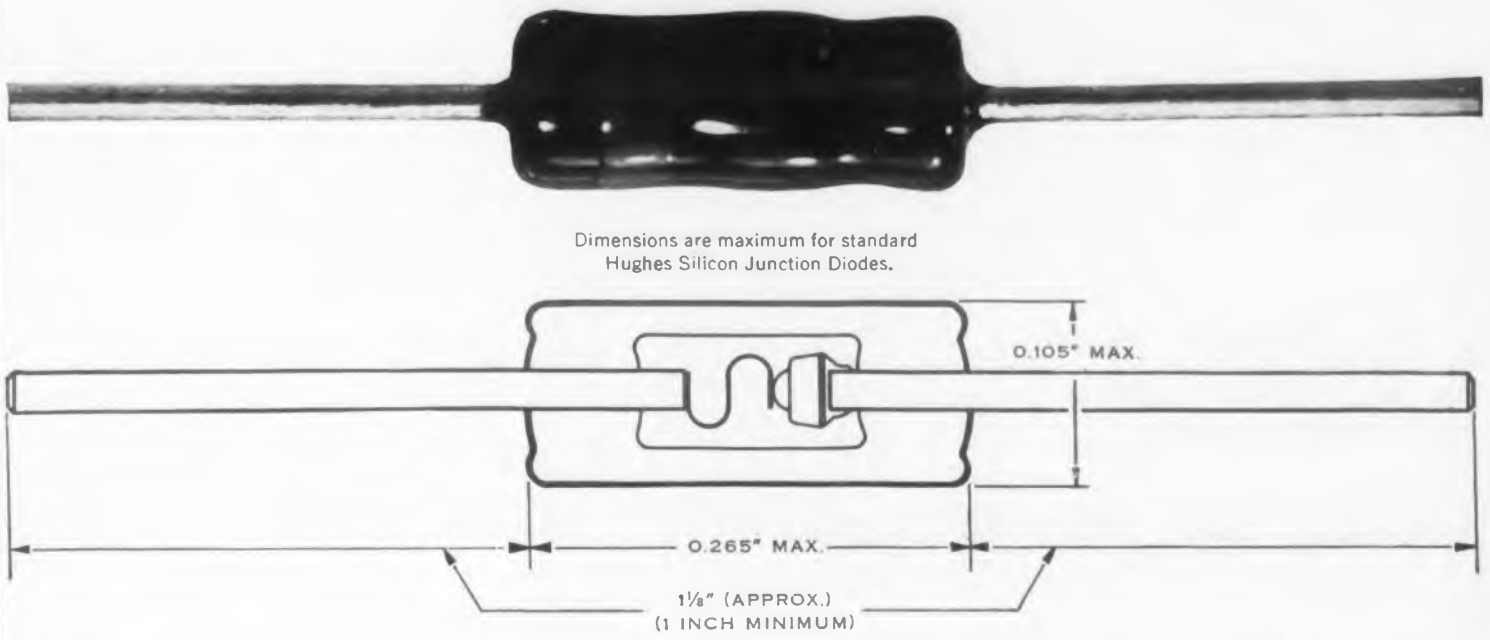
The "Dynograph" is supplied with one or two channels. A console model, the Type M, is available for up to six channels. Offner Electronics, Dept. ED, 3330 N. Kedzie Ave., Chicago, Ill. *This product will be displayed at the Wescon Show, Booth 338.*

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

HUGHES

SILICON JUNCTION

DIODES

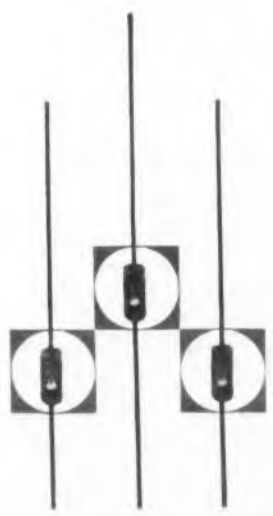


Dimensions are maximum for standard Hughes Silicon Junction Diodes.

*High Temperature Operation**

Extremely High Back Resistance

Exceptionally Stable Characteristics



Actual Size

FEATURES—High temperature operation . . . *extremely* high back resistance . . . very sharp back voltage breakdown . . . one-piece, fusion-sealed glass body . . . axial leads for easy mounting . . . subminiature size . . . exceptionally stable characteristics.

TESTED—All Hughes Silicon Junction Diodes are subjected to rigorous testing procedures. Specific electrical characteristics are measured and, in addition, each diode is temperature-cycled twice in a moisture-saturated atmosphere. When specified, special tests are also performed.

CONSTRUCTION—Hughes Silicon Junction Diodes are packaged in the famous fusion-sealed glass body, developed at Hughes. This construction is impervious to moisture penetration—*ensures* electrical and mechanical stability, and freedom from contamination.

When high temperatures or high back resistance requirements call for silicon, be sure to specify *Hughes* Silicon Junction Diodes. They are first of all—for RELIABILITY!

Diode glass body is coated with opaque black enamel, color-coded on cathode end. Available now in nine types: HD6001, HD6002, HD6003, HD6005, HD6006, HD6007, HD6008, HD6009, HD6011. Ask for descriptive Bulletin SP-4.

**Characteristics rated at 25°C and at 150°C. Ambient operating range, −80°C to +200°C.*

HUGHES SEMICONDUCTOR DIVISION

Aircraft Company, Culver City, California

New York Chicago Los Angeles

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

never before...
a potentiometer
the size of a penny
yet worth a fortune
in performance!

DeJUR Series C-078

SUBMINIATURE POTENTIOMETERS

Now – the features of full-size potentiometers in a new series that's no larger than a penny! If your product is for computers, trimmers, guided missiles, or any portable or aircraft equipment, DeJUR's new subminiature potentiometers help you achieve substantial savings in weight and space.

- Unit height only ⅜", weight only ½ oz.
- Single or multiple gangs
- Independently phased
- Completely enclosed
- 320° electrical and 326° mechanical rotation
- Gold collector for trouble-free contacts
- Multiple-finger precious metal contact brush
- Available with special torque ratings, ball-bearings, sealed housings, special tolerances and other requirements for any linear or non-linear function.

WRITE FOR COMPLETE TECHNICAL LITERATURE. *No obligation. Our engineering department can supply prototypes to meet unusual design specifications for tests and approval. Send us your specs for analysis.*

DeJUR-AMSCO CORPORATION • 45-01 NORTHERN BLVD.
LONG ISLAND CITY 1, N. Y.

- potentiometers
- connectors
- instruments

you're sure with **DeJUR** electronic sales division

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

☐ Breakaway Connector

Insulated with Teflon

This miniature two-piece connector is for breakaway connections. It consists of a feed-through plug with pigtail terminal, and a contact receptacle, both with Teflon "Press-Fit" bodies. Both elements may be press-fit into chassis or component holes for a tight, rigid, permanent mounting.

To insure positive, low-resistance conduction, the plug is of brass, silver-plated with gold flash, while the receptacle has a beryllium-copper, silver-plated, gold-flash contact. The connector is intended for breakaway connections, such as in multiple plugs and receptacles; plug-in crystal diodes; flyback and other TV components; plug-in coils and forms; and also for test prods, chassis test points, and interconnecting applications. Sealectro Corp., Dept. ED, 186 Union Ave., New Rochelle, N. Y. *This product will be displayed at the Wescon Show, Booth 1515.*

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

☐ Power Supply

For Low Voltages, Currents

The D50-.05B unit is a dual-output, high-precision regulated power supply for laboratories. It offers wide application as a low-voltage, low-current supply for instrumentation groups. Output is 0-50v at 50ma per side.

Regulation from no-load to full-load is better than 0.1%. Output impedance is less than 1 ohm at d-c; output ripple is 3mv or better. Each side can be operated independently of the other. The two sides are contained in a chassis suitable for rack mounting or bench use. Panel size is 7" x 19" x 11" deep. The chassis fits a standard 19" rack. Dressen-Barnes Corp., Dept. ED, 250 N. Vinedo Ave., Pasadena 8, Calif. *This product will be displayed at the Wescon Show, Booth 116.*

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

Veco Thermistors also are sensitive to temperature!

These versatile sensing elements are resistors with a high negative temperature coefficient of resistance — temperature goes up — resistance goes down. This characteristic makes thermistors useful components in electronic circuits as temperature compensators, surge suppressors, voltage regulators, automatic gain controls, etc.

They are used also as sensing elements in high speed thermometry and temperature control for which they are available in a multiplicity of forms such as small beads, rods, discs, washers, glass, plastic or metal probes, or even embedded in the tips of hypodermic needles! Because of their extremely small size, they assist in miniaturization.

To find out how "VECO" thermistors can improve your products, write for free information. New M-168 kit of 6 thermistors and 1 varistor with suggested circuitry. $5.00 postpaid, or available at electronics parts wholesalers.

Victory Engineering Corporation

102 Iorio Court, Union, New Jersey
Tel. MUrdock 8-7150

VECO

THERMISTORS • VARISTORS
TEMPERATURE SENSING DEVICES
ELECTRONIC AND THERMAL CONTROL INSTRUMENTS

CIRCLE ED-112 ON READER-SERVICE CARD

Miniature Components for Transistor Circuits

The pioneer miniature dry battery with exceptional life on the shelf and in service. Constant voltage discharge characteristic is ideal for use with transistors.

Compress capacitances up to 30 mfd. at 6 volts into a subminiature case only 7/32" in diameter by 3/8" long . . . rated for temperatures from —55° C. to +85° C. Ultra-miniature Type TAW, rated 4 and 6 mfd. at 4 volts, is only 0.145" in diameter by 3/8" long.

Both of these lines of components are available in production quantities. For technical details, write today to P. R. MALLORY & CO. INC., Indianapolis 6, Indiana.

*Trade Mark

P.R. MALLORY & CO. Inc.
MALLORY

CIRCLE ED-113 ON READER-SERVICE CARD

Stepping Servo

Inexpensive Feedback Control

Known as the "'Step-Servo", this discrete - position servomechanism can be utilized in a number of instruments or control systems. Over an input voltage range of ±10v, it can move a valve or switch through a predetermined number of steps. Applications of the device are given in an article appearing on pp. 44 to 47 of this issue.

Since this device does not require a precision potentiometer and a stepping solenoid can be used instead of a motor and gear train, it is less expensive than conventional servomechanisms. Standard units with outputs of 1 to 4 lb-in are available. Special units with outputs to 54 lb-in can be ordered. One-direction units are standard, but two-direction units can be ordered.

The standard units are 3" x 4" x 5" in dimensions exclusive of tubes and weigh 3-1/2 lb. Input impedance is 1 megohm. Number of steps are 8, 10, 12, 18, or 24. Power requirements: 7w, 50/60 or 400cy. Bergen Laboratories, Dept. ED, 11 Godwin Ave., Fair Lawn, N. J.

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

☐ Bridge Circuit

Designed for Easy Operation

The "Deka-bridge" Model 210 Wheatstone Bridge Circuit is designed for easy operation with increased operating speed and improved accuracy. A dual set "Deka-dials" provides uniline readouts to four places over the resistance range of 8-12 megohms. The basic rheostat arm has a total resistance of 12,000 ohms in range. Limit of measurement error is 0.1%.

An adjustable base provides a means for setting the dial face angle for maximum readability. Size is less than 5-1/2" x 6-1/2" x 7-1/2" and weight approximately 8 lb. Electro-Measurements, Inc., Dept. ED, 4312 S.E. Stark St., Portland 15, Ore. *This product will be shown at the Wescon Show, Booth 817.*

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

GENERAL ELECTRIC ANNOUNCES . . .

NEW, faster, smaller micro-miniature relay

LIGHT WEIGHT, SMALL SIZE: Weighs only .35 ounces and measures .34" x .781" x .84". This tiny relay utilizes balanced armature and simple design, giving you quality and more reliable operation at a consistently high level.
HIGH CONTACT RATING: For low contact resistance and long life, fine silver is used . . . contact rating is 2 amps resistive load at 30 V d-c or 115 V a-c . . . contact arrangement is 2PDT.
FAST OPERATION: With rated voltage on coil, operating time is 1.5 milliseconds. By adding series resistance in coil circuit or by applying high voltage pulse to coil . . . pickup time will be less than 1 millisecond!
LOW OPERATING POWER: 300 milliwatts for standard model . . . 150 milliwatts for current sensitive model.
HIGH SHOCK: VIBRATION RESISTANT: G.E.'s balanced armature and high tip forces withstand shock of over 50 g's and vibration of 10-55 cp's at .12" maximum excursion and 55–500 cp's at 20 g's acceleration.
HIGH TEMP OPERATION: This new micro-miniature relay gives you continuous and efficient operation at ambient temperatures of 125° C.

G.E.'s line of aircraft-type relays will help solve your space-weight problems. Contact your G-E Apparatus Sales office for more application information. General Electric Company, Schenectady 5, New York.

SEE THESE RELAYS IN BOOTHS 1 & 2—1955 WESCON SHOW

MAIL THIS COUPON FOR G-E RELAY DATA . . .

- ☐ A: Micro-miniature Relay—Bulletin GEA-6346
- ☐ B: High Speed Relay—Bulletin GEA-6212
- ☐ C: Miniature Relay—Bulletin GEA-6213
- ☐ D: Subminiature Relay—Bulletin GEA-6211
- ☐ E: Have Sales Engineer contact me.

Section G792-2, General Electric Company, Schenectady 5, New York

NAME..... TITLE.....

COMPANY.....

ADDRESS.....

CITY..... STATE.....

GENERAL ELECTRIC

CIRCLE ED-116 ON READER-SERVICE CARD ➤

Electro-Snap Switches Can Be Adapted to Almost Any Job — Quickly, Easily, Economically

Just choose the Electro-Snap Basic Switch that meets your electrical requirements, add the proper actuator — and presto! — you have a tailor-made precision switch that exactly fits your application. Electro-Snap makes a wide variety of stock actuators to fit almost any requirement. And our engineering department is at your service if a standard combination "won't fill the bill."

For prompt action on your switching problems, send us a brief description and rough sketch of the switch you need.

Switching Problem?

SUB-MINIATURE SWITCHES TYPE E-4

S.P.D.T., 1 circuit; 5 amps, 125/250 v. AC
Operating force 150 grams max.
Exceptionally vibration-resistant.
Special model E4-7 is stabilized for — 65° to + 350° F. operation.


Push Button Actuator


Toggle Actuator (Momentary or Constant Contact)


Double Toggle Actuator


Roller Leaf Actuator


Leaf Actuator


Extension Leaf Actuator


Ganged Interlock

TYPE S SWITCHES
Series S1

S.P.D.T., 2 circuit; 10 amps, 125/250 v. AC/ 30 v. DC. Ind. Screw or solder terminals on ends or one side of switch. Also available with reset button at bottom of switch or in Type S-100 Make-Before-Break Series where switch completes a new circuit before interrupting old one.


Roller Lever Actuator


Roller Actuator


Push Button Actuators (Various button sizes available)


Toggle Actuator (momentary or constant contact)


Extension Leaf Actuator


Special Push Button Actuator designed for fire control system

DOUBLE-POLE SIMULTANEOUS ACTION TYPE D-8

D.P.D.T., 4 Circuit
15 amps, 125/250 v. AC.
10 amps, 30 v. DC Ind.
Eight terminals and four separate circuits which operate simultaneously permit switch to reverse 3-phase motors, replace expensive relays, etc.


Roller Leaf Actuator


Roller Lever Actuator


Leaf Actuator


Extension Leaf Actuator


Push Button Actuators (Various button sizes available)

HERMETICALLY-SEALED DOUBLE-POLE SWITCH


Type J2-4


Toggle Actuator for J2-4

D.P.D.T., 4 circuit 10 amps, 125/250 v. AC/30 v. DC.

ELECTRO-SNAP SWITCH & MFG. CO. 4220 West Lake Street, Chicago 24, Illinois
MANUFACTURERS OF A COMPLETE LINE OF PRECISION SWITCHES FOR INDUSTRY AND AVIATION

ELECTRO SNAP

Ferrite Kit
Includes Various Cores

An assortment of 27 representativ ferrite cores is available in kit for to engineers and designer. The core included vary from a flat stick core to discs, pigtail cores, standard stud ded cores, spaghetti cores, as well a many other types. This kit will en able a designer to have a correct sam ple core for most any coil jol Superex Electronics Corp., Dept. EI 4-6 Radford Place, Yonkers, N. Y

CIRCLE ED-117 ON READER-SERVICE CARD

Casting Resin
Very Low Weight

Casting resin Stycast 1090 has specific gravity when fully cured o 0.90. It floats. This epoxide base ma terial is useful from —100 t +400°F, has excellent adhesion to wide variety of materials and negli ible shrinkage during cure. Therma expansion coefficient is close to tha of most metals. The material is par ticularly useful in airborne applica tions where weight is important Emerson & Cuming, Inc., Dept. ED 869 Washington St., Canton, Mass

CIRCLE ED-118 ON READER-SERVICE CARD

High Voltage Tip Jack
Made of Nylon

This jack, Part No. 4173, will mee high temperature requirements an has extremely low leakage and lo moisture absorption. The nylon insu lation is sufficient to withstand mor than 10,000v d-c. It is adjustable t panels ranging in thickness fro 1/16 to 1/8". All metal parts ar plated to Government specification for 50 hour salt spray tests. The on piece phosphor bronze spring contact accommodates standard 0.080 plugs Robco Manufacturing Div., Dept ED, Pilot International Corp., 27-0 Bridge Plaza No., Long Island Cit I, N. Y.

CIRCLE ED-119 ON READER-SERVICE CARD

◄ CIRCLE ED-120 ON READER-SERVICE CARD

Miniature Tubes
For Series String

Two additional "Series-600" triode-pentode 9-pin miniatures now in the line of controlled warm-up tubes are the *5AT8* and *5X8*. Six-volt heater versions of these, also in the line, are the *6AT8* and *6X8*.

Actually, these are four versions of the same tube—two with different heater current and two with different basing. These combination medium-mu triodes/sharp-cutoff pentodes are designed primarily for use in oscillator-mixer service in TV and FM receivers. Tube Dept., General Electric Co., Dept. ED, Schenectady 5, N. Y.

CIRCLE ED-121 ON READER-SERVICE CARD

Nomogram About Packaging
Tells Cushioning Thickness

Called a Cushioning Nomogram, this mathematical tool tells a shipper the exact thickness of Celotex cushioning material that is required for a specific shipment. All the packager needs to know at the start is the fragility of the merchandise, its weight, bearing area, and the height of drop expected in normal handling. Projection of straight lines across the graduated columns of figures on the Nomogram gives the answer. Celotex Corp., Dept. ED, 120 S. La Salle St., Chicago, Ill.

CIRCLE ED-122 ON READER-SERVICE CARD

Metallurgical Wires
For Semiconductors

Metallurgical wire products specifically developed for application in the fields of semiconductors, transistors, diodes, and crystals are available. These products includes: 99.99% pure gold and doped gold alloys; fine aluminum wire in four grades of purity; whisker wires; and a variety of lead wires such as tinned copper wire or ribbon. Secon Metals Corp., Dept. ED, 7 Intervale St., White Plains, N. Y.

CIRCLE ED-123 ON READER-SERVICE CARD

CIRCLE ED-211 ON READER-SERVICE CARD ➤

DU PONT
REG. U.S. PAT. OFF.

ELECTRONIC DESIGN NEWS

PROPERTY AND APPLICATION DATA ON THESE VERSATILE ENGINEERING MATERIALS: "ZYTEL," "ALATHON," "TEFLON," "LUCITE."

No. 1 — 1955

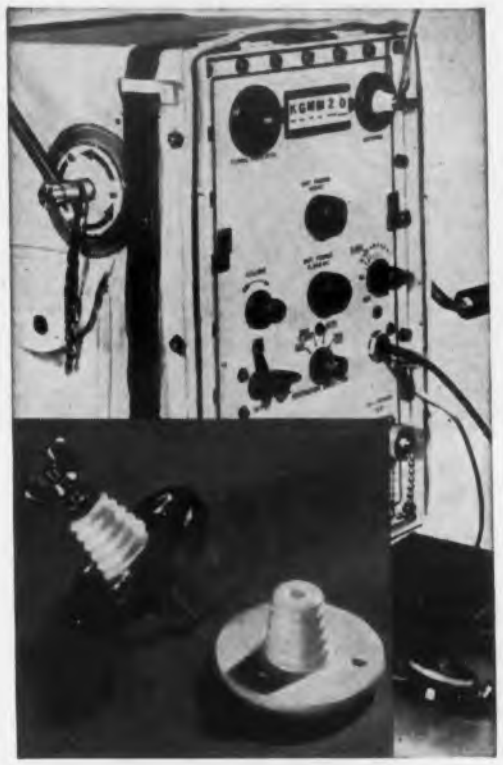
"Teflon" and "Zytel"† nylon combine to make a better relay

Type "TQ" miniature telephone-type relays operate at about 150°F. and are used for power-switching duties – solenoids, valves and magnetic motors. The bobbin is molded of Du Pont "Zytel" nylon – chosen because of its lightness, strength in thin sections, and high insulating properties. It will not gas at operating temperatures.

Miniature telephone-type relays use "Zytel" nylon resin for the bobbin, and wire coated with "Teflon", to assure superior performance. Use the coupon below for complete property information on these Du Pont engineering materials.

The wire is coated with Du Pont "Teflon" tetrafluoroethylene resin. "Teflon" is an electrical insulating material that's especially suited for tough operating conditions. It has good thermal expansion properties and will not gas. The "TQ" miniature relay pictured here is the product of Advance Electric and Relay Company, Burbank, California.

Two-Way Portable Lifeboat Radio Uses Tough TEFLON® for Antenna Post



This antenna post of Du Pont "Teflon" tetrafluoroethylene resin has high dielectric properties, resists salt water and can take rough handling. (Radio manufactured by Marine Division, Mackay Radio and Telegraph Company, Inc., New York City, New York. Insulator of "Teflon" made by Tri-point Manufacturing & Developing Company, Brooklyn, New York.)

Resists cracking and chipping, won't corrode from salt spray

Designers have found another use for Du Pont "Teflon"– as the antenna post on a portable lifeboat radio. This radio for emergency use is buoyed up by encased air when it's in the water.

Conventional insulating materials tested for this antenna post failed. Some would chip or crack under the especially rough service this radio encounters. Other materials deteriorated from salt spray. Only Du Pont "Teflon" had the dielectric properties, strength and corrosion resistance to do this job dependably.

The superior properties of versatile Du Pont "Teflon" tetrafluoroethylene resin find a wide use in the electronics field. Fill out the coupon below for full property data about this versatile engineering material.

These wire supports molded of "Zytel" nylon resin (named "tombstones" because of their shape) can take any size wire bundle and eliminate the disadvantages of metal clamps. Besides saving many man-hours in installing airplane wiring, "Zytel" nylon standoff insulators are lightweight, take stress in all directions and are impervious to solvents — including gasoline and jet fuels. "Zytel" is also fungus-resistant, an excellent insulator and won't carbonize. (Stand-off insulators are manufactured by the Nylon Molding Corporation, Garwood, New Jersey, under license of Boeing Airplane Company, Seattle, Washington.)

NEED MORE INFORMATION? CLIP THE COUPON for additional data on the properties and applications of these Du Pont engineering materials.

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department
Room 418, Du Pont Building, Wilmington 98, Delaware

Please send me more information on the Du Pont engineering materials checked: ☐ "Teflon"• tetrafluoroethylene resin; ☐ "Alathon"• polyethylene resin; ☐ "Zytel"† nylon resin; ☐ "Lucite"• acrylic resin. I am interested in evaluating these materials for_____

NAME_____

POSITION_____

COMPANY_____

STREET_____

CITY_____ STATE_____

TYPE OF BUSINESS_____

•"Teflon", "Alathon" and "Lucite" are registered trade-marks of E. I. du Pont de Nemours & Co. (Inc.)

†"Zytel" is the new trade-mark for Du Pont nylon resin.

TO THE FINE ENGINEERING MIND
SEEKING THE CHALLENGING PROJECTS IN

TELEMETERING

TELEMETERING ENGINEERS experienced in research, design and development of all types of static and airborne telemetering systems are offered challenging career opportunities on advanced projects in the rapidly expanding Engineering Department at Convair in beautiful San Diego, California. These responsible positions call for experience in telemetering systems, planning and study; transducer design, selection and application; airborne and ground-based telemetering equipment design and development; and instrumentation systems installation design.

CONVAIR offers you an imaginative, explorative, energetic engineering department to challenge your mind, your skills, and your abilities in solving the complex problems of vital, new, immediate and long-range programs. You will find salaries, facilities, engineering policies, educational opportunities and personal advantages excellent.

SMOG-FREE SAN DIEGO, lovely, cool city on the coast of Southern California, offers you and your family a wonderful new way of life . . . a way of life judged by most as the Nation's finest for climate, natural beauty, and easy (indoor-outdoor) living.

Generous travel allowances to engineers who are accepted. Write at once enclosing full resume to:

H. T. Brooks, Engineering Personnel, Dept. 1008

CONVAIR

A Division of General Dynamics Corporation

3302 PACIFIC HIGHWAY SAN DIEGO, CALIFORNIA

☐ Accelerometers; Pickups

Withstand Temperatues to 2200°F

Accelerometers and pressure-measuring pickups that will operate under temperatures as high as 2200°F are now available from this firm.

The Accelerometer Model 2205 (illustrated) provides a dynamic acceleration range from 0 to 1000g. It weighs only 5 oz and is constructed of stainless steel, permitting operation under corrosive atmospheres. The unit features a high output of at least 10mv/g and a flat frequency response of 2 to 4000cy.

The Model 2502 Dynamic Pressure Pickup has a number of features, including: flat frequency response from 2 to 5000cy, and a large output of 40mv/psi in the 0 to 500psi pressure range. Units are available in ranges of 500, 1000, 2500, and 5000psi. Endevco Corp., Dept. ED, 180 E. California St., Pasadena 1, Calif. *These products will be displayed at the Wescon Show, Booth 1409.*

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

Mercury Switch

Gives Pulse Actuation

This mercury switch can be used to give pulse actuation to many devices where short-time operation without permanent closing of contacts is desirable. The glass tube contains a drop of mercury (or a mercury-thallium amalgam for low temperature operation). The tube can be rotated with very little power (such as a timing motor) around the axis of its two horizontal lead wires. When the glass revolves, the globule of mercury rolls past the inside electrodes, short-circuiting them for an instant. Then the current is immediately interrupted after the connection has been established, because the drop of mercury continues to fall to the other end of the tube. The unit shown has a contact time of approximately 50millisec and can handle 10amp peak. A larger unit handles 47amp, inductive.

The appearance of the switch is that of a closed back cartridge 1-1/2" long x 1.4" diam. From this cartridge extend rod contactors on each side 3/4" long x 1/4" diam. Tensitron, Inc., Dept. ED, Harvard, Mass.

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

A GREAT NAME CONTINUES GREAT NEW ACHIEVEMENT

Thomas A Edison

How Edison achieves extraordinary timing accuracy in a **thermal relay**

By calibrating each 501 Thermal Relay *after* hermetic sealing, EDISON provides unequalled timing accuracy – assures absolute production uniformity. Circuit designers can realize *all* of the benefits of a thermal relay without concern for changes in atmospheric pressure – or the problems of relay maintenance.

This exclusive method of calibrating, developed in the world-famous EDISON Laboratory, is just one of the features that have earned the EDISON 501 Relay an outstanding in-use record. A high degree of vibration and shock resistance, extreme light weight and typical EDISON construction ruggedness are but a few of the other features of the EDISON 501 Relay that lend it to such applications as these:

- Sustained over-current or over-voltage protection
- Integration of pulses or intermittent current
- Improving sensitive contact operation
- General control use
- Cathode protection
- "Holdover" circuits
- Motor starting

Send for complete information on the dependable EDISON 501 Thermal Relay – now.

Thomas A. Edison
INCORPORATED
INSTRUMENT DIVISION
55 LAKESIDE AVENUE
WEST ORANGE, NEW JERSEY

CIRCLE ED-126 ON READER-SERVICE CARD

FIRST MK 4 MOD 0 EQUIVALENT SIZE 11 PRECISION INDUCTION RESOLVER!

Available Immediately!

SIZE 11—Mark 4 Mod 0 Electrical Equivalent, Winding Compensated
Frame Size: 1.062"
Functional Error less than 0.1%
Perpendicularity: less than ±5 minutes

SIZE 15—Mark 4 Mod 0 Equivalent with accuracies and phase shift better than specified!

SIZE 23—Exceptionally high functional accuracy—better than .05%. Perpendicularity better than ±3 minutes.

ALSO AVAILABLE—All American Electronic SIZE 11, 15 and 23 Resolvers may be obtained with: HIGH IMPEDANCE NETWORK COMPENSATION, PARTIAL OR COMPLETE WINDING COMPENSATION, BROAD BAND, HIGH FREQUENCY RESPONSE.

Complete line of SERVO MOTORS, GEARED SERVO MOTORS, MOTOR TACHOMETERS, BRUSHLESS INDUCTION POTENTIOMETERS, MINIATURE SYNCHRONOUS MOTORS; *low and high temperature models.*

American Electronic Mfg., Inc.
INSTRUMENT DIVISION OF
AMERICAN ELECTRONICS INC.
9503 W. JEFFERSON BLVD., CULVER CITY, CALIF.
Engineering Representatives in all Principal Industrial Areas

Computer Storage Tube

For Binary-Digital Systems

The *6571* is a 3" storage tube designed primarily for use in binary-digital computer systems. It is of the single-beam type, utilizes electrostatic focus and deflection, has its storage surface on the inner surface of the faceplate, and requires an external signal-output electrode shaped to conform to and placed in contact with the entire area of the faceplate. Redistribution writing and capacitance-discharge reading are employed.

Features include: a storage surface having relatively uniform secondary emission to prevent "bad spots" on which information cannot be stored; a focused beam having an exceptionally small effective area, especially significant whenever a single storage element is addressed several times before neighboring elements are regenerated; and separate external connection for the collector to permit operation of the collector at a voltage slightly different from that of the ultor (grids 2 and 4) thereby enabling the collector to serve as an effective shield preventing cross-coupling between the electron gun and the external signal-output electrode. Tube Div., Radio Corp. of America, Dept. ED, Harrison, N. J.

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

☐ Ultrasonic Cleaner

Portable, High-Efficiency Unit

The Model C100 Ultrasonic Cleaner uses millions of tiny bubbles to blast dirt loose by an efficient scrubbing action which does not damage complex or delicate structures. It is for small and medium sized parts that must be cleaned of grease, dirt, or metal particles such as precision bearings. Designed for use with organic solvents such as "Turco-Solv" or trichlorethylene, it consists of a separate r-f generator and an ultrasonic cleaning tank assembly which includes cleaning tank, ultrasonic transducer, parts-holding basket, rinse spray nozzle, and solvent filtering and recirculation system. The 3gal cleaning tank is 11-1/2" x 8" x 8". The parts-holding basket is 4" x 4" x 1". Power input is 110v 60cy 5amp. McKenna Laboratories, Dept. ED, 2503 Main St., Santa Monica, Calif. *This product will be displayed at the Wescon Show, Booth 134.*

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

Typical digital phase-shift measurement set-up employing a BERKELEY Model 5510 Universal Counter & Timer, with a Shasta oscillator as reference frequency source and an oscilloscope to provide visual check.

Now-A Digital Method for Precise Phase Measurements

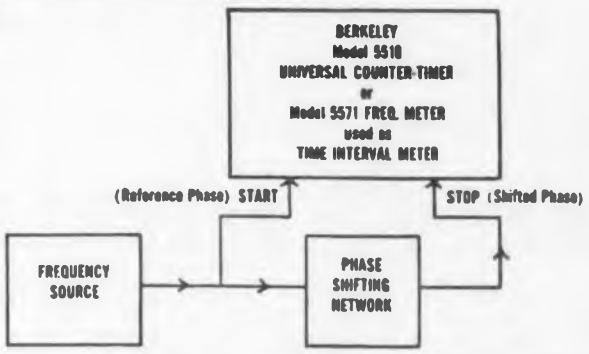
ADVANTAGES:

* No interpolation required—results displayed in direct-reading digital form (in degrees, mils, or any desired unit of angular measure).
* Accuracies to 0.1°
* Utilizes standard BERKELEY Universal Counter-Timer or Time Interval Meters.

APPLICATIONS:

1. Calibration of synchros and resolvers
2. Measurement of gain-phase characteristics of closed-loop servo systems.
3. Low frequency response studies
4. Precise phase measurements at audio and sub-sonic frequencies

TYPICAL INSTRUMENTATION:



COMPLETE DATA AVAILABLE

Data File 107 completely describes the theory and practice of digital phase measurement, including set-up and operational instructions. A copy is yours for the asking; why not write now? Please address Dept._____

Berkeley *division* 63
BECKMAN INSTRUMENTS INC.
2200 Wright Avenue, Richmond 3, California
INDUSTRIAL CONTROL SYSTEMS
ANALOG COMPUTERS • COUNTERS • TEST & NUCLEAR INSTRUMENTS
SEE OUR DISPLAY—Booths 724-725 WESCON, San Francisco, August 24-26

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

RADAR TRANSFORMERS AND INDUCTORS

WEIGHT OF A TYPICAL POWER SUPPLY WAS CUT 61 LBS. when redesigned for smaller embedded-layer coil. New and old coils in foreground illustrate typical size reduction now possible.

G-E EMBEDDED-LAYER COILS NOW . . .

Reduce radar transformer weight as much as 35 percent

G-E oil-filled radar components are now smaller and more compact—they can help you reduce the overall size and weight of your system. Tightly wound by a new process, embedded-layer coils use 20% less copper, cool faster, and are up to 53% smaller than paper-and-cotton insulated types. These features permit the use of smaller cores, less insulating liquid, and more compact tanks than before possible.

Progress Is Our Most Important Product

GENERAL ELECTRIC

SEND ME YOUR NEW RADAR COMPONENT BULLETIN

General Electric Co., Section A434-1
Schenectady 5, New York

Name.....

Address.....

City.....

State.....

CIRCLE ED-130 ON READER SERVICE CARD FOR MORE INFORMATION

Pressure Pickups

For High-Pressure Transients

These electrical resistance-type pressure pickups are designed to measure gas and liquid pressures in the higher ranges designed for missile testing, petroleum field-work, chemical plants, and other allied applications. They are available in gage and absolute models which feature high corrosion resistance and a flush-type diaphragm.

The Type 4-313 (illustrated) is designed for general-purpose measurements and provides for flange-type mounting, while the Type 4-314 is supplied with a threaded case for hydraulic system applications where it is desirable to have the diaphragm flush with the liquid. The pickups are available in 1000, 2000, 3000, and 5000psi gage and absolute ranges, with other ranges available on special order. Each pickup weighs approximately 50gr. The 4-313 has 0.625″ diam, while the 4-314 is 0.75″; nominal length is 1″.

The variable-resistance sensing unit incorporates a four-arm bridge to convert changes in diaphragm pressure to proportional changes in voltage output. Performance characteristics include: 20mv open-circuit output, full scale, on all pressure ranges at 5v d-c or a-c (rms) excitation; and linearity deviation of less than ±1.0% of full-scale output. Consolidated Engineering Corp., Dept. ED, 700 N. Sierra Madre Villa, Pasadena 15, Calif.

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

☐ Miniature Power Relay

Handles 10 Amps

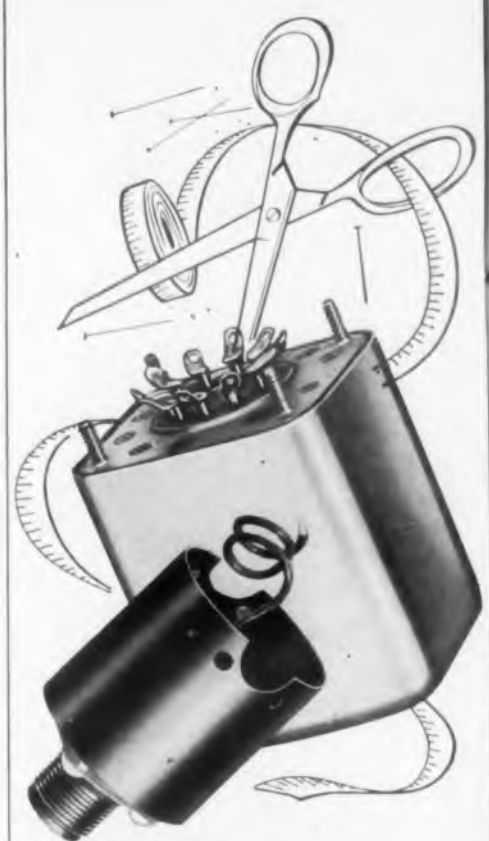
Reliable switching of heavy currents up to 10amp and good operating sensitivity are combined in this new miniature power relay. The contacts can be furnished in combination with bifurcated contacts for switching both heavy loads and low level signal loads with the same relay.

Contact combinations up to 4-pole, double-throw can be furnished as well as hermetically sealed or dust tight enclosures.

Available for 60cy a-c, any voltage to 440; d-c, any voltage to 230. Magnecraft Electric Co., Dept. ED, 3350D W. Grand Ave., Chicago 51, Ill. *This product will be displayed at the Wescon Show, Booth 1509.*

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

Custom Tailored FOR YOU!



Electron FILTERS

Electron Products manufactures radio interference filters that are tailored to the exact application for which you need them. These filters are potted and impregnated in "Epicon"° which allows for the widest possible temperature ranges with low insertion loss. The units are resistant to extreme shock and vibration.

Because Electron filters are *built* to the highest quality standards and are *designed* to fit your specific requirements they will give the *best* possible service in the *smallest* amount of space.

We solicit your inquiries.

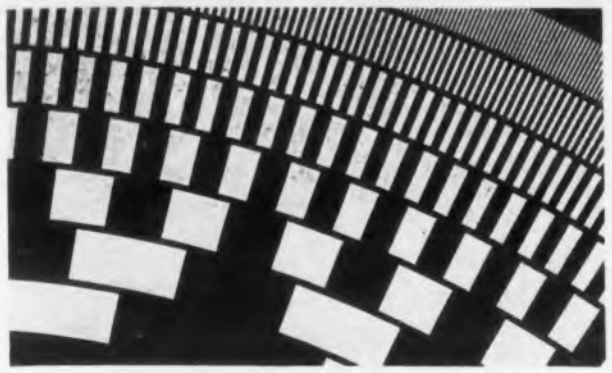
°*Our own improved exclusive formula epoxy resin.*

ELECTRON PRODUCTS, INC.

SALES OFFICE: 1220 E. Green St., Pasadena 1, Calif.
FACTORY: 919 Riverside Drive, Los Angeles 31, Calif.

CIRCLE ED-133 ON READER-SERVICE CARD

Gurley Standard Binary Code Discs Now Available in Four Versions



Gurley, manufacturer of the *standard* binary code disc for the electronics industries, is now able to supply four versions for use in either photo-electric, magnetic or contact types of pickups.

Containing concentric zones of information in the gray (reflected) code, the Gurley discs contain alternate clear and opaque sectors. Thin annular rings separating adjacent zones are opaque. Varying patterns record up to 8192 bits of information (65,536 on special designs!).

Four coatings are available: "Type T"—photoengraver's glue with colloidal (black) silver, essentially grainless; "Type R" with etched metal coating, for reflectivity and transmission contrast; "Type M" with chemically deposited ferrous alloy possessing both *magnetic* and optical transmission contrast; and "Type C"—metal bonded on glass for electrical *contact* use as well as in contrast of optical transmission. WRITE FOR BULLETIN 7000.

W. & L. E. GURLEY • 525 Fulton Street, Troy, N. Y.

GURLEY *since 1845*

CIRCLE ED-259 ON READER-SERVICE CARD FOR MORE INFORMATION

Silicon Area Rectifiers

Maximums of 25amp at 1000v

The type BD series of SiR Silicon Area Rectifiers have an average rectified forward current of 25amp for an inverse working voltage as high as 1000v. These rectifiers make it practical to design high power d-c generators and motors without commutators or brushes. The largest units are only 0.5″OD by 1″ long.

All three series have an extremely high back resistance, the rectification ratio being up to 10^9. Rectification efficiency is as high as 99.8%. Thirty different standards types in three sizes are available in a variety of voltage ratings from 50 to 1000v (peak 1200v). Average current ranges at 25°C are from 500ma to 25amp. Maximum wattage dissipation for the larger units is 50w with external heat dissipator. Silicon Corp. of America, Dept. ED, 120 Austin Blvd., Island Park, N. Y.

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

DATA SHEET

FAIRCHILD PRECISION POTENTIOMETERS

3″ diam.

Type 743 For linear and nonlinear functions

Type 753 For sine-cosine functions

These Fairchild potentiometers have all-metal-case construction providing high electrical and mechanical stability. The Type 753 provides a sine-cosine function in resistance ranges of 2K to 45K/quadrant, with standard conformity of ±0.5% peak to peak. The Type 743 can be furnished with either a round mandrel or flat card type resistance element to obtain linear or nonlinear functions, in resistance range of 1,000 to 250,000 ohms. Standard linearity is ±0.25%.

SAMPLES AVAILABLE ON ORDER

These units show how Fairchild can help you solve all your precision potentiometer problems. For more information write Fairchild Controls Corporation, Potentiometer Division, Dept. 140-61N2, 225 Park Ave., Hicksville, L. I., N. Y.

CIRCLE ED-260 ON READER-SERVICE CARD FOR MORE INFORMATION

A Motor for LOW SPEED OPERATION

If you are now manufacturing a product or developing a product where you need motion at slow speed, here is the motor for you. Hundreds of thousands now in use on cooking appliances, vending, coin operated, amusement, and advertising displays.

These AC gear motors are precision built and are being manufactured in volume for immediate delivery. For further information, send the requirements of your application to us. Special motors are built to meet your new product needs. Write today for data sheet.

MOTORESEARCH COMPANY

1600 JUNCTION AVENUE
RACINE, WISCONSIN

Designers and Manufacturers of
SPECIAL INDUCTION MOTORS

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

PENTA

PINT-SIZED POWERHOUSE!

Here is Penta's new PL-6549 beam pentode, a compact power package which is daily finding new applications where reliability, high efficiency at low and medium voltages, low driving power, and excellent linearity are required.

For r-f output of 50 to 250 watts, or audio output up to 325 watts, the PL-6549 outclasses all other transmitting-type tubes. The beam pentode construction improves linearity—provides distortion-free high peak power output in audio or linear r-f amplifier service.

RATINGS

Filament—Thoriated Tungsten (quick heating)	
Voltage	6.0 volts
Current	3.5 amps
Plate Voltage, Max.	2000 volts
Plate Current, Max.	150 ma.
Screen Voltage, Max.	600 volts
Plate Dissipation, Max.	75 watts

PENTA LABORATORIES, INC.
312 NORTH NOPAL STREET
SANTA BARBARA, CALIF

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

KAY *Mega-Sweep*

Wide Range, Wide Sweep

SWEEPING OSCILLATOR

Widest range of the Kay line of sweeping oscillators, the Kay Mega-Sweep provides continuous frequency coverage up through UHF-TV bands — 50 kc to 1000 mc. Widely used in radar system development and in alignment and testing TV and FM systems and components, as well as wide band IF and RF amplifiers and filters.

SPECIFICATIONS

Freq. Range: 50 kc to 1000 mc.
Freq. Sweep: Sawtooth, adjustable to 40 mc. Repetition rate, 50 to 100 c/s.
RF Output: High, approx. 100 mv max into open circuit. Low, 5 mv into open circuit.
RF Output Control: Microwave attenuator continuously variable to 26 db.
Output Waveform: Less than 5% harmonic distortion at max. output.
Meter: Provides crystal detector current for peak output.
Regulated Power Supply: 105-125 v., 50 to 60 cps. Power input, 100 watts.

Write for Catalog 100-A **Price: $465.00 f.o.b. factory.**

KAY ELECTRIC COMPANY
Dept. ED-8 14 MAPLE AVE., PINE BROOK, N. J.

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

NEW...

The SHURE "Micro-Gap"

MAGNETIC RECORDING HEAD

—so versatile it can be used for specialized precision applications, as well as in professional and fine quality tape recorders.

This new, versatile, high output magnetic recording head offers you these important advantages—

- **Excellent response** over an extremely wide frequency range.
- **Product uniformity.** Advanced Statistical Quality Control techniques assure strict adherence to close mechanical and electrical tolerances. Your design and production problems are considerably reduced.
- **Convenient, versatile mounting.** The "Micro-Gap" is available as a base-mounted (Model TR30) or as a rear mounted (Model TR35) unit.
- **Ease of adjustment** for proper gap alignment and angularity. Track and gap location procedures are greatly simplified.
- **Small size.** The "Micro-Gap" Model TR-35 measures only 45/64″ from face to the mounting shoulder. Model TR30 measures only 9/16″ from top to mounting shoulder. Both models are 31/64″ from top to bottom and 21/32″ from side to side. The "Micro-Gap" is ideal for miniaturization applications—it is one of the smallest commercially-available magnetic recording heads on the market.
- **Hum Shielding.** The "Micro-Gap" is shielded in a seamless, drawn high-permeability metal case which provides excellent hum reduction.
- **Stability.** Highly resistant to variations of temperature and humidity, being embodied in a stable, synthetic resin.

Write now for complete specifications on the "Micro-Gap" magnetic recording head. Shure research and development engineers can assist you with your specific magnetic recording problems.

"MICRO-GAP"

For all types of data gathering and recording equipment which require the use of a precision-quality recording head.

Magnetic Recording

Dictating Equipment

Pulse Width Recording
- Strain gauges
- Pressure gauges
- Velocity indicators

Direct Recording
- Noise analyses
- Vibration analyses

FM Recording
- Transient Phenomena
- Analog data
- Vibration-strain-stress

Direct Pulse Recording
- Computers
- Precision Systems

ENGINEERS:—

Excellent employment opportunities available for men having Research and Development ability in Magnetic Recording, Microphones, Transducers, Phonograph Reproducers. Write Chief Engineer, Shure Brothers, Inc.

SHURE *The Mark of Quality*

SHURE BROTHERS, INC.

225 W. HURON STREET • CHICAGO 10, ILLINOIS

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

Oscillator Sweep Drive

For Automatic Presentations

This sweep drive for oscillators replaces point - by - point frequency analyses by using a mechanical hand which turns an oscillator dial back and forth. Known as the Type 1750-A Sweep Drive, it is adjustable over a speed range from 1/2cy to 5cy. The sweep arc is independently adjustable from 30° to 300°. Flexible couplings are provided for attaching to knobs or shafts. The drive also provides a sweeping voltage, proportional to shaft angle, which is applied to the horizontal deflection plates of a cathode-ray oscilloscope. The output of the circuit under test supplies the vertical deflection voltage, and the frequency characteristic of a network can thus be displayed on the face of the oscilloscope.

The Type 1263-A Amplitude-Regulating Power Supply is available to provide cathode and plate power for oscillators and adjust the plate voltage to keep the oscillator output constant as the frequency is swept. General Radio Co., Dept. ED, 275 Massachusetts Ave., Cambridge 39, Mass.

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

☐ Wide Range VTVM

0.1 to 1000v

Designated as the type 800B, this multipurpose test instrument is the newest version of the type 800 Vacuum Tube Voltmeter. It is for use at frequencies as high as 700Mc as an a-c voltmeter with full scale ranges from 0.1 to 300v. As a d-c voltmeter, it has full scale ranges from 0.1 to 1000v using a standard probe, and provision for use with an RCA WG 290 high voltage probe for voltages up to 30,000v. As a d-c ammeter, full scale ranges are from 0.001μamp to 0.1amp; and as a d-c ohmmeter it measures resistances from 0.2 ohms to 5000 megohms.

The type 800B Vacuum Tube Voltmeter incorporates a high degree of negative feedback which stabilizes the instrument. Technology Instrument Corp., Dept. ED, Acton, Mass. *This product will be displayed at the Wescon Show, Booth 1113.*

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

EASY DOES IT!

get LFE's "flexible 411"

The highly accurate, all-purpose

OSCILLOSCOPE

EASY TO OPERATE

EASY TO SERVICE

6 X-axis plug-in units, ample bandwidth and sensitivity provide unmatched flexibility to handle your most advanced electronic research.

Yet, the 411 is competitively priced!

For more details about this "Flexible 411", contact your local LFE Engineering Representative or write LFE direct.

Inquiries on export sales should be addressed to:

Andrew S. Szucs, Inc.

50 Broad Street, New York 4, N. Y.

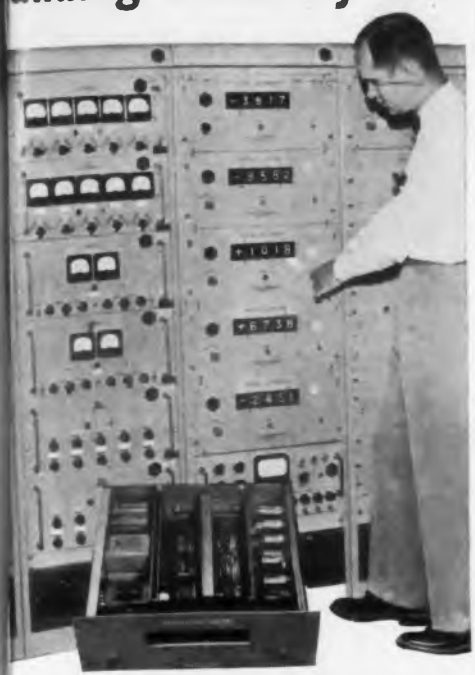
LABORATORY for ELECTRONICS Inc.

75 Pitts St., Boston 14, Mass.

OSCILLOSCOPES • COMPUTERS
COUNTING INSTRUMENTS
SOLID DELAY LINES • SPAR • STAR

CIRCLE ED-141 ON READER-SERVICE CARD

E-I Digital Voltmeters automatically digitize analog telemetry data



give Douglas engineers digital output *in real time*

The Telemetry Ground Station for the Douglas F4D Skyray monitors and records the various parameters of the aircraft during flight. The data, as recorded on magnetic tape, is then played back through the Data Reduction Station where it is plotted and digitized *in real time*.

Automatic operation

To compute in real time requires that the varying analog voltages from the aircraft be digitized. Six EI Digital Voltmeters, used in this application as analog-to-digital converters operating in real time, automatically digitize these voltages, and provide the necessary circuits for printing the data on an IBM tabulator.

Measure voltages within 0.01%

Although these particular EI instruments are special, in that they employ a unique, high-speed logic, standard EI Digital Voltmeters are now widely used for precise, automatic measurement and display of D.C. voltages. Operation is entirely automatic; no manual adjustments are required after calibration. Digital, in-line presentation eliminates reading and interpretation errors. Numerous models are available, including 3-, 4-, and 5-digit instruments. Special requirements given prompt attention. Write for catalog explaining these precision devices today.

Engineering representatives in major U. S. and Canadian cities

ELECTRO INSTRUMENTS INCORPORATED

3794 Rosecrans St., San Diego 10, California

CIRCLE ED-142 ON READER-SERVICE CARD

Sync Unit

For Video Circuit Evaluation

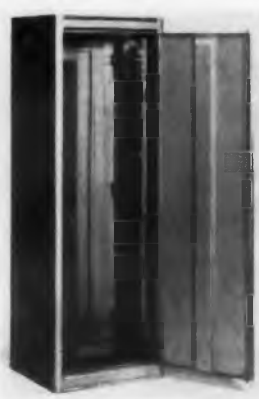
The "Keydsweep" is designed to eliminate spot frequency checking in video circuit evaluation. It provides internal sync pulses, and will operate with an external source of sync and blanking pulses giving pedestals and spacings in accordance with the source characteristics.

Requirements for external sync and blanking source are: sync, —0.5v min; blanking, —0.5v min into 75 ohms. Kay Electric Co., Dept. ED, 14 Maple Ave., Pine Brook, N. J.

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

☐ Panel Cabinet

In Three All-Welded Sizes



The DF is an all-welded cabinet rack with both a front door and rear door. The panel mounting angles are adjustable.

These units are available in three panel spaces: 61-1/4" x 19", 70" x 19", and 77" x 19". Three colors are offered; grey wrinkle, black wrinkle, and silver grey hammertone. Wyco Metal Products, Dept. ED, 6918 Beck Ave., North Hollywood, Calif. *This product will be displayed at the Wescon Show, Booth 309-310.*

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

☐ A-C Amplifier

With 250 Megohm Input Impedance

Model 102A Decade Isolation Amplifier has an input impedance of 250 megohms shunted by 3mmfd; gains of 0.1, 1, 10, 100, and 1000, accurate within 2%; and a frequency response of 3cy to 300kc. Other features include an accessory double-shielded low-capacitance probe, printed wiring, and optional cabinet or rack panel mounting; up to three units may be mounted on a 5-1/4" x 19" panel. Keithley Instruments, Dept. ED, 3868 Carnegie Ave., Cleveland 15, Ohio. *This product will be displayed at the Wescon Show, Booth 110.*

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

your KEY TO EXCELLENCE

phaostron

"777"

NEW!

The MODEL **"777"** VTVM is a completely self-contained, ready-to-use test instrument. Its accessories and the HF co-ax cable, DC Probe, AC line cord and instruction book **all fit** in the genuine California Saddle Leather carrying case that is furnished with the instrument.

- ✓ 42 UNDUPLICATED RANGES
- ✓ ILLUMINATED DIAL (5000 hour self-contained lamps)
- ✓ DIE CAST CHROME FINISHED BEZEL
- ✓ METAL CASE—unbreakable, ultra compact
- ✓ DOUBLY SHIELDED, time proven 200 microamp movement
- ✓ PERMANENT ACCURACY . . . 3% DC, 5% AC
- ✓ LARGE, EASY TO READ SCALES 4-7 8" LONG
- ✓ COLOR CODED SCALES: green-ohms; black-AC, DC; red-P. to P.
- ✓ 2 ZERO CENTER SCALES for FM DISCRIMINATOR ALIGNMENT
- ✓ SEPARATE RANGE and FUNCTION SWITCHES
- ✓ ONLY 2 JACKS for ALL MEASUREMENTS
- ✓ NEW HIGH STYLE, EASY-TO-USE CHROME BAR KNOBS
- ✓ DUAL PURPOSE HANDLE also serves as AC line cord reel

$69.95 "777" VTVM complete with Coaxial Cables DC Probes and Leather Case at your PARTS DISTRIBUTOR

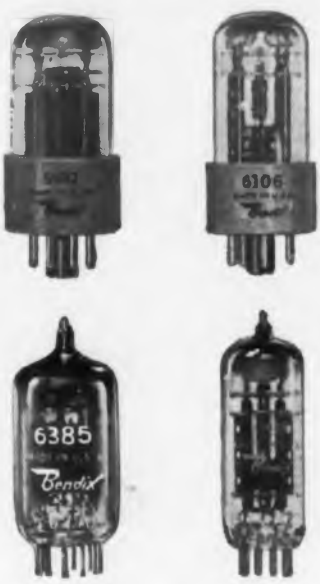
PHAOSTRON COMPANY • 151 PASADENA AVE. • SOUTH PASADENA, CALIF., U.S.A.

CIRCLE ED-258 ON READER-SERVICE CARD FOR MORE INFORMATION

DEPEND ON

Bendix Red Bank

RELIABLE ELECTRON TUBES



With electronic controls taking over more and more operational functions in military and industrial applications, it is becoming increasingly important that the electron tubes used be dependable under extremely severe conditions. This applies particularly to installations in aircraft where tubes must operate reliably at high altitudes, while subjected to continuous vibration, varying voltages and frequent shock. Because of their advanced design and construction . . . born of never-ceasing research and special production skills . . . Bendix Red Bank Reliable Electron Tubes have the dependability necessary to meet these severe operating conditions. You can depend on our long, specialized experience to give you the right answer . . . for all types of regular as well as special-purpose tube applications. Tubes can be supplied to both commercial and military specifications. Call on us for full details.

Manufacturers of Special-Purpose Electron Tubes, Inverters, Dynamotors, AC-DC Generators, Voltage Regulators and Fractional H.P. DC Motors.

DESIGNATION AND TYPE					TYPICAL OPERATING CONDITIONS		
Type	Prototype	Bendix No.	Description	Base And Bulb	Heater Voltage	Plate Voltage Per Plate	M.A. Load
5838	6X5	TE-3	Full Wave Rectifier	Octal T-9	12.6	350.	70.
5839	6X5	TE-2	Full Wave Rectifier	Octal T-9	26.5	350.	70.
5852	6X5	TE-5	Full Wave Rectifier	Octal T-9	6.3	350.	70.
5993	6X4	TE-10	Full Wave Rectifier	9-Pin Miniature	6.3	350.	70.
6106	5Y3	TE-22	Full Wave Rectifier	Octal T-9	5.0	350.	100.

Type	Prototype	Bendix No.	Description	Base And Bulb	Heater Voltage	Plate Voltage	Screen Voltage	Grid Voltage	Gm	Plate Current	Power Output
5992	6V6	TE-8	Beam Power Amplifier	Octal T-9	6.3	250.	250.	12.5	4000	45. MA	3.5 W
*6094	6AQ5 6005	TE-18	Beam Power Amplifier	9-Pin Miniature	6.3	250.	250.	12.5	4500	45. MA	3.5 W
6385	2C51 5670	TE-21	Double Triode	9-Pin Miniature	6.3	150.	—	−2.0	5000	8. MA	—

*Tube Manufactured with Hard (Nonex) Glass for High Temperature Operation (Max. Bulb Temp. 300°C.)

Bendix Red Bank

DIVISION OF

THE NAME Bendix AVIATION CORPORATION MILLIONS TRUST

EATONTOWN, N. J.

West Coast Sales and Service: 117 E. Providencia Ave., Burbank, Calif. • Export Sales: Bendix International Division, 205 East 42nd St., New York 17, N. Y.
Canadian Distributor: Aviation Electric Ltd., P.O. Box 6102, Montreal, P. Q.

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

Transistor Test Set

Measures Low and High Power Transistors

This test set handles point contact and junction transistors from minute up to high power types in the grounded base or grounded emitter connection. Bias ranges from 50μ-amps to 500ma full scale. There are two collector voltage bias ranges, 0-10 and 0-100v. All power supplies are self-contained.

Small signal parameters h_{11}, h_{12}, h_{22}, α, 1-α, are measured at 270cy by a powerful and stable self-contained oscillator and locked-in phase-sensitive voltmeter. All ranges of practical interest are provided at very low signal levels.

The unit permits measurement and recording (with accessory X-Y reorder) of all static characteristics and small signal parameters of all types and sizes of diodes and transistors. Scientific Specialties Corp., Dept. ED, Snow & Union Sts., Boston 35, Mass.

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

Servo Converter

In Variety of Outputs

The Model C104 Servo Converter is a miniature positional-servo system designed to MIL-E-5400 specifications for use in instrument - type applications. It contains a two-stage voltage-amplifier, a magnetic power-amplifier, a two-phase servo motor, a gear train, a follow-up potentiometer, and a synchro transmitter or some other type output device. Flexible design permits output choices of any one, or a combination of two or more of the following: mechanical shaft position, electrical angular (synchro), variable resistance, variable d-c voltage, variable a-c voltage, and coded digital.

The unit was designed especially for airborne measurements of such flight parameters as air-speed, pressure-altitude, free-air temperature, power plant temperatures, interior temperatures, control positions, etc. Size is only 3" x 4" x 4" exclusive of mounts and connectors. Weight is 2-1/4 lb. Datran Engineering Corp., Dept. ED, 3613 Aviation Blvd., Manhattan Beach, Calif.

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

CRITICAL QUALITY CONTROL

Means the Finest in Frequency Control in

Midland CRYSTALS

Midland makes more frequency control crystals than anybody else. Millions are used in two-way communications thruout the world.

Only a product of the highest quality rates that kind of demand. That's why you *know* your Midland crystal will do a completely dependable job for you.

The quality of Midland crystals is assured by exacting tests and controls through every step of processing. It's quality you can stake your life on — as our men in the armed forces and law enforcement do every day.

Whatever your crystal need — conventional or highly specialized... when it has to be exactly right, contact

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WORLD'S LARGEST PRODUCER OF QUARTZ CRYSTALS

CIRCLE ED-149 ON READER-SERVICE CARD

Radically
NEW RELAYS
Out of the future...

6 P.D.T. or 4 P.D.T.

30+G to 500 cps

15+G to 2000 cps

100+G Shock

with Deltronic MAGNA-LOK principle

Deltronic's radically new relays are specifically designed to meet high performance characteristics. With pure silver contacts for general purpose duty and specially compounded contacts for "dry circuit" or signal switching, they provide exceptional reliability over a wide range of applications, with low contact resistance and long life. Meet or exceed specifications of MIL-R-5757B and MIL-R-25018.

FEATURES: (DC-36, DC-34)

6 or 4 P.D.T.
Length (Body): 1.485"
Diameter: 1.19"
Weight: 4 oz.
Mtg. Centers: 1.562"
Life: 100,000 cycles (min.)
Temperature: −65°C to +125°C
Operate time: 8 ms.
Drop-out time: 3 ms.
Resistive load: 2 amps.
Contact resistance: .03 ohm
Insulation res. (min.) 1000 megohms
Volt. insulation: 1000 V.R.M.S.
Dry Circuit Applications
Micro amp switching
New compounded alloy contacts
Extremely low contact resistance

Deltronic's LOG-K feature incorporated in the DC-33C type D.P.D.T. relay, shown here, insures positive and reliable "snap-action" performance to 2000 cycles under 15+G vibration and 50+G shock. Also available Model DC-33-AC for operation at 60 to 400 cycles AC.

Write today for detailed information

Deltronic CORPORATION
Dept. ED
1507 Riverside Drive, Los Angeles 31, California

CIRCLE ED-150 ON READER-SERVICE CARD

Tubular Capacitors

Plug-In's for Printed Circuits

The "Type BC" phenolic - cased plug - in paper tubular capacitors are especially designed for use with printed circuits. They are encased in molded phenolic shells with two parallel lead wire terminals. These terminals are brought out from the end of the capacitor through a thermosetting plastic end fill compound, and are spaced a fixed distance so that they may be plugged directly into printed circuits and dip soldered.

The capacitor section is inserted in a pre-molded, mineral-filled phenolic shell. The element is sealed within the case by "Polykane" which bonds to the container wall and wire leads, barring moisture creepage, while at the same time holding the lead wires rigidly in place. Polykane will not soften, melt, or flow, even under soldering temperatures. Cornell-Dubilier Electric Corp., Dept. ED, S. Plainfield, N. J.

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

Frequency Calculator

Solves Resonant Circuit Problems

Problems involving frequency, inductance, and capacity are quickly solved with the "Calculaide Frequency Computer". It correlates, in one setting, the natural frequency and wave length of a circuit comprising a coil and capacitor with the physical dimensions of the coil and the capacity of the capacitor.

The calculator's range covers frequencies from 400kc to 3000Mc and wave lengths from 2 to 600 meters. It handles capacitances between 0.1 and 1000mfd. Inductance values which can be determined extend from 0.1 to 1500μh. The device performs calculations with coils of 1/4 to 5-1/2"diam, 1/4 to 10" length, 2 to 150 turns per inch of No. 10 to No. 35 gage wire.

Produced from three sheets of vinylite, the calculator is 6-1/4" in diameter, and semi-flexible. American Hydromath Corp., Dept. ED, 25-20 43rd Ave., Long Island City 1, N. Y.

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

CHICAGO STANCOR®

CONSERVATIVELY RATED INDUSTRIAL TRANSFORMERS

Typical units from the industry's largest and most complete line of transformers for electrical and electronic applications.

ISOLATION TRANSFORMERS

"KA" TYPE
tap switch, line cord and output receptacle

Primary 125/115/105 Volts. Secondary 115 Volts-50/60 cycles

PART NO.	RATING WATTS	MOUNTING TYPE
P-6160	100	KA
P-6161	250	KA
P-6298	500	KA
P-6125	1000	FK
P-6123	1500	FK

STEP-DOWN ISOLATION

"FK" TYPE
ceramic insulated input terminals, two output receptacles

Primary 250/230/210 Volts. Secondary 115 Volts-50/60 cycles

PART NO.	RATING WATTS	MOUNTING TYPE
P-6383	100	KA
P-6385	250	KA
P-6387	500	KA
P-6389	1000	FK
P-6390	1500	FK

STEP-DOWN AUTOTRANSFORMERS

"K" TYPE
line cord on input, output receptacle

"SD" TYPE
"Sealed-in-Steel" construction. Line cord and output receptacle

Primary 230 Volts. Secondary 115 Volts-50/60 cycles

PART NO.	RATING WATTS	MOUNTING TYPE
SD-50	50	SD
P-5062	80	K
SD-100	100	SD
P-5063	100	K
SD-150	150	SD
P-5064	150	K
SD-250	250	SD
P-5065	300	K
SD-500	500	SD
P-6141	500	K
SD-1000	1000	SD
P-6124	1000	FK

LINE ADJUSTING TRANSFORMERS

"PV" TYPE

Input voltage 65/75/90/100/115/130/145, output voltage 115: with selector switch and output voltmeter

PART NO.	RATING WATTS	MOUNTING TYPE
PV6441	150	PV
PV6442	350	PV
PV6443	500	PV
PV6444	750	PV

Full lines of Control and Power Circuit Transformers are also available from Chicago Standard

CHICAGO STANDARD TRANSFORMER CORPORATION

ADDISON AND ELSTON
CHICAGO 18 ILLINOIS

FREE CATALOGS listing these units, and over 1000 other CHICAGO-STANCOR transformers are available from your CHICAGO STANDARD distributor or by writing Chicago Standard Transformer Corporation.

Export Sales: Roburn Agencies, Inc., 431 Greenwich St., New York 13, N. Y.

CIRCLE ED-153 ON READER-SERVICE CARD FOR MORE INFORMATION

everything in Fluorocarbons...

the most complete service in parts and stock

■ United States Gasket Company offers precision parts fabricated from duPont TEFLON, Kellogg KEL-F, BAKELITE Fluorothene and other plastics. U.S.G. facilities provide cold molding and sintering techniques, compression molding, extruding and injection molding—quality controlled "from powder to part," to assure uniform electrical, chemical and physical characteristics of the highest quality.

U.S.G. also maintains a machine shop specially equipped for the precision machining of parts from fluorocarbon stock.

Come to U.S.G. for all your requirements—sheets, rods, tubing, tape, cylinders, bars, beading, electrical spaghetti—as well as custom-molded and machined parts.

Write for Catalog No. 300.

United States Gasket Company
CAMDEN 1, NEW JERSEY

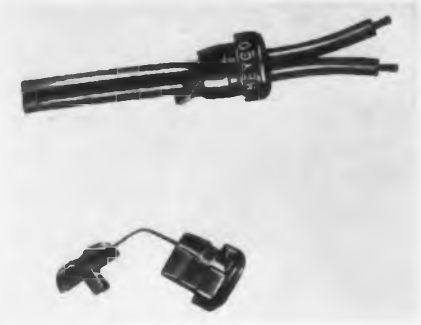
FABRICATORS OF FLUOROCARBONS AND OTHER PLASTICS

Representatives in principal cities throughout the world

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

Strain Relief Bushings

In One-Piece Construction



All popular-size "Heyco" strain relief bushings made by this firm are now of one-piece construction. The two component parts of the former units now are joined by an integral web of thin, tough nylon. This joining web is completely flexible, yet strong and will not crack or weaken with handling. When the bushing is assembled, the web in no way interferes with the cord.

These bushings firmly hold cord or cable in a vise-like grip and insulate it from the chassis. Push, pull, and twist are absorbed. They are available in straight-through or right-angle constructions for all standard wire types and cables. They are fully approved by UL and by the Canadian Standards Association. Heyman Manufacturing Co., Dept. ED, 100 Michigan Ave., Kenilworth, N. J.

CIRCLE ED-159 ON READER-SERVICE CARD FOR MORE INFORMATION

Computing Differential

Only 0.930" Long

This miniature differential gear unit is intended for use as a computing element in servo systems, gunfire control, missile navigational systems, and related equipment. It is of the hollow-shaft type, supplied completely assembled for easy mounting at any position on a shaft. This construction allows installation in a minimum space between permanent supports.

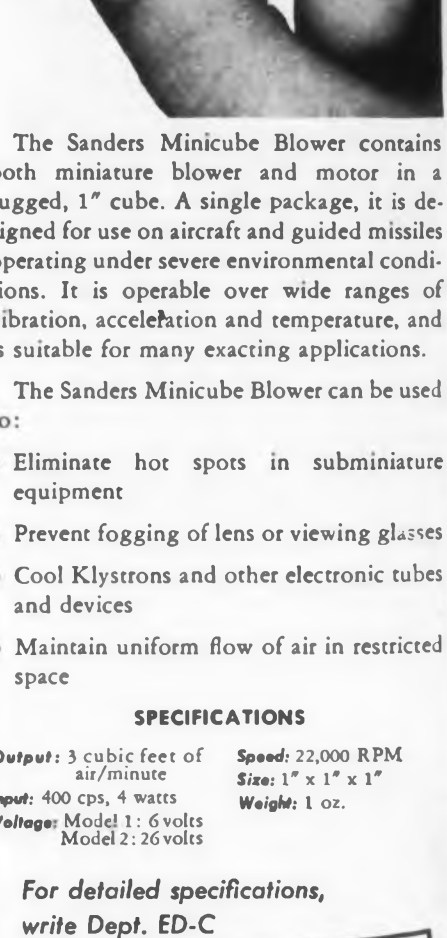
Models are available for either a 1/8" or a 3/16" shaft. Size has been held to a minimum (overall length is only 0.930"); yet backlash is less than 0°7'. Models with as low as 0°3' backlash are available on special order. Breakaway torque is less than 0.01 oz-in.

This unit is arranged for maximum flexibility in that spur gears of 48, 64, 96, or 120 pitch may be used on the ends, and gears are removable and interchangeable in the field. The unit as a whole may be either clamped or pinned to the shaft. Stainless-steel construction is used throughout, and the stainless-steel ball bearings are of the shielded type to exclude dirt. Reeves Instrument Corp., Dept. ED, 215 E. 91st St., New York 28, N. Y.

CIRCLE ED-160 ON READER-SERVICE CARD FOR MORE INFORMATION

SANDERS MINICUBE BLOWER

ruggedly constructed for use on aircraft and guided missiles



The Sanders Minicube Blower contains both miniature blower and motor in a rugged, 1" cube. A single package, it is designed for use on aircraft and guided missiles operating under severe environmental conditions. It is operable over wide ranges of vibration, acceleration and temperature, and is suitable for many exacting applications.

The Sanders Minicube Blower can be used to:

- Eliminate hot spots in subminiature equipment
- Prevent fogging of lens or viewing glasses
- Cool Klystrons and other electronic tubes and devices
- Maintain uniform flow of air in restricted space

SPECIFICATIONS

Output: 3 cubic feet of air/minute
Input: 400 cps, 4 watts
Voltage: Model 1: 6 volts; Model 2: 26 volts
Speed: 22,000 RPM
Size: 1" x 1" x 1"
Weight: 1 oz.

For detailed specifications, write Dept. ED-C

SANDERS ASSOCIATES INCORPORATED
NASHUA, NEW HAMPSHIRE

CIRCLE ED-161 ON READER-SERVICE CARD

BURROUGHS

facilities available for subcontract work

Specialists in digital and pulse techniques

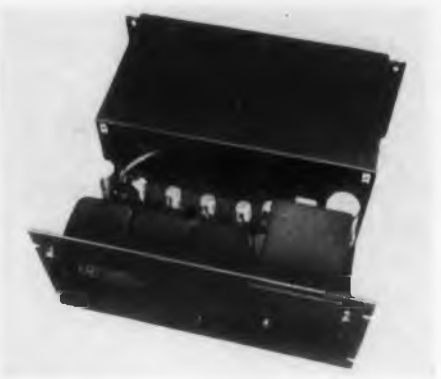
Expand your production without adding capital investment. Let Burroughs Electronic Instruments Division build your electronic assemblies or magnetic devices. Especially skilled and equipped for manufacturing in the digital and pulse fields, including prototypes and pilot systems. Facilities for complete testing from finished systems to components. Large technical staff. Burroughs offers you dependability, experience, security. Located in the heart of one of America's largest pools of trained electronics personnel. Write for quotation. *Burroughs Corporation, Electronic Instruments Division, 1209 Vine Street, Philadelphia 7, Pennsylvania.*

ELECTRONIC INSTRUMENTS DIVISION
Burroughs
FIRST IN PULSE HANDLING EQUIPMENT

CIRCLE ED-154 ON READER-SERVICE CARD

D-C Amplifier

Low-Voltage Linear Type



The "Powr-Amp" Model P d-c amplifier is an electronic low-voltage type designed to increase the speed and accuracy of practically all low level d-c voltage measurements. This instrument has laboratory precision and is completely compatible with inputs from such elements as thermocouples, radiation pyrometers, thermal converters, and d-c strain gages. Applications involve temperature measurement and control, telemetering, automation, and d-c preamplification.

Full-scale response is listed as better than 0.1sec. Long-time measurement accuracy is ±1/4% of input range for 5mv and up. Highly useful outputs can be established with input ranges as low as 0.2mv. Measuring 9" x 20" x 10", the amplifier is available in multiple fixed and adjustable ranges, with fixed or adjustable zero suppression circuits. Shipping weight for a rack-mounted amplifier is 50 lb, and 60 lb for a wall-mounted type. Hagan Corp., Dept. ED, P. O. Box 1346, Pittsburgh 30, Pa.

CIRCLE ED-155 ON READER-SERVICE CARD FOR MORE INFORMATION

Test Chambers

Perform Multiple Functions

The "Tenney-Mite", is a small-size, low-cost testing chamber, which can perform multiple functions in labs and medium-sized shops. It is available as a complete low or high temperature testing unit, a bath, or laboratory oven.

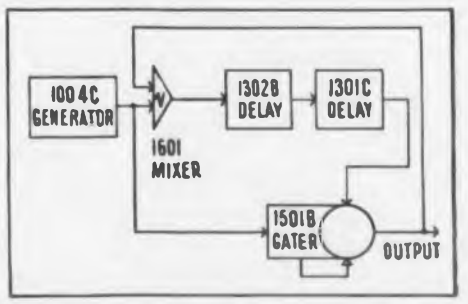
Three low temperature models are available: —40, —100, and —120°F. Pull-down on the basic —100°F model is approximately 60 minutes. Standard upper temperature is 250°F.

The unit operates on any regular 110v 60cy line, and occupies little floor space. Interior capacity is 1-1/2 cu ft. Five separate vertical and horizontal arrangements of the two cabinets are possible. Tenney Engineering, Inc., Dept. ED, 1090 Springfield Rd., Union, N. J.

CIRCLE ED-156 ON READER-SERVICE CARD FOR MORE INFORMATION

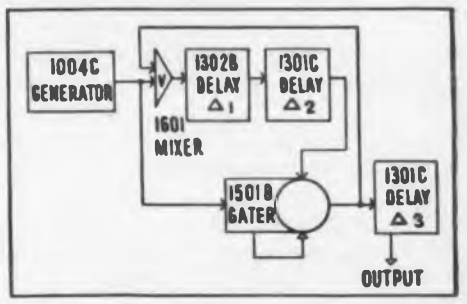
Pulse sequence changed in 10 minutes with BURROUGHS PULSE UNITS

1. Multiple pulse group generator. Number of pulses in group can be changed by varying delay time in pulse gater. Group repetition rate is varied by adjusting frequency of pulse generator. Distance between pulses is continuously variable by means of a front panel control knob.



2. 10-minute changeover. Engineer simply connects one new delay unit into the system and sets up controls for new pulse sequence. Units are matched to each other; so no buffers are required. Units connect together through standard cables.

3. Pulse train generator. Presto! A completely new pulse system that generates trains of pulses of variable width. Panel controls give engineer easy adjustment of pulse number, pulse width, interval between pulses, spacing of pulse trains.



Burroughs CORPORATION
ELECTRONIC INSTRUMENTS DIVISION
1209 Vine St., Dept. 4-H, Phila. 7, Pa.

Send me detailed literature on Burroughs Pulse Units

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FREE ENGINEERING SERVICE

Let Burroughs engineer a system for you. Next time you have a problem involving pulses, write Burroughs, giving the pulse sequence desired. Get back complete information on how you can build the needed pulse system in just minutes with Burroughs Pulse Units. Prove to your management how much money and time you can save. Write or send coupon for literature.

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

In today's atmosphere of new horizons being sighted, new frontiers being pushed back, and everyone out-pioneering his neighbor, it is pleasant to find that one of our own products has stumbled over the threshold of opportunity, firmly wedging its foot against the door to a whole new world of applications. What especially interests us is that the "product", the AC version of our Series 41 relay, had, until now, lead a notoriously humdrum sales life. (Oh, it has *bad* some perfectly good uses: e.g., it performed admirably in electric blanket controls. It's just that AC applications never seemed to fire anyone's imagination very much.)

But returning to the 41's NEW WORLD—and what it means to YOU . . . (1) commercial development of broad area cadmium sulfide photocells* of hithertofore unheard of (output 2.5 ma. rms at 50 volts, 2 foot-candles) sensitivity, now makes possible the construction of greatly simplified, "amplifier-less" AC photoelectric devices, and (2) the Series 41 is probably the best low cost AC relay available with sufficient sensitivity (0.10-0.15 VA) for such use. Conceivably, such a photoelectric control might consist of simply an AC line cord, broad area CdS cell and a 41. (Of course, if you *want* to fuss around with rectifiers, we have some capable DC relays for power switching,—but who hasn't?)

At this stage, we know of at least one manufacturer of photoelectric controls already re-designing his devices along the lines indicated, and we suspect this signals some sort of beginning. In case you have some ideas, you can get basic data sheets describing the 41 just by asking. We'll also give you the benefit of what application experience we've had to date, bearing in mind this *is* a new world.

**for sale elsewhere, not here.*

SIGMA

SIGMA INSTRUMENTS, INC.
91 Pearl Street, So. Braintree, Boston 85, Mass.

CIRCLE ED-162 ON READER-SERVICE CARD FOR MORE INFORMATION

Crystal Calibrator

Uses WWV Signals

The Model 542 R-F Crystal Calibrator, a compact, portable source of harmonics of 1Mc, 100kc, and 10kc, utilizes signals from *WWV* to assure a high order of accuracy. Designed especially for frequency measurement or for the calibration of receivers and transmitters, it is also particularly useful as a marker source for panoramic presentations.

Built in is a mixer and audio amplifier to facilitate comparison or accurate tuning of the fundamental and harmonics of its r-f source with the *WWV* transmission. No accessory equipment other than a pair of earphones or some form of null detector is needed. As a source of signals, the Model 542 is useful to 1000Mc. Accuracy of output frequency is within 0.001%, and the short term stability is in the order of one part per million. The unit's aluminum case measures 6-1/2" x 11" x 7". Metronic Inc., Dept. ED, P. O. Box 549, New London, Conn.

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

VTVM

Miniature Panel-Mounted Unit

The Model F, a complete d-c vacuum tube voltmeter, can be mounted in operating or test equipment without exceeding the area required by a standard panel meter. The instrument consists of a standard 4" rectangular meter that has a small housing extending approximately 3" from the rear of the meter movement. Complete amplifier and power supply circuits are contained within the housing, and terminals are available for d-c signal input and for 60cy power input.

The front panel of the meter contains two controls: a switch to remove the input signal, and a zero adjustment. An additional control is available at the rear for calibration adjustment. Accuracy is 3%, and input impedance is 10 megohms. Voltmeters are available in single-scale sensitivities ranging from 1 v to 300v. Multiple-scale operation can be readily tailored to meet exact equipment requirements, at the factory or by the purchaser. Trio Laboratories, Inc., Dept. ED, 3293 Seaford Ave., Wantagh, L.I., N. Y.

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

Molded Units Have All-Weather Protection

A Raytheon transformer molded with Acme compound

WITHOUT METAL CASES

For example—

ACME 2002 POTTING COMPOUND is unaffected by climatic changes and assures 100% protection against extremes of temperature ranging from —100° F. to +185° F.

Developed to withstand elevated and subzero conditions, ACME 2002 forms a hard, moisture-proof seal that will not crack or become brittle when subjected even to *sudden* changes in temperature. Exterior casings are not necessary.

There are many Acme Compounds for various applications. Let us help you.

Integrated Electrical Products of Highest Quality for Over Fifty Years

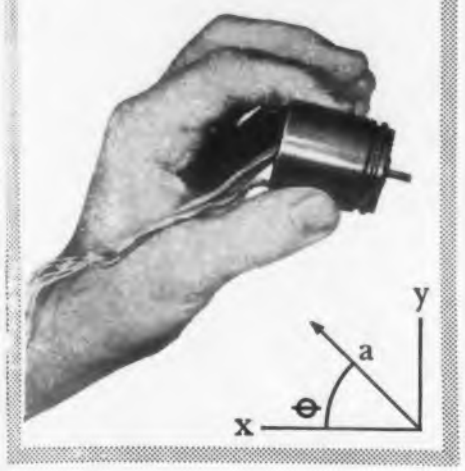
ACME WIRE CO.
NEW HAVEN, CONN.

MAGNET WIRE • COILS
VARNISHED INSULATIONS
INSULATING VARNISHES
AND COMPOUNDS

CIRCLE ED-165 ON READER-SERVICE CARD

TELESYN® 400 CYCLE RESOLVERS

from FORD INSTRUMENT



- **STANDARD RESOLVERS** in Sizes 15, 23 and 31
- **RESOLVER SYSTEMS** incorporating size 23 or 31 resolvers, network box and amplifier.
- and **SPECIALS** designed to the particular application.

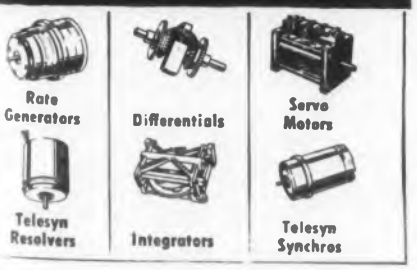
Ford Instrument's *Telesyn* Resolvers – precision-built for the extreme efficiency and accuracy of the Company's computers and control systems – are available to meet your *own* quality requirements.

FREE – Fully illustrated data bulletin gives specifications and performance information. Please address Dept. ED.

69

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

Ford Instrument's standard components



CIRCLE ED-166 ON READER-SERVICE CARD

Traveling-Wave Tube Amplifiers

Feature Electronic Tuning

This series of three dispersive traveling wave tube amplifiers features electronic tuning across their respective frequency ranges with 5db bandwidths from 15 to 20% of center frequency. Tuning is accomplished by varying or sweeping a single voltage without any complementary mechanical adjustments. The amplifier should find use in receiver applications requiring a tunable filter or tunable r-f input to achieve a panoramic display. The narrow band characteristics suggests its use for i-f amplifiers and similar extremely high-gain, narrow-band amplifier applications. The frequency band may be traversed in a fraction of a microsecond.

Chracteristics of the three tubes span the frequency ranges of 0.5-1kMc, 1-2kMc, and 2-4kMc, with tuning voltages of 1015-550, 920-380, and 2280-1160v, respectively. Gains are in the order of 10db at the low frequency end of the band and 25db at the high frequency end. Huggins Laboratories, Inc., Dept. ED, 711 Hamilton Ave., Menlo Park, Calif.

CIRCLE ED-167 ON READER-SERVICE CARD FOR MORE INFORMATION

Capacitor Induction Motors

In Variety of Small Units

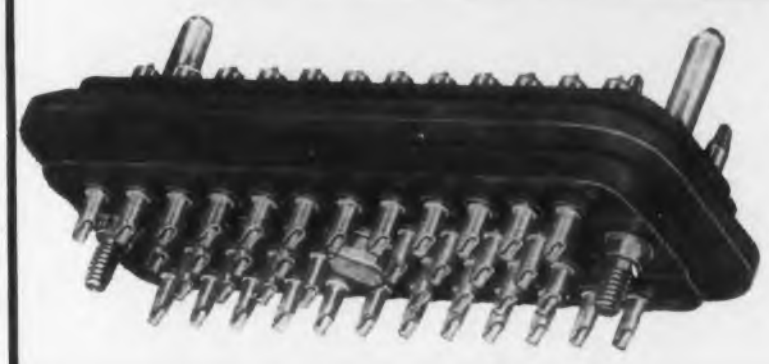
A line of capacitor induction motors is offered by this firm for use in electronic equipment, automatic devices, business machines, control equipment, antenna drives, and similar applications. The motors are available in frequencies of 60 and 400cy, sized at 3-7/8″ diam for self-cooled, continuous duty, and 3-5/16″ diam for fan or intermittent duty. Horsepower ranges are from 1/10 to 1/100 at all standard voltages, 1, 2, or 3 phase. Maximum weight for any motor design is less than 5 lb.

The motors are shock resistant and can be provided with ball or sleeve bearings, a choice of Class A or H insulation, and bracket, face, or strap mounting. Shaft configuration and size can be varied to suit applications. The 60cy models have speed ranges of 1100, 1650, and 3300rpm, and 400cy models have ranges of 5600, 6800, 11,000, and 22,000rpm. Eastern Air Devices, Inc., Dept. ED, 391 Central Ave., Dover, N. H.

CIRCLE ED-168 ON READER-SERVICE CARD FOR MORE INFORMATION

new... precision **Continental Connectors**

Series 'GA'



40 Contacts... spring loaded for quick release

Quick Release **PRESSURIZED CONNECTORS** for guided missile and similar applications

Here's the connector you can specify for pressurized equipment without fear of dangerous air leakage. The Series "GA" plug is molded from Orlon filled Diallyl Phthalate. When subjected to a pressure differential of 30 PSI at 25° C, leakage is less than 1 cubic inch of air per hour. This series is available with hood and cable clamp. Gold plated, nickel silver contacts take #16 AWG wire, and each is spring loaded for easy release. A spring action center screwlock permits quick, easy release or engagement without damage to the unit.

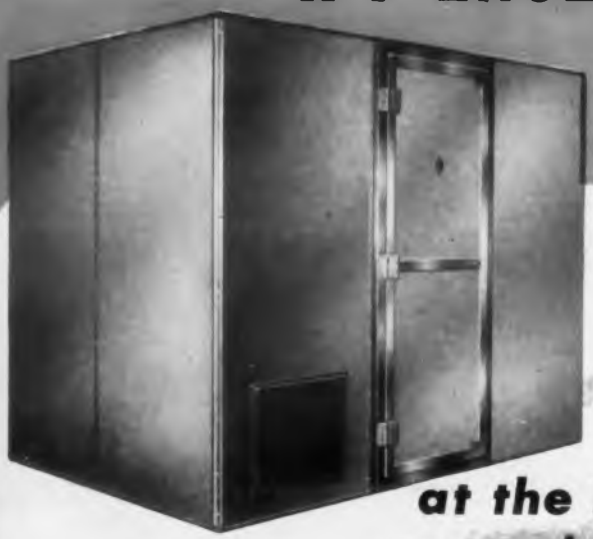
Write for complete technical data without obligation.

Note: Complete Continental Connector Catalog, covering subminiature, printed circuit, hermetic seal, pressurized, high voltage and power connectors, is available on request. Send us your name and title on your company letterhead.

Electronic Sales Division
DeJUR-Amsco Corporation,
45-01 Northern Boulevard, Long Island City 1, N. Y.
DeJUR

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

NOW SHEET METAL R-F ENCLOSURES



at the lowest price ever

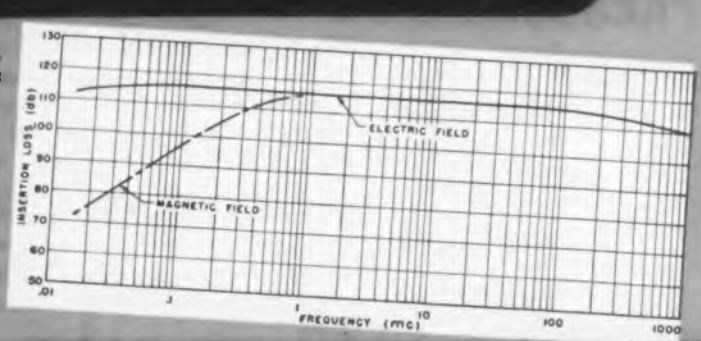
Offering all the advantages of sheet metal construction, Ace's new *galvanized* sheet metal enclosure is easily erected — ideal for use indoors or out — readily weather-proofed for any climate — safely transported assembled or disassembled — ideally suited for mobile units—constructed to take a real beating in the toughest kind of service.

Furthermore, you get top attenuation across the entire frequency range, typical of all Ace shielded enclosures. See curve below.

This new low priced enclosure uses the famous patented Lindsay Structure, with solid 24 gauge galvanized steel panels fastened to rigid steel channels forming leak-proof seams. Service entrances can be provided to meet every need, from power and water to forced air ventilation or air conditioning systems.

Get complete information now on this new solution for your r-f interference problems. Write for new catalog which contains performance and construction data on every type of ACE Shielded Enclosure.

Plotted by an independent electronic interference measurement laboratory.



SHIELDED ACE ROOMS

ACE ENGINEERING & MACHINE CO., INC.

3644 North Lawrence Street • Philadelphia 40, Pennsylvania

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

Electronic Computer

For Engineering and Research

This high-performance moderately-priced electronic computer is capable of solving the lengthy and complex problems of research and engineering organizations. It incorporates an improved two-address command structure which permits greatly increased versatility. The commands provide for addition, subtraction, multiplication, and division, as well as branching and other logical operations.

Standard input and output devices furnished with the computer include an electric typewriter, a photoelectric tape reader, and a mechanical tape punch. Accessory magnetic tape units are available for additional storage or input and output purposes. As many as four magnetic tape units may be used to store an additional 600,000 words. Auxiliary equipment is also available to permit the use of punched cards and an incremental graph plotter.

The cabinet is only 27″ x 30″ x 60″ high. Single-phase power requirements are only 3kva. Because the computer cabinet is mounted on casters, it can be easily relocated. Bendix Computer, Dept. ED, 5630 Arbor Vitae St., Los Angeles 45, Calif.

CIRCLE ED-171 ON READER-SERVICE CARD FOR MORE INFORMATION

Power Tetrode

Ceramic Radial Beam Type

The *4X5000A*, a radial-beam power tetrode, is constructed entirely of ceramic and metal, thereby offering greater electron-tube reliability and increased immunity to damage from thermal and physical shock. With a plate dissipation rating of 5000w and a power output of 16kw in Class C telegraphy service through 30Mc, the unit fills a power gap in the tetrode field. Especially suitable for single-sideband operation, it delivers 10kw ouput in Class AB_1 service and handles high inputs without going into the positive grid region.

The simple coaxial structure allows low lead inductance, and an integral finned anode permits improved cooling with low air pressure. Mass production economy and uniformity are assured by a stack-type construction. Eitel-McCullough, Inc., Dept. ED, San Bruno, Calif.

CIRCLE ED-172 ON READER-SERVICE CARD FOR MORE INFORMATION

3 new polyphase TRANSISTOR ANALYZERS

pic

CURRENT GAIN METER & CURVE TRACER
Model TA-1A

- Measures current gain of P-type and N-type point contact transistors or NPN and PNP junction transistors.
- Measures α and β on a direct reading 4" panel meter—either emitter to collector or base to collector current gain.
- Plots α vs I_e, and β vs I_b as an oscilloscope display.

pic

NEGATIVE RESISTANCE & CHARACTERISTIC CURVE TRACER
Model TA-2A

- Traces all of the negative resistance curves of point contact transistors.
- Traces the collector characteristics, R_{22}, (grounded base or grounded emitter) for junction and point contact transistors.

pic

FAMILY CURVE TRACER
Model TA-3A

- Accommodates P and N type point contact transistors; PNP and NPN junction transistors.
- Displays R_{12}, R_{22}, H_{12} curves in the grounded base connection, and R_{22} curves in the grounded emitter connection.
- Provides an internally generated calibration signal.

Supplied in sturdy ash cabinets with front panel suitable for relay rack mounting.

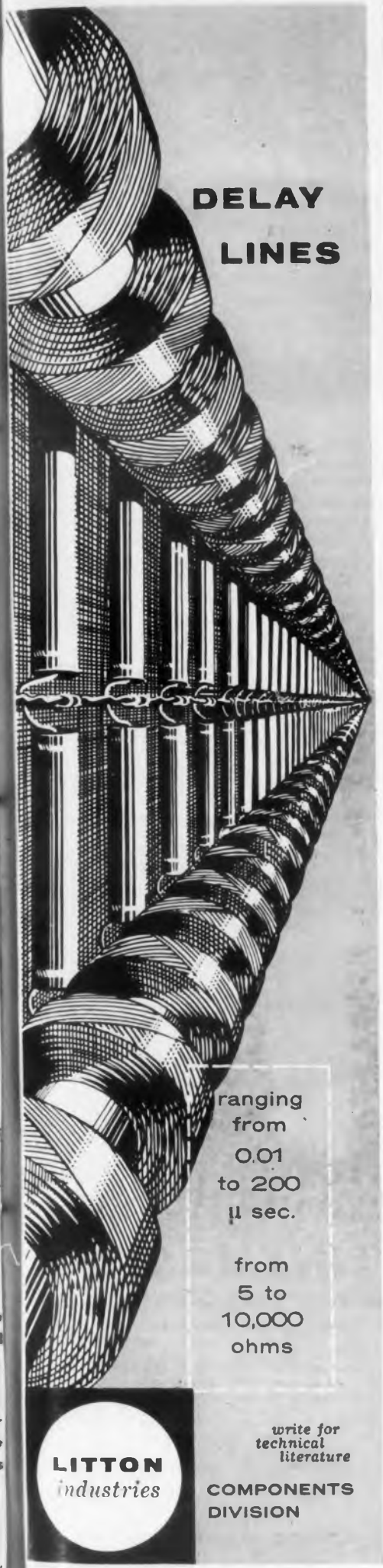
WRITE FOR INFORMATION... Bulletins include complete specifications and price lists.

pic

POLYPHASE INSTRUMENT COMPANY

BRYN MAWR, PENNSYLVANIA

CIRCLE ED-173 ON READER-SERVICE CARD



LITTON *industries*

write for technical literature

COMPONENTS DIVISION

336 north foothill road, beverly hills, california • crestview 4-7344
345 s. fulton ave., mount vernon, new york • mount vernon 7-6609

CIRCLE ED-174 ON READER-SERVICE CARD

☐ Marker-Pulser

Locks All Outputs

In this combination precision marker generator and pulse generator, all outputs are locked together to provide jitter-free synchronization of output pulses, scope-marker pulses, and scope-synchronizing pulses. The output pulses and scope-synchronizing pulses are variable with respect to each other as well as to the scope markers. Measurements of time delays in increments of 0.01μsec are made rapidly and easily by means of the calibrated dial.

Output pulse width is 0.10μsec; amplitude, 0-100v; rise and fall time, 0.03μsec; delay, 0-1μsec (course), 0-0.1μsec (fine, calibrated); repetition rate, 100-5000pps. Synchronizing pulse width is 3μsec; amplitude, 5v; delay, 0.50μsec. Brubaker Electronics, Dept. ED, 9151 Exposition Dr., Los Angeles 34, Calif. *This item will be displayed at the Wescon Show, Booth 156.*

CIRCLE ED-175 ON READER-SERVICE CARD FOR MORE INFORMATION

Vibration Isolator

Dampens in All Directions

The "All-Angl" mount is designed essentially for operation under the conditions of violent maneuvering, high steady-state acceleration, and vibrations at all frequencies. Its internal construction permits loading in any mounting position, even horizontal and inverted, and consists of seven principal parts. Two conical steel springs support the load; a split nylon washer between two steel washers provides vertical and lateral friction damping; two molded nylon spring seats also serve as top and bottom snubbing washers.

Because of effective friction damping properties, mounted equipment will be subjected to less than 300% of the carrier's vibration. The new isolator has a higher than usual natural frequency, to meet the needs of jets and missiles.

The present Miniature Model B22-BB, is available in four spring stiffnesses providing for four maximum loads; 1/2, 1, 2, and 3 lb per mount. Production of isolators capable of handling up to 40 lb per mount is expected. Barry Controls, Inc., Dept. ED, Watertown, Mass.

CIRCLE ED-176 ON READER-SERVICE CARD FOR MORE INFORMATION

avoid breakdown at high power

WITH A

LITTON *industries* rotary joint!

rated at 250 kw, joint carries up to 700 kw without breakdown

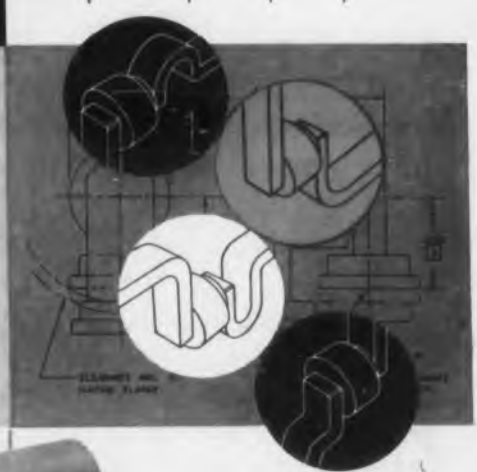
Broad band Litton Rotary Joints are engineered to provide a generous extra margin of safety for today's high powered microwave systems. Precision assembly, new methods of construction, and a unique dielectric application permit these components to handle power far in excess of the 250 KW at which they are nominally rated.

Preloaded ball bearings are used to assure maximum mechanical reliability and service life. Full 360° rotation is provided. Joints may be supplied with either a pressure or weather seal, or both.

Litton Model	frequency	rated power	VSWR	for waveguide
H250R	8.5-9.6 KMC	250 KW	1.10 max.	RG-51/U or RG-68/U
X250R	8.6-9.6 KMC	250 KW	1.15 max.	RG-52/U or RG-67/U

FLEXIBLE DESIGN permits ready adaptation to your particular application.

Litton Rotary Joints are compact, rugged, and can be readily modified to solve virtually any antenna packaging problem. You supply the specifications—length, configuration, flange type—and Litton will furnish the waveguide runs as integral parts of the rotary joint. Thus, potential breakdown points are eliminated.



LITTON INDUSTRIES MAGNETRON LOAD ISOLATORS

. . . insure concentration of energy in the useful pass band of your system. By employing the unidirectional properties of magnetically polarized ferrites at microwave frequencies, Litton Load Isolators permit high power magnetrons or klystrons to operate satisfactorily into long lines terminated in poorly matched loads. They reduce frequency pulling and moding; provide broad band operation with high isolation; present low input VSWR.

LITTON HIGH POWER ISOLATORS improve performance in high power radar and other microwave systems.

LITTON LOW POWER ISOLATORS for laboratory use, permit you to obtain maximum performance from your X band equipment.

Litton Industries offers an integrated microwave engineering service. We will manufacture waveguide assemblies to your specifications or drawings . . . or engineer special microwave components to meet your particular requirements.

LITTON *industries*
COMPONENTS DIVISION

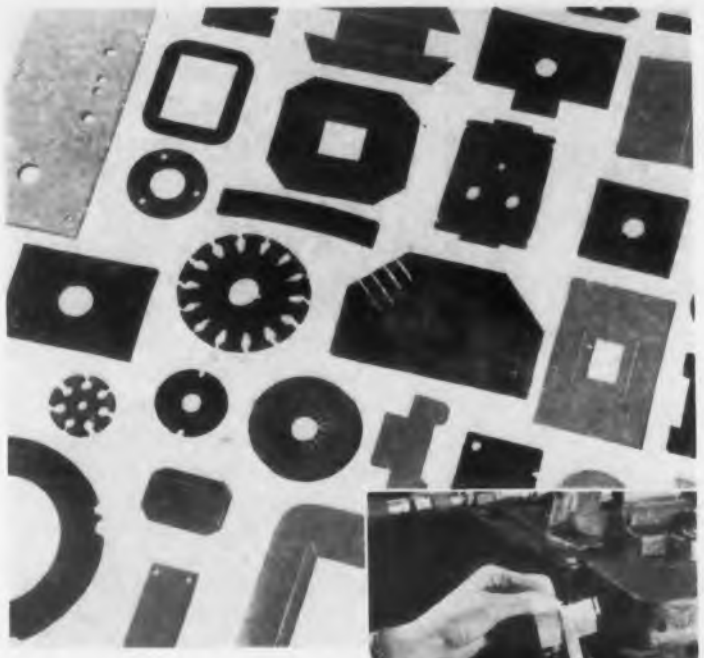
Write for complete data and name of nearest representative . . .

336 N. Foothill Road,
Beverly Hills, California
CRestview 4-7344

215 S. Fulton Ave.,
Mount Vernon, New York
Mount Vernon 7-6609

Other precision products of the Litton Components Division include: Precision Potentiometers, Metal Film Resistors, Delay Lines

CIRCLE ED-177 ON READER-SERVICE CARD FOR MORE INFORMATION



Cut Assembly Cost with FABRICATED Inmanco Electrical Insulation Parts

By using Inmanco completely fabricated electrical insulation parts, many manufacturers of electrical equipment are cutting costly assembly time. Inmanco parts slip into place easily because specialized fabricating know-how insures accurately fabricated insulators.

This is made possible by IMC's modern, high-speed equipment designed to shear, saw, slit, die-cut, crease, mill, form or cuff exactly as you specify. IMC also has available a complete line of insulating materials for parts, including papers, varnished cloth, combination insulation, fibre, laminates, etc.

Contact your nearest IMC office or representative for more information on fully fabricated electrical insulation parts that save time and cut cost.

Send your blueprints or specifications, and ask for Inmanco Product Bulletin No. 499 today.

INSULATION MANUFACTURERS CORPORATION

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— AUTHORIZED REPRESENTATIVES —

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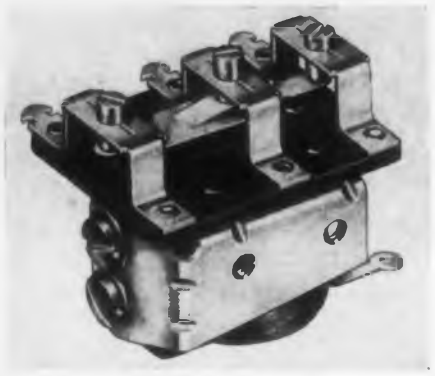
Campbell-Bowling Elec. Co. Inc. 100 S. Jefferson St. Phone Central 6-5390	Harry D. Dreher 15 Lawrence Ave. Phone TUxedo 8-2577	Manufacturers Specialties Co. 1272 West Clybourn Street Phone Division 6-5488	R. A. Holden, Inc. 1298 Harmon Place Phone Geneva 5353	W. C. Johnson 101 Huber Court Phone 3-7786

*LOCAL STOCKS AVAILABLE AT THESE LOCATIONS

CIRCLE ED-178 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Relay

Adjustable Over Wide Range



This small, sensitive spdt relay. the "SO" type, occupies only 1-1/8" x 1-7/32" x 1-1/4" and weighs 1-1/2 oz. It is set at the factory to operate on 10mw. The user can adjust it down to 2mw, or any desired pick-up or drop-out. A balanced armature provides extremely sensitive operation.

Ruggedly constructed, the unit performs with high efficiency. Life expectancy is 250,000 operations at a contact rating of 1.5amp. Vibration resistance is 20g at 10-55cy, 5g at 10-500cy. Shock resistance is 10g. All contacts are above ground, and flexible pigtail connections which might cause adjustments to change are eliminated.

Three standard coil resistances are available: 4000 ohms, 6500 ohms, and 10,000 ohms. Maximum allowable coil rating is 3w. Temperature range is —55 to + 85°C. Units are available in open types, dust-tight, or hermetically sealed enclosures. Advance Electric and Relay Co., Dept. ED, 2435 N. Naomi St., Burbank, Calif.

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

Preset Counters

For Close Control Uses

Designated as the DS-8600 Series, these reliable and rugged preset counters will control with absolute accuracy any counting operation after a preselected total has been reached. Any electrical, mechanical, or optical event which can be converted into electrical impulses can be counted and controlled. Photocells, magnetic coils, or switches may be used as transducers.

Offered in five models, the counters have count capacities (dependent on the number of decades) from 100 to 1,000,000. All units operate on 117v ±10%, 50-60cy. The Computer-Measurement Div., Detectron Corp., Dept. ED, 5528 Vineland Ave., N. Hollywood, Calif.

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

CIRCLE ED-181 ON READER-SERVICE CARD FOR MORE INFORMATI

This is the EXECUTIVE by LINEMASTER®

America's Foot Switch Leader

PRICE ONLY $6.50 list less discount

Size 4" x 4⅝" x 1¼". Weight 14 ounces

- The Executive incorporates two switches one, with selective circuits and guaranteed me chanical interlock. Its sleek low-to-the-floor de sign enables easy and comfortable on-centre pivot action; only one circuit can be operate at one time—preventing accidental tripping o two circuits.
- It's the Electrician's dream—only one scre to remove and the switch is ready for wirin
- Engineers will want to incorporate the Exec tive by Linemaster into their plans when desig ing their modern machines.
- Rating (each interior): Single Pole—Doub Throw. 20A @ 125V—15A @ 250
- *Write for Descriptive Bulletin*

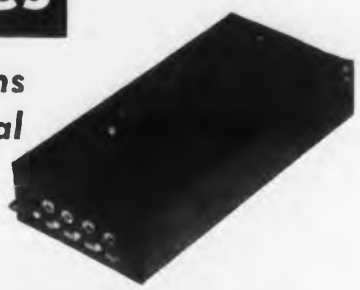
LINEMASTER SWITCH CORP.

130 PUTNAM ROAD • WOODSTOCK, CONNECTICU

CIRCLE ED-182 ON READER-SERVICE CARD FOR MORE INFORMATI

Brew Delay Lines

. . . for applications requiring exceptional characteristics



Shown above is a Lumped Constant Delay Line designed, manufactured, and *delivered on schedule* to a customer who came to us with the following requirements: delay 1.0 usec, reflections 50 db below peak signal, frequency response: from 0-4.5mc less than ±0.1 db — from 4.5-10mc less than ±6 db, attenuation less than 6 db, phasing ±.01 usec 0-4.2 mc, impedance 150 ohms, max. temp. 150° F., operating temperature 120° F., voltage 350 VDC ±6 VPP video, source impedance 4 uu 1200 ohm, grid circuit termination 10 uu.

The three main types of delay lines . . . Lumped Constant, Ultrasonic, Distributed Constant . . . are available from Richard D. Brew and Co., and our special techniques and methods, plus rigid quality control measures assure you of the finest and most practicable delay lines to meet your needs. Major consideration is given to proper packaging as well as electrical specifications.

Consult Richard D. Brew and Co. and you'll get enthusiastic cooperation and help.

Send for General Catalog 54

BREW

Richard D. Brew and Company, Inc.
Concord, New Hampshire
design · development · manufacture

CIRCLE ED-183 ON READER-SERVICE CARD FOR MORE INFORMATION

6 KVA Automatic Line-Voltage Regulator

- Extra-High Response Speed: 10 to 40 Volts Per Second
- High Efficiency: 98 Per Cent
- ZERO Waveform Distortion
- Unaffected By Load Magnitude and Power Factor
- Adjustable Output Voltage: ±10% of Input
- Models for Both 115 Volts and 230 Volts

PRICE: $465: any model

Type 1570-ALM, 115 Volts, Table Model
Type 1570-ALR, 155 Volts, Relay Rack Model
Type 1570-ALW, 115 Volts, Wall Model
Type 1570-AHM, 230 Volts, Table Model
Type 1570-AHR, 230 Volts, Relay Rack Model
Type 1579-AHW, 230 Volts, Wall Model

Write for the G-R Line-Voltage Regulator Bulletin

GENERAL RADIO Company

275 Massachusetts Avenue, Cambridge 39, Massachusetts, U.S.A.

90 West Street **NEW YORK 6** • 8055 13th St., Silver Spring, Md. **WASHINGTON, D. C.**
1150 York Road, Abington, Pa. **PHILADELPHIA**
920 S. Michigan Ave. **CHICAGO 5** • 1000 N. Seward St. **LOS ANGELES 38**

CIRCLE ED-184 ON READER-SERVICE CARD FOR MORE INFORMATION

Frequency Standard

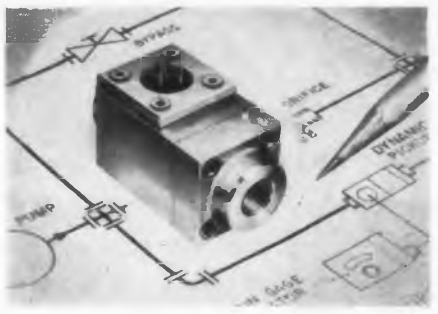
Stable 100Kc Source

The Model FS-185 Frequency Standard is a highly stable source of 100Kc signals. A precision GT-cut quartz crystal housed in an oven within an oven. The short period stability (5 minutes, any instant) is 2 parts in 100 million. The medium period stability (24 hours, averaged) is 0.5 parts in 100 million. The long period stability (2 months, averaged) is 10 parts in 100 million. A sinusoidal output of 3v rms amplitude across 600 ohms and a trigger (harmonic) output of 20v peak amplitude across a 300 ohm load are provided. Teletronic Laboratory, Inc., Dept. ED, 54 Kinkel St., Westbury, L. I., N. Y.

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

Pressure Pickups

For Differential Measurements



This line of "Dynisco" pressure pickups is for differential pressure measurements at line pressures up to 2000psi. The units consist of a flexible, pressure-sensitive diaphragm connected by an actuating rod to a special, strain-sensitive resitsance bridge. Separate input pressures are applied to either side of the diaphragm. An electrical output signal proportional to the difference between the two pressure inputs is brought out through a connector in the side of the case.

Models are available with differential pressure ranges of 0-10, 0-25, 0-50, 0-100, 0-300, 0-500, and 0-1000psi. All units can be adjusted so that the operating range either straddles or falls to one side of a 2000psi reference figure. Standard units operate with a-c or d-c excitation voltages of 6, 12 or 15v with bridge resistances of 350, 600, or 800 ohms, and minimum full-scale outputs of 20, 40, or 50mv, respectively. Measurements are accurate to 0.5% of full scale at 70°F. Dynamic Instrument Co., Inc., Dept. ED, 28 Carleton St., Cambridge, Mass.

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

aluminum

The Right Light Screw by SOUTHERN

Give time and weather resistance to your product and economy to your production with Aluminum screws by Southern —

Wood Screws-Machine Screws-Tapping Screws

Also from Southern — all standard size wood screws in Steel, Brass, Silicon Bronze and popular plated finishes, flat, round and oval with Phillips or slotted heads. Flat or round head, slotted steel stove bolts.

WOOD SCREWS • STOVE BOLTS • DOWEL SCREWS
MACHINE SCREWS • A & B TAPPING SCREWS
ROLL THREAD CARRIAGE BOLTS • HANGER BOLTS

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CIRCLE ED-187 ON READER-SERVICE CARD FOR MORE INFORMATION

DOES A

Billion Operations

—with no maintenance—

INTEREST

YOU?

• Cutaway view of HG Relay showing how wick action keeps the mercury at the contacting surfaces continuously replenished.

New CLARE Mercury-Wetted Contact Relays meet ALL requirements of today's high-speed switching devices

• If you design high speed switching machines or devices which demand accuracy and dependability of the highest order, you should know ALL about the new CLARE Mercury-Wetted Contact Relays.

CLARE Type HG and HGP Relays offer a combination of high speed, high current and voltage-handling capacity, and extraordinary uniformity of performance over very long periods.

The relays consist of a magnetic switch, hermetically sealed in a high pressure hydrogen atmosphere in a glass capsule, and a coil, enclosed in a steel vacuum-tube-type envelope which has a standard medium-sized octal base. Platinum contact surfaces are continually wetted with mercury by means of a capillary connection to a mercury reservoir below the contacts. Relays can be factory-adjusted to provide either biased or polarized characteristics.

For complete information on the CLARE *Type* HG *and* HGP *Mercury-Wetted Contact Relays, address C. P. Clare & Co., 3101 Pratt Blvd., Chicago 45, Ill.*

Send for Engineering Bulletin No. 120

CLARE RELAYS

FIRST *IN THE INDUSTRIAL FIELD*

CIRCLE ED-188 ON READER-SERVICE CARD FOR MORE INFORMATION

Time Interval Meter

For Timing Relays, etc.

The WE-210 is a small, lightweight, inexpensive, yet highly accurate time interval meter and frequency standard using glow - transfer tubes in the counter unit and a crystal-controlled oscillator as the time base. Time is displayed directly to the nearest 0.0001sec by four easily read decades. Two ranges of 1sec and 10sec are provided; longer intervals are easily noted by watching the thousands decades, or by use of an auxiliary electro-mechanical register.

The WE-210 can be used for timing high-speed electrical or mechanical devices such as relays, actuators, camera shutters, etc. The instrument also operates as an electronic counter having a maximum counting rate of 50,000pps. It has 1kc and 10kc front-panel outputs for use as a frequency standard.

Maximum indication is 10,000. Accuracy is 0.005% (0.001% on special order). Maximum counting rate is 50kc. Inputs are "start" and "stop" (6-30v, positive and negative). Size is 6" x 6" x 11", and weight is 11 lb. Power required is 105-130v 60-400cy, 50w. Westport Electric, Dept. ED, 149 Lomita St., El Segundo, Calif.

CIRCLE ED-189 ON READER-SERVICE CARD FOR MORE INFORMATION

Tantalum Electrolytics

With Large Values of Capacitance

This miniature "cup" electrolytic capacitor is the fifth design to be added to the "Tantalex" line. Designated Type 104D, these units are valuable for low-voltage applications, where they provide values of capacitance up to 30 mfd in volumes less than 1/10 cu in. The use of tantalum, the most stable of all anodic film-forming materials, gives them unusual stability of performance. They exhibit no shelf aging under long periods of test, and have extremely low leakage current.

Normal operating temperature range from —55° to +85°C at rated working d-c voltage. Units may be obtained on special order which operate at 100°C with a voltage derating of 15%. Sprague Electric Co., Dept. ED, 347 Marshall St., North Adams, Mass.

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

Can you make your transformers smaller, lighter... with Class C encapsulation?

Where a higher hot spot is permissible, you can reduce the ounces and the inches of your transformers by ¼ to ½.

How? With *silicone rubber encapsulation*. This allows operation in the 160°C. to 200°C. range at a reduced size.

Silicone rubber encapsulation is one of the many services available to the communications industry at Caledonia. (We provide Class C transformers open and in cases, too.) All encapsulation is done *in our plant*.

For help with this problem, and others involving transformers and related electronic assemblies, contact Caledonia.

When you have a transformer problem, call on

CALEDONIA

ELECTRONICS AND TRANSFORMER CORPORATION

Dept. ED-8, Caledonia, N. Y.

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

Easy to Get—

the RIGHT Data
the RIGHT Ideas
about YOUR

MINIATURE LIGHTING NEEDS

Here's the *scientific* way to approach Miniature Lighting. Just fill in basic questions on Drake's new PROJECT DATA SHEET, and mail it back. Our expert engineers will scientifically analyze your data . . from all the thousands of possible lighting arrangements, will recommend the *one best* for top results, greatest economy, in *your* specific case. Drake's decades of specialized Miniature Lighting experience, and complete line of regular and special units, are thus at your disposal. *This service is free—no obligation.*

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MANUFACTURING COMPANY

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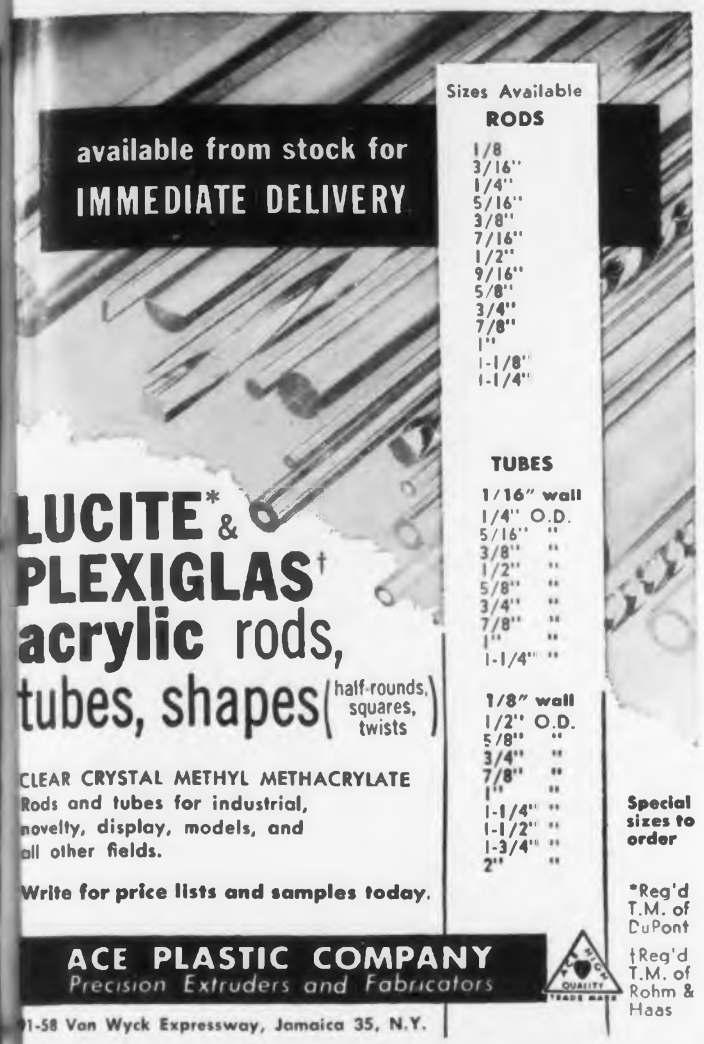
SOCKET & JEWEL LIGHT ASSEMBLIES

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



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

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

Delay Lines

Wide Choice of Characteristics

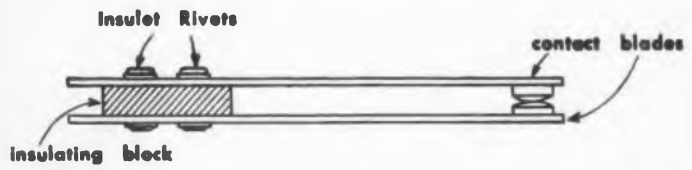
The "FD" series of miniature distributed constant delay lines is offered for use in computers, color TV oscilloscopes, and in many other applications. They are available in a wide choice of performance characteristics and sizes, with bandwidths to 30Mc, impedances of 200 to 5000 ohms, and delays up to 4μsec in a 6" stick. They can be cascaded for longer delays. Many impedances and bandwidths are now available, and a rapid sample service to meet special requirements is offered.

These lines are packaged in 5/16" diam casings with lengths determined by performance and delay requirments. Contrasting examples are Model FD-115 which is packaged in a 1-1/2" length, has a frequency response which is down 3db at 2Mc, and a delay of 0.75μsec; while a higher performance line like Model FD-122 (3db down at 15Mc) requires 7" for 0.16μsec of delay. Control Electronics Co., Inc., Dept. ED, 1925 New York Ave., Huntington Station, N. Y.

CIRCLE ED-195 ON READER-SERVICE CARD FOR MORE INFORMATION

Rivets

With Plastic Insulation

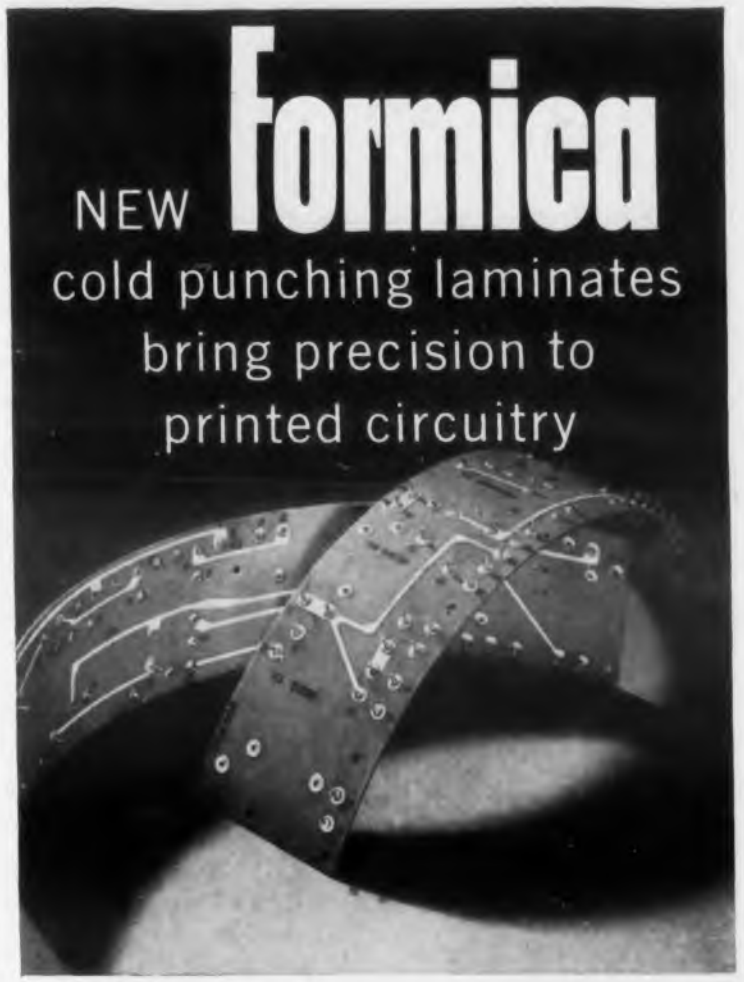


"Insulet" rivets are fasteners consisting of metal rivets whose shank and under-the-head surfaces are covered with a uniformly thick plastic insulation. The rivets have flat heads and semi-tubular shanks, and are available in aluminum, brass, steel, and other metals. Nylon insulation is standard; "Kel-F", vinyl, and other insulating materials can also be supplied. In production quantities, the color of the insulation can be varied for color matching or color coding. The plastic insulation extends slightly beyond the end of the metal rivet.

Applications other than that illustrated include riveting to ceramic or glass where the plastic sheath acts as a shock-absorber, for air-tight or water-tight joints, and similar uses.

The rivets are assembled with the tools used in rolling over conventional tubular shank rivets. They can be hopper-fed for economical assembly. A variety of lengths and diameters are now in production, and other sizes will become available as required. Pylon Co., Dept. ED, Attleboro, Mass.

CIRCLE ED-196 ON READER-SERVICE CARD FOR MORE INFORMATION



2 new Formica cold punching grades

— XXXP-36 paper base phenolic and FF-91 epoxy glass base — now bring greater accuracy to printed circuitry.

An entirely new cold fabricating process is now made possible thanks to the new cold punching grades and also to a new air drying ink resist. Cold fabricating obviously requires no heat cycle. Therefore, the base laminate is not subject to dimensional change as heretofore . . . which means that with Formica you can now produce printed circuits with new and higher standards of accuracy.

For complete information on how you can get this extra margin of accuracy built into your printed circuits . . .

Send today for your FREE COPY of the new Formica Copper Clad Catalog

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4642 Spring Grove Ave., Cincinnati 32, O.

Gentlemen: Please send me at once my free copy of the new Formica Copper Clad catalog (form 457)

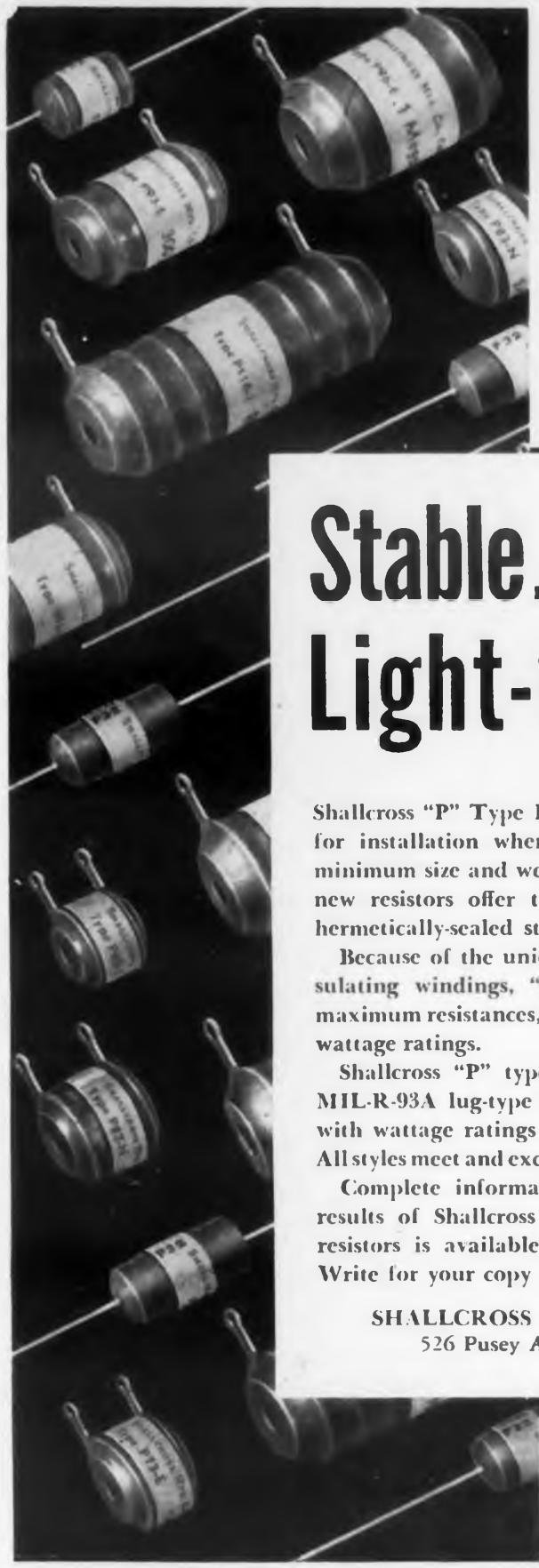
Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

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



New!

"P" TYPE ENCAPSULATED RESISTORS

Stable...Small... Light-weight...

Shallcross "P" Type Encapsulated Resistors are ideal for installation where stability, dependability, and minimum size and weight are a must. These radically new resistors offer the performance advantages of hermetically-sealed steatite resistors at less cost.

Because of the unique Shallcross method of encapsulating windings, "P" type resistors have greater maximum resistances, longer leakage paths, and higher wattage ratings.

Shallcross "P" type resistors are available in six MIL-R-93A lug-type styles and five axial lead styles with wattage ratings ranging from .500 to 3.5 watts. All styles meet and exceed JAN-R-93A, Characteristic A.

Complete information on sizes, ratings, and test results of Shallcross "P" type precision wirewound resistors is available in Engineering Bulletin L-30. Write for your copy today.

SHALLCROSS MANUFACTURING CO.
526 Pusey Avenue, Collingdale, Pa.

Shallcross

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

Large-Screen Oscilloscopes

For Low-Frequency Applications

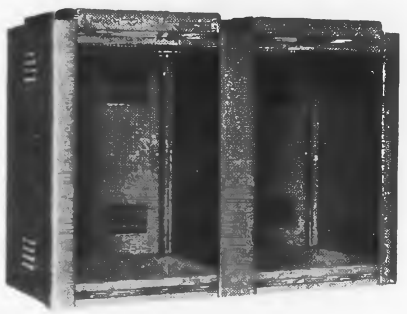
This series of 12 models of large-screen (17" x 21") precision oscilloscopes has many applications for measuring and observing low frequency phenomena. Because of the flat frequency response from d-c to 10,000cy down only 3db at 100,000cy, with d-c amplifiers and inverse feedback to assure stability, the oscilloscopes are being used for displaying telemetering data, results of geophysical seismic "shots", and test information from such devices as strain gages, thermocouples, induction potentiometers, and many other measuring instruments. An interesting application is to present graphically the outputs of an analog computer, instead of using an automatic plotter.

Specifications include 5000v anode potential, magnetic deflection, and focusing; ±1% trace linearity, horizontal and vertical; and a minimum of ±2% measuring accuracy. These oscilloscopes are accurately calibrated and may be used to measure voltages in the frequency range from d-c to 100kc, along either horizontal or vertical axes, at levels from 1 mv to 10v peak-to-peak per inch. Sweep velocity is continuously variable and permits time or frequency measurements from 10μsec to 10millisec per inch with slow sweep of 100millisec per inch available at slight additional cost. Technomatic Instrument Co., Dept. ED, 11368 W. Olympic Blvd., W. Los Angeles 64, Calif.

CIRCLE ED-199 ON READER-SERVICE CARD FOR MORE INFORMATION

☐ Multiple Relay Back

In Four Basic Sizes



These enclosed relay racks for standard 19" rack panels can be jointed together to make multiple units (double, triple, etc.) by means of a solid center partition bolted to the top and bottom. Each multiple section consists of a top, bottom, rear door, and center partition. Multiple units are available in four sizes: 36-3/4", 42", 61-1/4", and 77", in standard, rounded, and "deluxe" types. Premier Metal Products Co., Dept. ED, 3160 Webster Ave., New York 67, N. Y. *This product will be displayed at the Wescon Show, Booth 362.*

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

Precision Tubeless

AIRBORNE INSTRUMENT SOURCE

STABLVOLT MODEL MRP-5-1

MRC's 5 volt instrument supply features dual magnetic amplifier regulation. Flux oscillator circuitry isolates line voltage transients from DC output voltage. Tubes and short-life components are eliminated for greatest reliability under severe operational conditions. A constant 5 VDC voltage is maintained regardless of changes in load current (0.1-1 amp.), line frequency (380-420 cps.), line voltage (95-135 volts) and temperature range (—70°F. to + 180°F.)

The Model MRP-5-1 is designed for airborne applications involving telemetering instrumentation. The Stablvolt unit components are cast in thermosetting plastic to withstand severe vibration . . . has been qualification-tested and meets MIL-E-5272-A specifications.

MICROMAG LOW-LEVEL MAGNETIC SIGNAL AMPLIFIER

The companion Micromag serves as a reliable DC voltage amplifier (5 V output from 1 millivolt input) for telemeter systems. A drift-free, stable and a rugged performer under extreme operating conditions.

For complete technical data request MRC Engineering Bulletins EB-101 and EB-201-A.

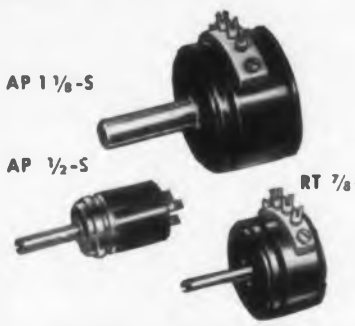
MAGNETIC RESEARCH CORP.
200 Center Street • El Segundo, California

CIRCLE ED-201 ON READER-SERVICE CARD

Aerohm Precision wire-wound Potentiometers

"Lo-TORK" POT LT ⅞

For minimum-torque uses in computer, servo, and selsyn service. Stainless-steel precision ball bearings. Maximum torque is 0.01 inch-ounce. Dissipates one watt at 80°C. Resistances—100 to 100,000 ohms. Weight is only ½ ounce. Ganging to six decks; internal clamps hold ⅞" diameter. Standard linearity 0.5%; on special order 0.25%; toroidal winding allows winding angles to 360°; standard 354°.



MICRO-MINIATURE and MINIATURE

Series AP ½-S—2 watts continuous at 80°C; resistances 10 to 20,000 ohms, 5% tolerance standard; diameter ½", depth ½", weight ¼ ounce; sealed well enough for potting.

Series RT ⅞-S—3 watts continuous at 80°C; resistances 10 to 100,000 ohms; diameter ⅞", depth ⅜", weight ½ oz.; standard linearity 2%.

Series AP 1⅛-S—4 watts continuous at 80°C; resistances 10 to 150,000 ohms; diameter 1⅛", depth ⅝", wt. less than ¾ oz.; standard linearity 1%.

All precision-machined, with anodized aluminum bodies, line-reamed phosphor bronze bearings, centerless ground stainless steel shafts, and gold-plated fork terminals. Fully sealed and fungus-proofed. Can be processed, on special order for use at 125°C. Aerohm potentiometers are individually checked for quality and performance.

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Waltham 54, Massachusetts
APPLICATION ENGINEERING OFFICES IN PRINCIPAL CITIES

CIRCLE ED-202 ON READER-SERVICE CARD

Tape Transport

Can Serve as Memory Device

The "Datacord", a high-speed, fast start-stop, tape transport, is suitable for use as an auxiliary memory storage device in computers or data reduction systems. This magnetic recorder-reproducer can be mounted on a 19" relay rack. It has a tape speed of 75ips in either direction. Starting and stopping time of the tape is in the order of 4millisec. The unit will accommodate tapes varying in widths from 1/4" to 2".

In order to insure the fast starting and stopping, the tape is stored in one basket and during operation is dropped into another basket. In this way, it is necessary to accelerate only the mass of tape which is suspended by the capstan.

Provisions have been made for lateral and azimuth positioning of the magnetic head. A total of 22 channels can be obtained by using a 2" tape and a brush BK-1322 head. By interlacing, the number of channels can be increased to 44. A tape storing reel is provided when the tape is not in use. Brush Electronics Co., Dept. ED, 3405 Perkins Ave., Cleveland 14, Ohio.

CIRCLE ED-203 ON READER-SERVICE CARD FOR MORE INFORMATION

Latching Relay

6PDT Unit Weighs 3.3 oz

Magnetically held and electrically reset, this latching relay is hermetically sealed in an enclosure of only 1" diam x 1-9/16" long (excluding terminals). It is available in 2, 4, and 6-pole double-throw contact arrangements and is designed to comply with MIL-R-5757B and MIL-R-25018 (USAF). The weight of the 6pdt type is only 3.3 oz.

The units are continuous duty (either coil) with a temperature range of —65° to +125°C and are able to withstand 50g shock. They remain in "energized" position indefinitely without consuming power. A relay can electrically reset from a remote position. Contacts can be closed by one circuit and opened by another. Small size, light weight, and hermetically sealed enclosure make possible use in airborne equipment. Filtors, Inc., Dept. ED, 30 Sagamore Hill Drive, Port Washington, N. Y.

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

DEPT. C-4, 415 N. COLLEGE AVE., BLOOMINGTON, INDIANA

In Canada: 700 Weston Rd., Toronto 9, Tel. Murray 7535 • Export: Ad Auriema, Inc., New York City

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

EAD's 2" DIAMETER MOTOR Makes Design easy as 1-2-3

1. one basic design
2. only 2" in diameter
3. three frequencies . . . 60, 400 and variable

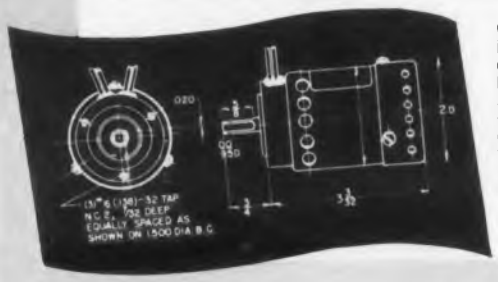
Here is one basic motor design incorporating the top-quality engineering that's "standard" at EAD . . . and capable of modifications for an unusually broad field of applications. You can order this 2" diameter motor (maximum weight is only 17 ounces) as an induction motor or a hysteresis-synchronous motor. It meets applicable MIL specifications and is available with Class "H" insulation for long life, high temperature operation. Just one more example of how EAD engineering meets the most exacting requirements for rotating electrical equipment.

INDUCTION MOTOR: For blowers, fans, automatic devices, business machines, control equipment, antenna drives, etc.

	HP	RPM	AMPS	MODEL
60 cycle, 115 volts	1/100	3,000	0.30	P52QDU
400 cycle 115 volts	1/100	7,200	0.30	P52QFU
	1/50	7,000	0.40	P52NFU
	1/30	6,200	0.80	P52LFU
	1/50	22,000	0.75	P50NDU
320-1200 cycle variable frequency	1/300	4,500 av.	0.60	P52UFU
	1/50	4,000	0.80	P52NEU

HYSTERESIS-SYNCHRONOUS: For timing devices; stroboscopic work; wherever load inertia is a problem (i.e. recorders, turntables, facsimile equipment, etc.)

	HP	RPM	AMPS	MODEL
60 cycle, 115 volts	1/200	3,600	0.26	P52SRU



Complete information on EAD's line of small motors and engineering-design service will be sent on request.

EASTERN AIR DEVICES, INC.

SOLVING SPECIAL PROBLEMS IS ROUTINE AT EAD

391 CENTRAL AVENUE • DOVER, NEW HAMPSHIRE

CIRCLE ED-206 ON READER-SERVICE CARD FOR MORE INFORMATION

Low-Pressure Pickup

Weighs only 60gr

The Type 4-315 is a miniature low-pressure pickup that is not adversely affected by outside vibrations prevalent in such applications as aircraft flight tests, automotive engine tests, and wind tunnel measurements. The pickup has low acceleration sensitivity as a result of the extremely low mass of the "star" sensing element. It is available in standard ranges of ±1, ±2, and ±3psi differential. The unit measures approximately 1-1/4" diam at the diaphragm x 1-1/8" long. Sensitivity is ±10mv full-scale open-circuit output at 5v excitation; input and output impedances are 350 ohms; linearity deviation is less than ±1.0% of full-scale out-put; hysteresis is less than 1.0% full-scale output; and compensated zero shift is less than 0.05% of full scale per degree F over the compensated temperature range of −65 to +165°F. Pressure overload limit is 200% of full scale on normal side and 150% on reference side. Maximum line pressure is 15psig. Total weight is only 60gr. Consolidated Engineering Corp., Dept. ED, 300 N. Sierra Madre Villa, Pasadena 15, Calif.

CIRCLE ED-207 ON READER-SERVICE CARD FOR MORE INFORMATION

Pressure Indicator

Electronic Pickup Type

This electronic pickup indicator, the "Rutishauser Model PM-121", is designed for use with "Rutishauser" transducers to measure transient, recurrent, and static pressures, as well as acceleration and displacement. The pressure-measuring system takes advantage of the fact that minute changes in capacity can easily be measured at higher frequencies. The indicator contains a stable high-frequency oscillator operating at approximately 12.5-Mc. The diaphragm of the pressure transducer, which serves as a variable capacitor, and the inductance of the matching transformer comprise a parallel resonant circuit tuned approximately to the oscillator frequency.

Cables for connecting with transducers may be as long as 2000 feet without requiring special adaptors. Rutico, Inc., Dept. ED, 490 S. Fair Oaks Ave., Pasadena, Calif.

CIRCLE ED-208 ON READER-SERVICE CARD FOR MORE INFORMATION

PLASTIC FABRICATING PROCESS SAVES ON MOLD COSTS

TOP QUALITY AT LOW PRICES!

Special processes developed by Sillcocks-Miller now permit fabrication of thin wall pieces such as insulators, washers, etc., with low tool cost and without sacrifice of quality or service life . . . Send specifications for details, recommendations and quotations on all your small part requirements.

45 Years Experience in Solving Problems with Plastics!

The SILLCOCKS-MILLER Company

12 WEST PARKER AVENUE • MAPLEWOOD, N. J.

CIRCLE ED-209 ON READER-SERVICE CARD FOR MORE INFORMATION

CUT FASTENER COSTS WITH TINNERMAN Speed Nuts®

Popular cost-cutters on thousands of assembly lines . . . Tinnerman "U" and "J" Type SPEED NUTS! These versatile, spring steel fasteners snap into place by hand, are self-retained in screw-receiving position. They furnish secure, vibration-proof attachments, eliminating welding, clinching, staking, tapping of holes, costly threaded inserts. Available for a full range of screw sizes and panel thicknesses. Write for complete details.

TINNERMAN PRODUCTS, INC.

BOX 6688, DEPT. 12, CLEVELAND 1, OHIO

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

Kanthal DR resistance wire
SAVES YOU UP TO 30% because...

. . . it is lighter in weight (more feet per pound), and the price per pound is low. Total savings approximately 30%.

. . . KANTHAL DR improves characteristics of resistors and precision equipment with its high electrical resistivity (812 ohms per circular mil foot), its low temperature coefficient (±20 ppm per degree C from −55° to +150°C), and its low thermal EMF to copper. Available in fine gages — all insulations. Write today for further information.

Also inquire about KANTHAL NIKROTHAL 6(60/16) nickel-chromium alloy for wire wound resistors. Savings up to 12%.

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

CIRCLE ED-212 ON READER-SERVICE CARD FOR MORE INFORMATION

OFTEN
TWO HEADS ARE BETTER THAN ONE

Often two heads are the only solution to a part or fastener problem. Take just a moment to look at this pump valve-plunger. It's a tricky job calling for two heads and two different shaft diameters. The big problem here was to produce this valve-plunger in *quantity, inexpensively and quickly* . . . and Hassall double-heading did the trick.

Double-heading is only one example of the almost limitless possibilities Hassall cold-heading offers you. If you have a fastener problem just send us samples or specifications for a quotation.

WRITE FOR CATALOG . . . with it we will send you our popular decimal equivalent wall chart.
John Hassall, Inc., Box 2202, Westbury, L. I., N. Y.

HASSALL

SINCE 1850 — NAILS, RIVETS, SCREWS AND OTHER COLD-HEADED FASTENERS AND SPECIALTIES

CIRCLE ED-213 ON READER-SERVICE CARD FOR MORE INFORMATION

Power Tube

A High-Efficiency Twin Beam

The *5894* is a small, sturdy, twin-beam power tube intended primarily for use as a push-pull r-f power amplifier or as a frequency tripler in fixed and mobile equipment operating in the uhf range between 450 and 470Mc. It has a maximum plate-dissipation rating of 40w under CCS conditions. Under these conditions in class C telegraphy and frequency-modulated amplifier service at 470-Mc, it can deliver to load of output circuit a useful power of approximately 55w. Radio Corp. of America, Tube Div., Dept. ED, Harrison, N. J.

CIRCLE ED-214 ON READER-SERVICE CARD FOR MORE INFORMATION

Pulse-Forming Network

Forms Two 0.6μsec Pulses

The No. 11-54 Dual Pulse-Forming Network forms two 0.6μsec pulses at 12 ohm impedance and 500v d-c working. It is designed to meet MIL specs and to afford maximum efficiency in a minimum amount of space. The entire unit measures only 1-5/8" x 1-1/4" x 1-1/8". E. S. C. Corp., Dept. ED, 534 Bergen Blvd., Palisades Park, N. J.

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

Wire-Wound Resistors

With Transparent Encapsulation

These wire-lead, precision wire-wound resistors use transparent encapsulation. The visibility that results assists materially in precluding service failures caused either by bubbles or strains.

The resistors include other improvements, such as electric welding of wire to the phosphor bronze leads —all being completely visible through the transparent encapsulation—and exceptional compactness. These wire-lead type resistors exceed the requirements of MIL-R-93A. Shallite, Inc., Dept. ED, 10 Mill St., Paterson 1, N. J.

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

"ELCO SCREWS ARE GOOD SCREWS
...ASK A MAN WHO HAS USED THEM"

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

ELCO TOOL AND SCREW CORPORATION
1948 BROADWAY, ROCKFORD, ILLINOIS

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

PDQ with CAC

Your answer pertaining to Production — Delivery — Quality in toroidal components may be obtained promptly by calling the CAC man nearest you.

Perhaps you need engineering assistance — CAC offers it — plus know-how which is backed by hi-volume production facilities at CAC.

The growth of our company — in fact its very existence is due largely to the solving of customer problems — We'd like to help on yours —

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PHILADELPHIA - C. R. Hile Co. - Elgin 6-2266 - Hillview Rd., Box 144, Paoli, Pa.
BALTIMORE - C. R. Hile - Northfield 5-4500 - L. G. Korman, 5006 Kenwood, Balt. 6, Md.
CHICAGO - Gassner & Clark Co. - Rogers Pk. 4-6121-6644 N. Western Ave., Chi. 45, Ill.
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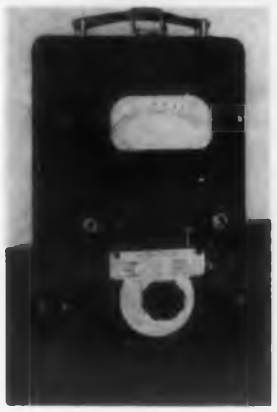
LOS ANGELES - S. O. Jewett - State 9-6027 - 13537 Addison St., Sherman Oaks, Cal.
SYRACUSE - Naylor Elec. Co. - 2-3894 - State Tower Bldg., Room 317, Syracuse 2, N.Y.
MERIDEN - H. Lavin Assoc. - Beverly 7-4555 - H. Lavin, P.O. Box 196, Meriden, Conn.
NEEDHAM - H. Lavin Assoc. - 3-3446 - R. V. Curtin, 82 Curve St., Needham, Mass.
CLEVELAND - E. Kohler Assoc. - Olympic 1-1242 - 8905 Lake Ave., Cleveland 2, O.
SEATTLE - Testco - Mohawk 4895 - D. Thompson, Boeing Field, Room 105, Seattle 8 Wn.
INDIANAPOLIS - R. O. Whitesell & Assoc. - Melrose 2-8517 - 2208 E. Wash., Ind. 1, Ind.
DALLAS - Norvell Assoc. - Forest 8-4180 - 5622 Dyer St., Dallas 6, Tex.
ST. PAUL - Northport Co. - Midway 4-7884 - 1838 Ashland Ave., St. Paul 4, Minn.

FOR ADDITIONAL INFORMATION CONTACT
COMMUNICATION ACCESSORIES COMPANY
HICKMAN MILLS, MISSOURI • PHONE KANSAS CITY, SOUTH 5528

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

Vibration Meter

Use with Velocity Type Pickups

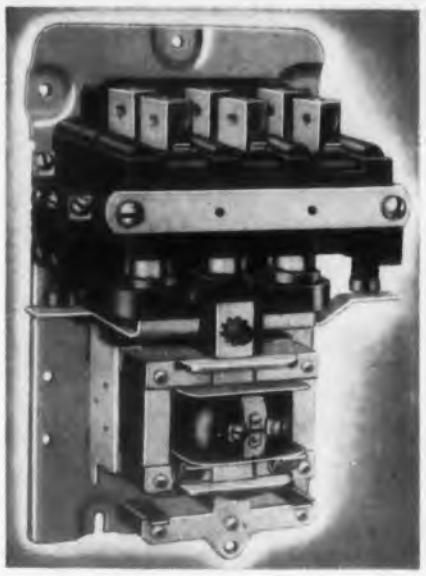


For use with velocity-type vibration pickups made by this firm, the Model M6 Meter measures the voltage generated by the pickups when attached to objects or surfaces being tested. It gives quantitative information in terms of amplitude, velocity, and acceleration. The instrument is especially useful in test programs involving jet engines, automobile engines, shipboard steam turbines, and others.

The meter has connections for the input of four pickups, each measured separately by use of a selector switch. A jack permits connecting the signals to recording equipment or an oscilloscope. Furnished with filters, the meter cuts off low-frequency vibrations from the overall vibration spectrum, thereby simplifying analysis work. It operates from 117v a-c, weighs 14 lb, and 6-7/8" x 12-3/8" x 8-3/4" overall, with space for two pickups in the cover. The MB Manufacturing Co., Inc., Dept. ED, 1060 State St., New Haven, Conn.

CIRCLE ED-219 ON READER-SERVICE CARD FOR MORE INFORMATION

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



1000 contactors in 1

You're looking at the most versatile solenoid contactor ever developed for building electrical controls.

This Ward Leonard Size 2 contactor is available in *three* basic models, *six* major variations, *one thousand* combinations.

Your savings: reduced stock, minimum panel space, lower assembly costs, less layout and drafting time. Write for Bulletin 4450 to Ward Leonard Electric Co., 77 South St., Mount Vernon, N.Y. 4.15

WARD LEONARD ELECTRIC CO.
Result-Engineered Controls Since 1892
RESISTORS • RELAYS • MOTOR CONTROLS • CHROMASTER

CIRCLE ED-221 ON READER-SERVICE CARD FOR MORE INFORMATION

No Levigation Required

with *Linde* FINE ABRASIVES

Trade-Mark

These fine alumina powders are directly calcined at a carefully controlled temperature to assure a uniform particle size that makes levigation unnecessary. Eliminating this preparatory step cuts polishing time and saves abrasive. Uniform particle size also assures an excellent, scratch-free finish on materials ranging from metallographic specimens to gem stones and noble metals.

Depending on the application, these powders can be used direct from the container or mixed with water or other vehicles to make a thin slurry or heavy paste. Users have also compounded them with waxes to make a convenient stick form. LINDE Fine Abrasives are available in two types. Type A removes stock faster than Type B, but Type B produces a superior finish.

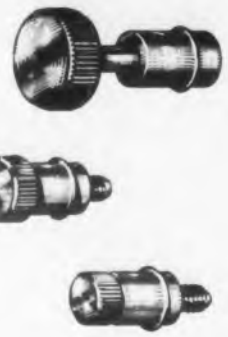
For detailed information on the properties of these polishing powders, call or write your nearest LINDE office.

Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities

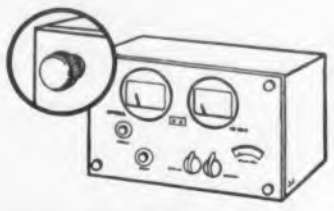
"Linde" is a registered trade-mark of Union Carbide and Carbon Corporation

CIRCLE ED-222 ON READER-SERVICE CARD FOR MORE INFORMATION

reduce costs with SOUTHCO CAPTIVE PANEL SCREWS from stock



This low-cost retractable screw fastener saves you assembly time —and eliminates frequent need for costly special design fasteners. Unmatched for use by assemblers of electronic units and other paneled cabinets.



"Floating" screw . . . insures easy alignment.
No special tools or skills needed.
3 head sizes and . . . 3 standard thread sizes available.

Write today for complete details. Southco Division, South Chester Corporation, 235 Industrial Highway, Lester, Pa.

SOUTHCO FASTENERS

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Whenever two or more parts are fastened together.

CIRCLE ED-223 ON READER-SERVICE CARD FOR MORE INFORMATION

Brake-Servo Motor

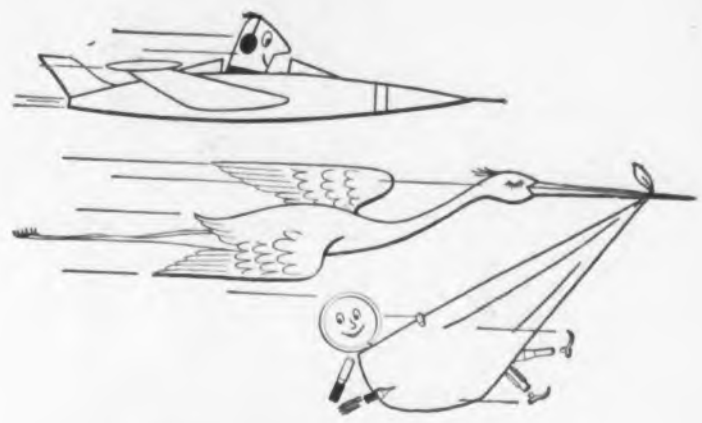
Stops in 0.02sec

Guaranteed for 100 hours operation at +125°C, the Type 2V-2397 is a compact, instant-stopping brake-servo motor unit which also provides high acceleration. The unit instantly responds to excitation at —65°C without preliminary warm-up. Theoretical acceleration is 12,000rad/sec², and stopping time is 0.02sec with no external inertia loading.

The entire unit measures 0.938"OD x 1.5" long, and weighs only 2.56 oz. No-load speed is 7000rpm, stall torque is 0.30 in-oz, and total rotor inertia is 1.8gr-cm². Input power is 3w per phase, and input current with rotor stalled is 175ma.

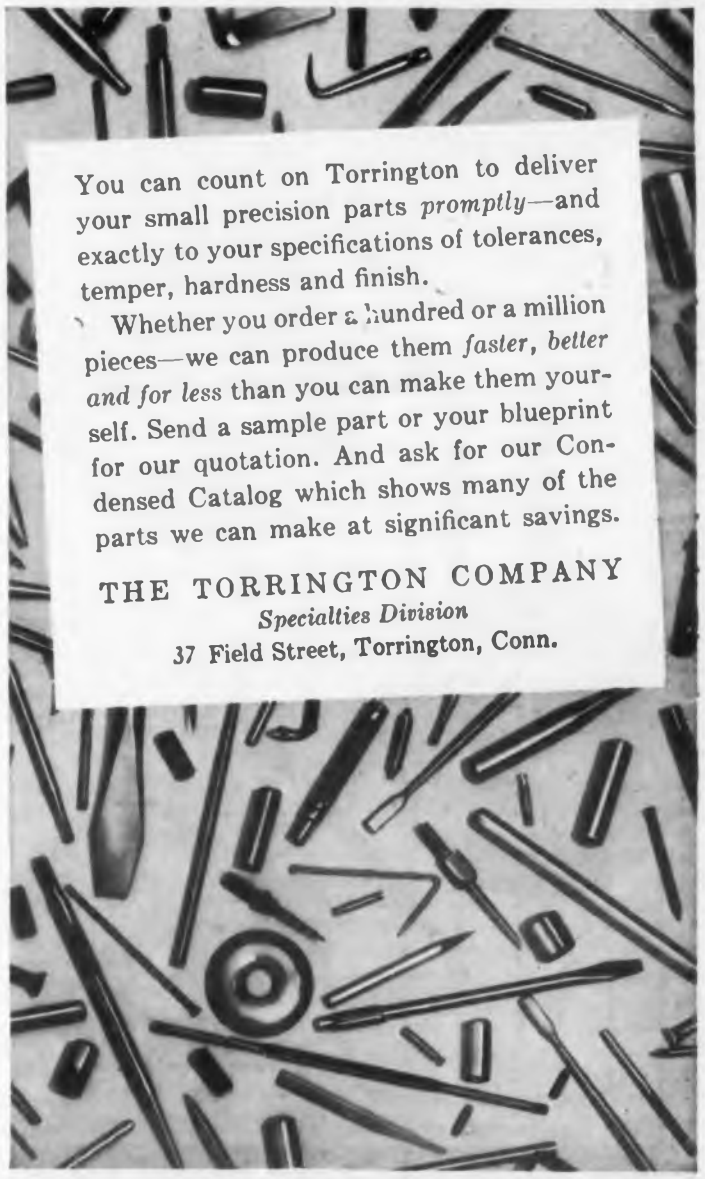
Servo motor excitation is 26v 400cy 2 phase, and brake excitation is 27v d-c. Stainless-steel housings provide full protection against salt spray and high humidity conditions. If desired, the motor is available without the brake. Avionic Div., John Oster Mfg. Co., Dept. ED, 1 Main St., Racine, Wis.

CIRCLE ED-225 ON READER-SERVICE CARD FOR MORE INFORMATION



When speed is important—

LET TORRINGTON MAKE YOUR SMALL PRECISION PARTS



You can count on Torrington to deliver your small precision parts *promptly*—and exactly to your specifications of tolerances, temper, hardness and finish.

Whether you order a hundred or a million pieces—we can produce them *faster, better and for less* than you can make them yourself. Send a sample part or your blueprint for our quotation. And ask for our Condensed Catalog which shows many of the parts we can make at significant savings.

THE TORRINGTON COMPANY
Specialties Division
37 Field Street, Torrington, Conn.

TORRINGTON *SPECIAL* **METAL PARTS**

Makers of Torrington Needle Bearings

CIRCLE ED-227 ON READER-SERVICE CARD FOR MORE INFORMATION

UNBRAKO®

Self-Locking Cup Point

Prevents this set screw from working loose

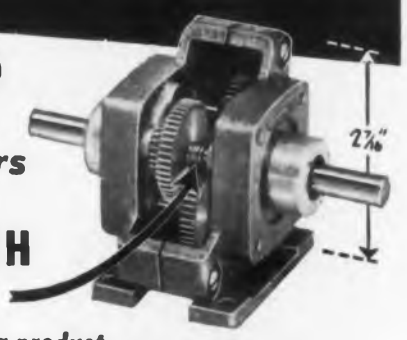
Unique counterclockwise knurls prevent these socket set screws from working loose, even in poorly tapped holes. And UNBRAKO Self-Locking Socket Set Screws can be seated tighter than ordinary set screws—as much as 45% tighter. For complete information, see your local UNBRAKO industrial distributor or write STANDARD PRESSED STEEL CO., Jenkintown 12, Pa.

UNBRAKO SOCKET SCREW DIVISION SPS
JENKINTOWN ■ PENNSYLVANIA

CIRCLE ED-224 ON READER-SERVICE CARD FOR MORE INFORMATION

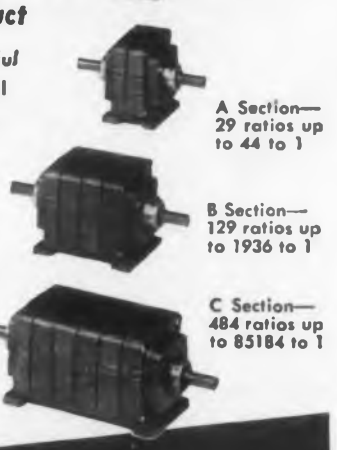
Pre-fab SPEED REDUCERS

Metron
Bantam Speed Reducers with ANTI-BACKLASH FEATURE
are ready-to-go in your product



When you need *small* but *powerful* speed reducers, a Metron Bantam will do the job. Save design time by using rugged pre-fab Bantams as components.

- 2 lb.-in. output torque
- Speeds up to 10,000 RPM input
- Quick delivery—1 or 1000 Bantams



A Section—29 ratios up to 44 to 1

B Section—129 ratios up to 1936 to 1

C Section—484 ratios up to 85184 to 1

Write for data sheet 10 and 11 for details

Metron INSTRUMENT COMPANY
450 Lincoln St., Denver 3, Colo.
DISTRICT OFFICES • NEW YORK • CHICAGO • LOS ANGELES

CIRCLE ED-226 ON READER-SERVICE CARD FOR MORE INFORMATION

EXCITING *new ink*

FOR *printed circuits*

NAZ-DAR **PC** BLACK

prints hairline circuits perfectly

resists all common etches

washes off instantly in solvent bath

For free sample and complete information write:

THE **NAZ-DAR** COMPANY

INKS VARNISHES LACQUERS SILKS SCREEN PLATES SQUEEGEES FILMS

461 Milwaukee Ave. Chicago 10, Ill.

CIRCLE ED-228 ON READER-SERVICE CARD FOR MORE INFORMATION

☐ 30 kw Variable Frequency

For Vibration Testing

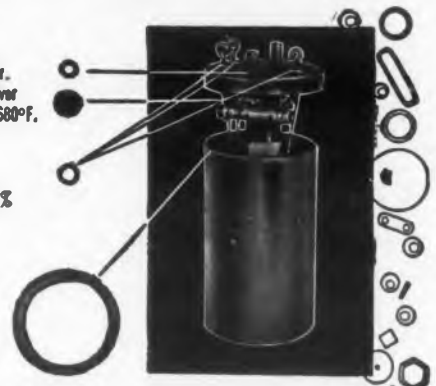
The Electronic Power Supply, Model PP-30-A, is for sine-wave, complex-wave, and flight - simulation vibration testing of airplane and missile components. It will continuously deliver 30,000w into a matched load without overheating or breakdown. It gives flat response from 5 to 3000cy. Harmonic distortion is less than 5% at full output. Internal noise and hum is better than —65db below full output.

Eight output impedances from 0.5 to 64 ohms are available from a front panel selector. The supply features a shaker armature protector, plate dissipation overload protection, start-stop sequencing and interlocking, and overcurrent and overvoltage protection. L. M. Electronics, Inc., Dept. ED, 5017 Exposition Blvd., Los Angeles, Calif. *This product will be displayed at the Wescon Show, Booth 1701-1702.*

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

3 Soldering Operations in 1 Easy as ABC with

KESTER "SOLDERFORMS"



A Solder screws and stud to can cover. "Solderform" Disc & Rings 5% Silver —95% Lead Alloy. Melting Point 580°F.

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

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

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

WRITE TODAY for free "Solderform" samples and literature.

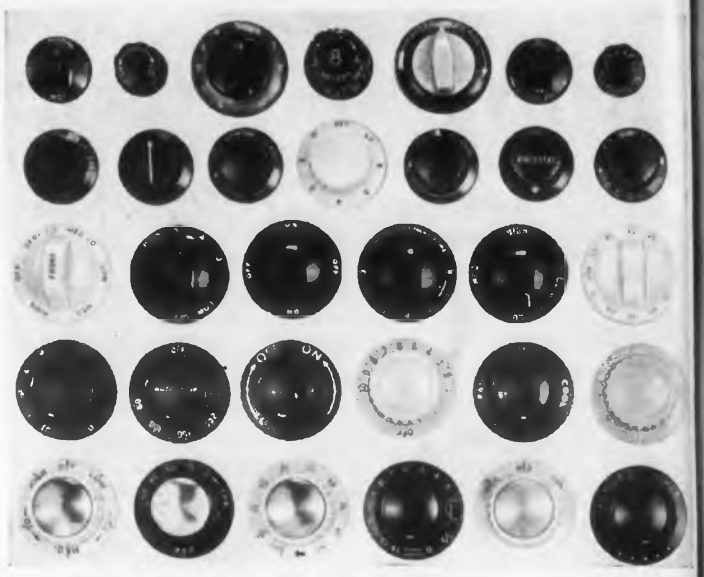
KESTER SOLDER COMPANY

4266 Wrightwood Avenue • Chicago 39, Illinois
Newark 5, New Jersey • Brentford, Canada

CIRCLE ED-230 ON READER-SERVICE CARD FOR MORE INFORMATION

PLASTIC MOLDED KNOBS

FOR INSTRUMENTS, APPLIANCES, ETC.



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INSURE Proven Quality with JONES PLUGS AND SOCKETS

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Jones Series 300 illustrated. Small Plugs & Sockets for 1001 Uses. Cap or panel mounting.

S-306-AB Socket with Angle Brackets.

- Knife-switch socket contacts phosphor bronze, cadmium plated.
- Bar type Plug contacts brass, cadmium plated, with cross section of 5/32" by 3/64".
- Insulation molded bakelite.
- All Plugs and Sockets polarized.
- Metal Caps, with formed fibre linings.
- Made in two to 33 contacts.
- For 45 volts, 5 amperes. Efficient at much higher ratings where circuit characteristics permit.

Ask for Jones Catalog No. 20 showing complete line of Electrical Connecting Devices, Plugs, Sockets, Terminal Strips. Write or wire today.

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HOWARD B. JONES DIVISION
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SUBSIDIARY OF UNITED-CARR FASTENER CORP.

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DONNER analog computer

$995

model 30 with 30-3 problem board as illustrated. f.o.b. Berkeley, Calif.

This versatile and compact Donner Model 30 is the first electronic computer specifically designed as a personal tool of the engineer, mathematician and scientist. It offers the speed and accuracy of electronic computation with slide rule operating simplicity wherever differential equations are used.

Write for Booklet No. 302 on the Model 30 and its applications.

DONNER SCIENTIFIC COMPANY

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CIRCLE ED-234 ON READER-SERVICE CARD FOR MORE INFORMATION

NEWLY-DEVELOPED Sub Miniature Type 10 H-SERIES

hermetically sealed resistors

The "H" Series Precision Resistors are encapsulated in a tough plastic compound. The result is a solid, homogeneous unit with unparalleled ruggedness, **impervious to the effects of moisture, thermal shock and mechanical shock.** The plastic is filled with heat conducting mineral which dissipates the heat and equalizes the "hot spots" in the resistor winding. The sealed-in terminal connections are welded.

SPECIFICATIONS:

MILITARY SPECIFICATIONS: Performance characteristics satisfy all requirements of MIL-R-93A & JAN-R-93.
TEMPERATURE COEFFICIENT: ±0.0022% per degree C.
OPERATING TEMPERATURE: −65°C. to +125°C.
RESISTANCE ACCURACY: Standard resistance tolerances are 1%, 0.5%, 0.25% and 0.1%.
TYPE 10 (illustrated): ¼" dia. x ½" long. Resistance range: 1.0 ohm −0.35 meg.

Send for Bulletin H for complete description on other physical sizes and wattage ranges.

HYCOR Company, Inc.

11423 VANOWEN ST., N. HOLLYWOOD 4, CALIF.
Subsidiary of International Resistance Company

CIRCLE ED-235 ON READER-SERVICE CARD FOR MORE INFORMATION

☐ Altitude Chamber
With Wide Range

The Model FH-8-2-2 Environmental Test Chamber provides rapid heating of test space. Temperature range is +250 to −100°F, and altitude range is 0 to 100,000′ (with up to 150,000′ available on special order). The refrigeration system features the "Freon 13—Freon 22" cascade arrangement.

The pressure member is external, and the unit also incorporates double articulating hinges and snap action trigger locks for vacuum sealing. The entire construction is hermetically sealed, with stainless-steel interior. Instrumentation is electronic or program type, to order. Conrad, Inc., Dept. ED, 141 Jefferson St., Holland, Mich. *This product will be displayed the Wescon Show, Booth 167.*

CIRCLE ED-236 ON READER-SERVICE CARD FOR MORE INFORMATION

microscopic Welds

AUTOMATIC precision combined forming and welding operations that are accomplished on "TWEEZER-WELD" equipment have revolutionized the Electronic and Instrument industries.

Brochure Mailed on Request

Bench Welder with Capacitor Discharge power supply.

Automatic Welder 3600 welds per hour.

TWEEZER-WELD GUN

• Contract Welding Service Available

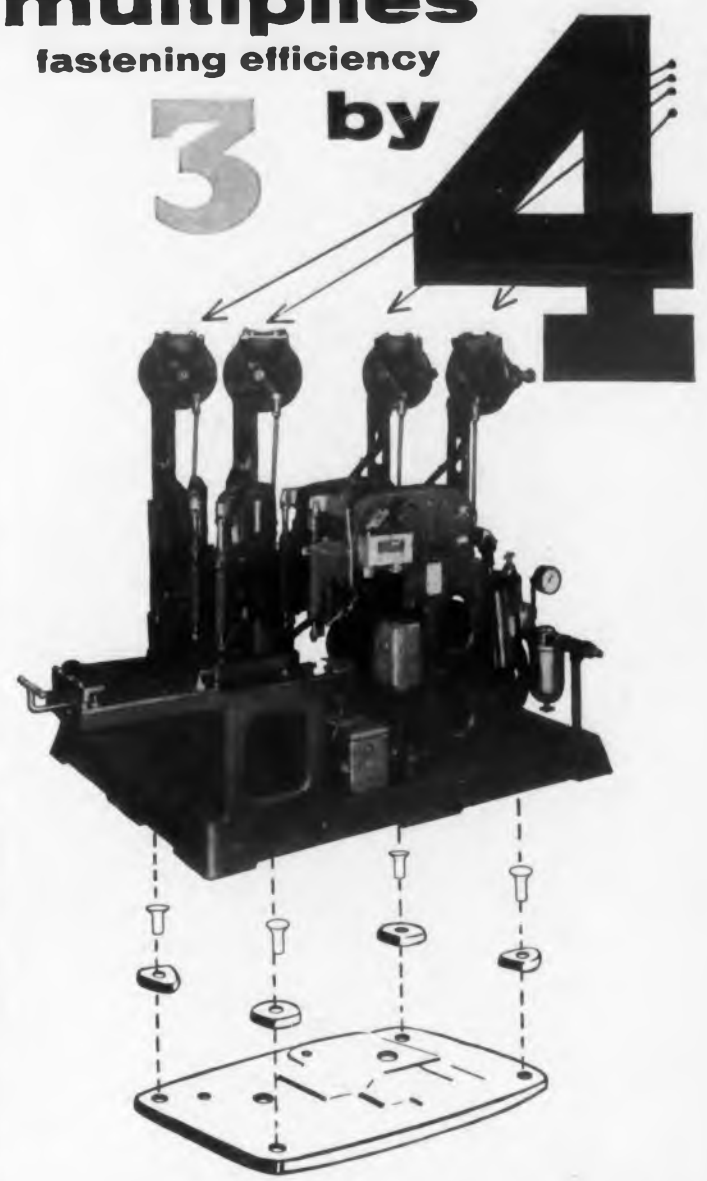
Millions of small parts have been made on **TWEEZER WELDERS**

FEDERAL TOOL ENGINEERING COMPANY TWEEZER-WELD

1376 POMPTON AVENUE, CEDAR GROVE, NEW JERSEY

CIRCLE ED-237 ON READER-SERVICE CARD FOR MORE INFORMATION

1 2 multiplies fastening efficiency 3 by 4



Tubular's Multi-Head Riveters can automatically feed and set six or more rivets simultaneously, depending upon the dimensional limits of the assembly. They infinitely simplify and speed up complex assembly fastening. Basic machines positioned to meet your present needs . . . economically re-positioned when requirements change. Feed and set rivets from ⅛" to 3/16" diameter — all alike or all different. Machine shown sets four rivets at a time, assembles 475 units per hour, reduces fastening costs about 50%.

You can benefit from ***Tubular's*** 85 years of fastening experience . . . rapid delivery from ample stocks of rivets . . . competent, confidential engineering counsel. Send blueprint or sample assembly to ***Tubular*** today.

Tubular Rivet & Stud Company

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CIRCLE ED-238 ON READER-SERVICE CARD FOR MORE INFORMATION

New Mico XXP Laminate gives you much higher Insulation Resistance

Here at last is a uniform, high-quality material with the higher insulation resistance you need for many applications in radar, television, radio, computers, electronic equipment of all kinds. It's MICO's Radar Grade LAMICOID® #6229.

Compare for yourself! Test it together with other laminates under your own test methods for insulation resistance.

Look at these other outstanding values!

WATER ABSORPTION, (%)
Precond. E-1/105
Cond. D1-24/23
1/16" thick 0.57
1/8" thick 0.37

SPECIFIC GRAVITY
1/16" thick 1.33
1/8" thick 1.33

FLEXURAL STRENGTH, (psi)
Tested flatwise, Cond. A
1/8" thick: cut lengthwise 21,000; cut crosswise 16,900

DISSIPATION FACTOR AT 1 MEGACYCLE
1/8" thick: Cond. A .0314; Cond. D-24/23 .0316

DIELECTRIC CONSTANT AT 1 MEGACYCLE
1/8" thick: Cond. A 4.42; Cond. D-24/23 4.63

DIELECTRIC BREAKDOWN, (Kv.)
Parallel to lamination, S/S
Cond. D-48/50
1/16" thick 68.8+
1/8" thick 68.0+

PUNCHING QUALITY
1/16" thick: Heated 1 min. Good; Heated 2 min. Good; Heated 3 min. Good

Write today for samples – or ask to have a MICO Sales Engineer call.

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Offices in Principal Cities
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LAMICOID® *(Laminated Plastic)* • MICANITE® *(Built-up Mica)* EMPIRE® *(Coated Fabrics & Papers)* • FABRICATED MICA • ISOMICA®

CIRCLE ED-239 ON READER-SERVICE CARD FOR MORE INFORMATION

Voltage Comparator

Compares Changing D-C to Reference

The Model REL-17 Voltage Comparator detects the point at which a changing d-c level is equal to a fixed reference voltage. In this way it may be used as a sine wave zero crossing detector with a ground reference, or it can detect the fact that a changing or static voltage is equal to or exceeds a preset reference.

The unit is incorporated into a standard plug-in can with octal socket and two hold-down shafts. It has the ability to detect an equality of two voltages within an accuracy of 100mv and has many applications in the field of automation as a limit detector and control element. A single pulse output is generated at the point of equality, or when the unknown voltage exceeds a fixed reference. Units are available in models which will operate with input signals ranging from d-c to 100,000cy. Rheem Manufacturing Co., Dept. ED, 9236 E. Hall Rd., Downey, Calif.

CIRCLE ED-240 ON READER-SERVICE CARD FOR MORE INFORMATION

Pressure Pickups

With 1/4" Diaphragm

For maximum convenience in the measurement of pressures up to 7000psi, this group of high-performance pressure pickups features pressure-sensitive diaphragms only 1/4" in diameter. A pickup can be mounted in a 5/16-24 threaded hole. They are particularly suitable for studies in high-pressure hydraulic and pneumatic systems.

Several units can be mounted close together for pressure differential measurements. The natural resonant frequency of the pickup mechanism approaches 20,000cy at the higher ranges of pressure.

Standard 1/4" pickups are available to cover pressure ranges of 0-300, 0-500, 0-1000, 0-2000, 0-3000, 0-5000, and 0-7000psi. Measurements may be made either of gage pressure (psig) or absolute pressure (psia) and are accurate to 0.5% of full scale at 70°F. Standard units are available which operate with minimum a-c or d-c excitation voltages or bridge resistances. Dynamic Instrument Co., Inc., Dept. ED, 28 Carleton St., Cambridge, Mass.

CIRCLE ED-241 ON READER-SERVICE CARD FOR MORE INFORMATION

CIRCLE ED-242 ON READER-SERVICE CARD FOR MORE INFORMATION

The unusual flexibility of Gries' die casting technique may answer your small parts problems. With almost unlimited design latitude, your designs—whether simple or complex—can be cast in zinc alloy, in one automatic operation, completely trimmed.

FACT-FILLED BULLETIN — showing how Gries' ingenious, economical operations can solve your problems.

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Quick delivery on quantities of 100,000 to many millions.

NO MINIMUM SIZE:
Max. Wgt. 1/2 oz.
Max. Lgth. 1-3/4"

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40 Second St., New Rochelle, N. Y. Phone NEw Rochelle 3-8600

World's Foremost Producer of Small Die Castings

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C-D-F *makes it!*

Silicone

TAPES and SHEETS

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High temperature resistance
High dielectric strength
Low dielectric loss
Resistant to moisture
High tensile strength
Good flexibility

SILICONE RUBBER FIBERGLAS
High temperature resistance
High dielectric strength
Low dielectric loss
Resistant to moisture
High tensile strength
Extreme flexibility

C-D-F Silicone Varnished Fiberglas cloth, and Silicone Rubber-coated Fiberglas cloth meet A.I.E.E. Class H electrical insulation requirements. They resist mild alkalis, non-oxidizing acids, mineral oils, oxygenated solvents. Silicone Rubber Fiberglas is recommended for many applications where a flexible material with good thermal conductivity is required. C-D-F Silicone tapes and sheets are available in a wide range of sizes in continuous rolls. For complete details, write for Technical Bulletin 47.

Continental-Diamond Fibre

CONTINENTAL-DIAMOND FIBRE DIVISION OF THE BUDD COMPANY, INC.
NEWARK 107 DELAWARE

CIRCLE ED-244 ON READER-SERVICE CARD FOR MORE INFORMATION

TWO-WAY STEPPING SELECTOR

For Computing, Control, and Indicator Systems

The flexibility of forward and reverse stepping at the operator's choice or by automatic cycling is now obtainable in a compact unit —the G. E. C. two-way stepping selector. Each of these units can replace several conventional one-way stepping relays, thus adding efficiency and versatility to circuit designs.

The G. E. C. two-way stepping selector operates in either direction at a speed of approximately 65 steps per second on self-interruption, and at speeds up to 20 steps per second from external impulses. Positive stepping action and freedom from over-stepping are assured by driving the wiper assembly on the forward stroke of the appropriate armature. The unit is designed for use with standard 25-contact banks up to three levels. All selectors can be supplied with bridging or non-bridging wipers, or any desired combination of both. The armature coils can be supplied for operation at 12, 24, 50, 110, or 220 volts d.c. Bank contacts, wipers, and wiper brushes are of nickel silver for maximum life. The interrupter springs, designed for easy adjustment, are fitted with plantinum contacts. The finish of the units makes them suitable for either standard or tropical use.

One-way stepping selectors with standard 25-point banks up to 8 levels, or 50-point banks up to 5 levels, are also available.

For bulletins and prices, write: General Electric Company, Limited, c/o Imtra Corporation, (U. S. Agents) 58 Charles Street, Cambridge, Massachusetts, U. S. A.

CIRCLE ED-245 ON READER-SERVICE CARD FOR MORE INFORMATION

Connectors

For Printed Circuits

To meet the requirements of equipment using printed-circuit construction, five new connectors have been made available in 10, 18, 22, 28, and 44 contacts. These fittings are made of Dupont "Zytel" molded insulation, with gold-plated phosphor-bronze or beryllium-copper contacts. Flashovers are 2000 and 2500v 60cy a-c (rms), with a current rating of 5amp.

Polarization is accomplished by deleting one or more contacts, and inserting a blanking stud in the vacant cavity. Four connector types have single contact rows, and one has double contact rows. Rivet-and-eyelet type terminals are available. Cannon Electric Co., Dept. ED, 3207 Humboldt St., Los Angeles 31, Calif.

CIRCLE ED-246 ON READER-SERVICE CARD FOR MORE INFORMATION

Scintillation Counter

Gives Maximum Directionality

The Model CS-100 "Radimax" is a collimated scintillation counter with heavy shielding for maximum directionality. The unit is supplied with a 1" x 1" sodium iodide crystal, and other sizes may be obtained on request. With the removable forward shield in place, a ratio of at least 50:1 is obtained between count rates from an iodine-131 source within the acceptance cone and one outside at the same distance from the crystal. The sensitive angle may be varied by changing the threaded lead collimator in the nose of the shield.

The CS-100 includes a photomultiplier chosen for good signal-to-noise characteristics, and is constructed mechanically so that the removable crystal joint is equal in light transmission and reliability to a cemented joint. It is supplied complete with cable ready for attachment to any scintillation scaler or rate meter. NRD Instrument Co., Dept. ED, 6425 Etzel Ave., St. Louis 14, Mo.

CIRCLE ED-247 ON READER-SERVICE CARD FOR MORE INFORMATION

buying small motors?

call Motordyne

for real cooperation!

Interchangeable DC and Universal AC motors. 1500 Series (1½" diameter). Horsepower 0.02. Drives co-axial transfer switches and actuators. Series, split-series, shunt or compound windings. 6 to 30 volts D.C. 115 volts, 60-cycle, A.C. Torque up to 2 oz. inch. Brake and speed governor optional.

We'll show you a broad selection of standard Motordyne fractionals. Sizes run as small as 1 1/16 inch diameters . . . power ranges from 1/1000 to ½ h.p. All types withstand high ambients and altitudes. If your needs are special, we put a veteran design staff at your disposal.

Manufacturers of Fractional h.p., D.C. Motors, Synchronous A.C. Motors, Induction Motors, Dynamotors, Inverters, and Motor-Tachometers.

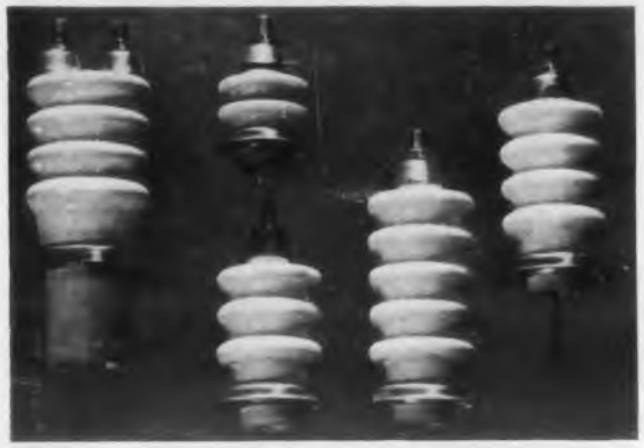
Close engineering liaison. Starting with a bare idea, or your specs, Motordyne's able engineering group will quickly design a new motor, or a modification . . . or suggest compromises that save you money. The prototype is developed in a few weeks. Then Motordyne swings promptly into manufacture. Modern equipment and large capacity assure prompt deliveries.

Catalog will be sent on request.

MOTORDYNE, INC.

2661 SOUTH MYRTLE AVENUE, MONROVIA, CALIFORNIA

CIRCLE ED-248 ON READER-SERVICE CARD FOR MORE INFORMATION



HIGH TEMPERATURE TERMINALS

100% leak tested, can be soldered, brazed, or welded

Now you can obtain electrical terminals made by a patented process utilizing a silver solder alloy to produce a molecular bond between metal and ceramic parts. They are hermetic, as proved by a mass spectrometer, and every terminal is leak tested before shipment. These high alumina-ceramic terminals operate at temperatures in excess of 350 deg. C, have unexcelled thermal and physical shock resistance, excellent electrical characteristics at high and low temperatures. Now used by leading electronic manufacturers in transformers, capacitors. Stocks on hand, 3/8" to 8" long, specials on request, engineering assistance provided for all your terminal needs. Call:

THE CERAMASEAL COMPANY
NEW LEBANON CENTER, N. Y.

CIRCLE ED-249 ON READER-SERVICE CARD FOR MORE INFORMATION

FIRST AGAIN—a high vibration, vertical mounting type hermetically sealed capacitor. Application and production proven characteristics for circuits designed with critical requirements in vibration and weight.

Eliminates a weakness common to capacitors of this style where the solder joint between the seal and the case makes the mechanical connection. Available and conforming to MIL-C-25A requirements.

WEST-CAP

LARGEST MANUFACTURER on the West Coast producing hermetically sealed, metal cased, MIL-C-25A and special application capacitors. Manufactured in both paper dielectric and plastic film dielectrics.

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SAN FERNANDO ELECTRIC MFG. CO.
1509 First Street
San Fernando, California

CIRCLE ED-250 ON READER-SERVICE CARD FOR MORE INFORMATION

New Literature . . .

R-F Connectors 251

Catalog No. D3 is devoted entirely to r-f connectors. It catalogs the following r-f connector series: N, BN, C, LC, UHF, BNC, HN, between series adapters, coaxial cable fittings, push-on, and subminax. Dimensions, mounting holes, weights, impedance, materials, and matching cable types are given for each connector. In addition the 64-page catalog contains illustrated connector cable assembly methods for each series. American Phenolic Corp., 1830 S. 54th Ave., Chicago 50, Ill.

Selecting Fans or Blowers 252

A new mathematical method (*ED*, April 1955, p. 48) of selecting the proper type of fan or blower for electronic applications is presented in a 2-page catalog sheet. The method resolves into determining the load-speed characteristic figure for any air system and matching this figure to the specific speed of the fan or blower to be used. Illustrations are given of typical wheels of various general types of fans and a graphic chart breaks down the various fan types into specific categories. Rotron Manufacturing Co., Schoonmaker Lane, Woodstock, N. Y.

Test Sets 253

Data sheets on two types of test sets are available. Bulletin No. TP-103 outlines the characteristics of the semi-conductor minority carrier lifetime test set. A block diagram is shown and data is included on the shutter, pulser, pulsed light source, bias supply, and other components. The semi-conductor resistivity test set is discussed in Bulletin No. TP-104. Method of operation is explained, with a block diagram of a typical installation. Baird Associates, Inc., Dept. SN, 33 University Rd., Cambridge 38, Mass.

Transistor Report Catalog

This catalog of technical reports on transistors lists 33 Government research reports covering the period 1949 through 1954. Descriptions of the various reports, prices, and ordering information are given. $0.10. Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

Color TV Microwave Relay 254

Bulletin No. 3-110 describes this firm's KTR-100 system of color TV microwave relaying. The KTR-100 provides one basic system for both color and monochrome transmission with built-in multiplexed audio signals and can be used as either a permanent or portable link for STL and remote pickups. The literature gives data on applications, performance, specifications, and accessories. Equipment Marketing Div., Raytheon Manufacturing Co., 100 River St., Waltham 54, Mass.

Industrial Sound Systems 255

Key functions of industrial sound systems are described in this 12-page booklet. Applications of sound and typical equipments are briefly discussed and amply illustrated. The booklet tells how sound can be used to simplify plant administration; coordinate production; improve employee morale; provide effective voice control of all plant functions, and save manpower. Engineering Products Div., Radio Corp. of America, Bldg. 15-1, Camden, N. J.

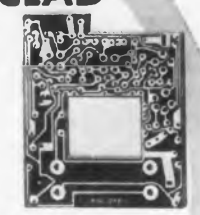
Detonator-Safe Initiators 256

Primarily for application to guided-missile problems, two units which serve the purpose of inserting a firing-safety function between electrical primers and a primacord firing train are described in leaflet No. DSI-555. The units are illustrated and described. Details on the electrical requirements are included, as are dimensioned mechanical drawings. Beckman & Whitley, Inc., 1085 E. San Carlos Ave., San Carlos, Calif.

Power Supply 257

Twenty-two standard economy power supply models are described in Bulletin No. 178. The 2-page, 2-color bulletin covers unfiltered units rated from 5 to 150amp and from 6 to 230v d-c, all having continuously adjustable outputs and for both 115 and 230v a-c operation. Opad Electric Co., 69 Murray St., New York 7, N. Y.

FIRST TRANSISTOR RADIO MADE POSSIBLE . . BY INSUROK® COPPER-CLAD PRINTED CIRCUITS!



This 12-ounce radio was made possible mainly through the use of printed circuits and transistors!

Regency laid out the circuit. Croname, Inc. printed it on Richardson T-725 copper-clad INSUROK, then etched it. Result: Light, compact circuit . . no tedious wiring . . faster assembly.

Ask for bulletin, "INSUROK T-725 Copper-Clad Laminates"

RICHARDSON *Laminated and Molded Plastics*

The RICHARDSON COMPANY
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2682 Lake Street, Melrose Park, Illinois (Chicago District)
SALES OFFICES IN PRINCIPAL CITIES

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Kenyon

your source

of supply

for special

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transformers

TWINS

The Kenyon Twins solve all problems for those who must meet rigid specifications.

- ML meets all MIL-T-27 requirements.
- CL meets all civilian requirements.
- Electrically identical — Mechanically interchangeable.
- Contain Best Class A Wire and Insulation available.
- Finished in smooth, durable, medium gray (other colors if desired).
- Completely Hermetically Sealed.

WRITE FOR CATALOG

Kenyon
TRANSFORMER CO., INC.
840 Barry Street, New York 59

CIRCLE ED-264 ON READER-SERVICE CARD FOR MORE INFORMATION

Plating Processes 265

Two technical bulletins describe plating processes. The "bright rhodium" process is described in one bulletin. Information on operating conditions, equipment requirements, physical properties of rhodium is provided, and special charts are included which indicate length of time required to electrodeposit a specified thickness of rhodium at given current densities. A high speed silver plating process for industrial applications is covered in another bulletin. The literature gives data on procedure for determining metallic silver content in potassium silver cyanide and a time table for specific thickness requirements. Sel-Rex Precious Metals, Inc., 229 Main St., Belleville 9, N. J.

Molding Compounds 266

A newly revised folder presents product data on granular, putty, and glass-reinforced Plaskon alkyd molding compounds. The folder describes the six mineral-filled and the three glass-fiber-reinforced molding compounds now available. A graph illustrates the relative insulating performance characteristics of these molding compounds when exposed to elevated temperature and humidity. Barrett Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

Soft Solder Alloys 417

This company's "Special Soft Solder Alloys" are shown in chart form in this new bulletin. The bulletin also contains brief descriptions of the alloys and some of their suggested uses. One of the uses is in sealing transistor cans. Alpha Metals, Inc., 56 Water St., Jersey City 4, N. J.

Hermetic Connectors 418

Hermetically sealed electrical connectors that withstand mechanical shock of 100g, thermal shock from —300 to 500°F, bonding temperatures as high as 1000°F, operating pressures up to 7000psi and high potentials of over 1500v are described in a new bulletin. Dimensional drawings and specifications are provided. Deutsch Co., 7000 Avalon Blvd., Los Angeles, Calif.

Radar and Missile Power Supplies 419

Bulletin No. RMPS-854 illustrates and describes applications of low-voltage, high-current tubeless magnetic amplifier regulated types of power supplies for ground and airborne missile and radar applications. One of the units is an airborne radar power supply; other units are used for missile launching, testing installations, ground radar trailer installations, etc. Perkin Engineering Corp., 345 Kansas St., El Segundo, Calif.

Corning Metallized Glass Enclosures like these are used for hermetically sealing rectifiers, resistors and capacitors.

How to protect delicate components *from moisture, mold, dirt, thermal shock*

You've got to safeguard delicate components so they can stand up under rough and tumble operating conditions.

Encapsulate sensitive components in rugged Corning Metallized Glass Tubes and you give them stamina they otherwise lack.

You protect them in a hermetic seal from moisture. You keep out dust and dirt. You prevent moulds and fungi from settling on them.

When assembled with metal end caps, Corning Metallized Glass Enclosures can take sudden temperature changes—from as much as 275° C. to ice water. And they are not affected by atmospheric changes.

The protection of metallized glass enclosures is permanent. Bond strength for metallizing used on enclosure tubes has been measured at 1500 to 2000 pounds per square inch. Because the glass is transparent, you can see inside the tubes to check the conditions of components. The electrical characteristics of the glass are excellent.

You can get metallized glass enclosures in a variety of sizes. We'll be happy to send you a descriptive catalog sheet telling you more about them. Or, if you have some specific problems metallized glass enclosures might help you solve, we'll be pleased to work with you. Write, wire or phone us.

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New Products Division

Please send me descriptive catalog sheet on Corning Metallized Glass Enclosures.

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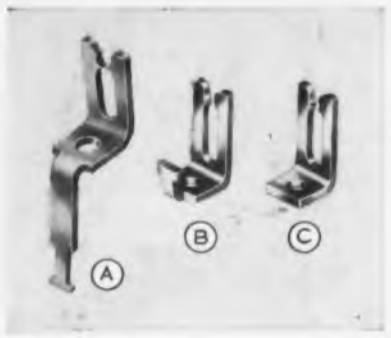
City ..... Zone ..... State .....

CIRCLE ED-268 ON READER-SERVICE CARD FOR MORE INFORMATION

New Diode Clips
Available in three styles



Now you can benefit from a more reliable, specially developed gripping power featured in these new diode clips by C.T.C. — *guaranteed* for quality performance.

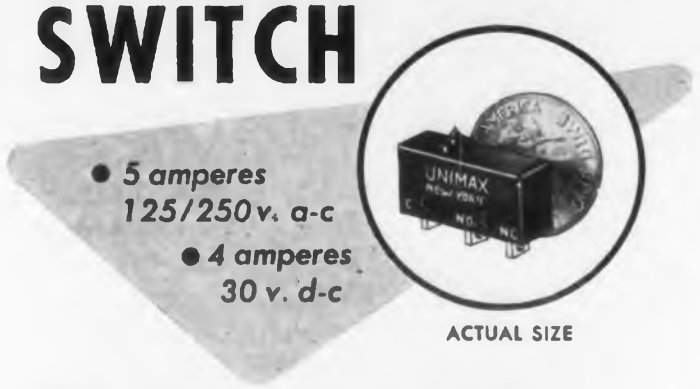
The special gripping power developed through heat treating to prevent fatiguing results in a vibration proof mounting with low contact resistance. The clips, mounted by means of a single rivet, are designed for diodes having nominal pin diameters of .079″, but will accommodate .069″ to .085″ diameters. Three styles include: X2090-A with feed-thru solder lug; X2090-B with solder lug for top wiring; X-2090-C less solder lug, for printed circuit applications.

Clips are made of beryllium copper, alloy #25. Finishes are either .0002″ brite alloy, or gold flash over .0002″ silver. They have a maximum width of 3/16″ and stand 13/32″ when mounted.

For further data, write Cambridge Thermionic Corporation, 457 Concord Ave., Cambridge 38, Massachusetts.

CIRCLE ED-273 ON READER-SERVICE CARD FOR MORE INFORMATION

SUB-MINIATURE SWITCH



ACTUAL SIZE

- 5 amperes 125/250 v. a-c
- 4 amperes 30 v. d-c

UNIMAX type USM

This compact, single-pole double-throw, snap-acting switch is built for easy wiring in miniaturized apparatus. Its sturdy, phenolic case is 25/32 x 23/64 x ¼ inch, with sturdy, standard flat terminals widely spaced for rapid wiring and easy soldering. Available in plain or leaf-actuator styles.

Free detailed data sheet on request.

UNIMAX

Division of the W. L. Maxson Corporation

460 WEST 34th STREET, NEW YORK 1, NEW YORK

CIRCLE ED-274 ON READER-SERVICE CARD FOR MORE INFORMATION

Broadband RF Power Meters

THE CHOICE OF ALL ARMED SERVICES FOR MICROWAVE POWER MEASUREMENTS

POWER: PULSE and CW—5μW to 5W average
FREQUENCY: 20MC — 10,000MC
ACCURACY: 5% Absolute at all ranges, frequencies, temperatures

- **INDICATIONS:** Direct Reading
- **CALIBRATION:** Compensates for All Variables
- **R-F COMPONENTS:** 3, 6, 10 and 20db Attenuators, Bolometer Mount and Elements, R-F Cable
- **BOLOMETER:** Broadband, High Overload Capacity
- **PLUMBING:** 3/8″ and 7/8″ 50-ohm Coaxial
- **POWER SOURCE:** 115VAC ±15%, 50-1000 cps
- **CONSTRUCTION:** Rugged, meets all JAN, MIL requirements

TYPICAL APPLICATIONS

Microwave Links . . . Television . . . Communications . . . Radar . . . Telemetering . . . Signal Generators . . . Laboratory Standards.

Write for descriptive literature to Department ED 8-M

Bruno-New York Industries Corporation

DESIGNERS AND MANUFACTURERS OF ELECTRONIC EQUIPMENT

460 WEST 34th STREET • NEW YORK 1, N. Y.

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

Transistor Applications

A 116-page illustrated manual, "Transistor Applications", describes constructional detail on over 50 different types of transistorized equipment. Complete component information, construction data, and test information is supplied with each article. Emphasis is placed on practical applications and basic transistor theory is discussed in many of the articles. $0.50. Dept. P-7, Raytheon Manufacturing Co., Receiving and Cathode Ray Tube Operations, 55 Chapel St., Newton 58, Mass.

Cleaning and Finishing 276

A quarterly brochure devoted to the subject of precision cleaning and finishing is being published by this firm. The first issue deals with the wet abrasive blast cleaning process. It contains a complete discussion of the scope of the wet blasting process and its many applications. Case history items are included. Other subjects will be covered in forthcoming issues. American Wheelabrator & Equipment Co., 1750 S. Byrkit St., Mishawaka, Ind.

Heavy Metal 277

This company's 77 Metal, a machinable tungsten-copper-inckel alloy used where high density is required in small space, is described in a 20-page illustrated book. The booklet lists the physical properties of the alloy, describes the processes of manufacturing and finishing, and contains a number of valuable reference tables and charts. The alloy, twice, as heavy as steel, 50% heavier than lead is used for balance weights and vibration damping devices, rotors, etc. Fansteel Metallurgical Corp., 2200 Sheridan Rd., N. Chicago, Ill.

Decade Resistance Unit 278

A catalog sheet describes the features of this company's miniature decade resistance unit. Designed for use in analog-computing equipment, circuit development, and specialized electrical laboratories, the unit is about 1/5 the size of standard decade resistors, yet is available in maximum resistance values of 1 and 10 megohms. A photograph of the unit and complete product specifications are given. Dept. KP, Telex, Inc., Telex Park, St. Paul 1, Minn.

Custom Panel Instruments 279

Custom panel instruments made by this firm are described in this data sheet. Ranges, mounting dimensions, and requirements are shown. Phaostron Co., 151 Pasadena Ave., S. Pasadena, Calif.

specify standard

FLEXLOC® SELF-LOCKING NUTS

Regular and Thin Types

Regular FLEXLOCS are one-piece, all-metal, standard height nuts that lock securely, even under extreme vibration. Thin nuts have the same one-piece, all-metal construction and the same positive locking principle, but these nuts are approximately 30% thinner. Your FLEXLOC industrial distributor stocks both types: regular FLEXLOCS in sizes from #4 to 2″; thin FLEXLOCS in sizes from #6 to 1½″. Ask him for catalog information and samples. Or write STANDARD PRESSED STEEL Co., Jenkintown 12, Pa.

FLEXLOC LOCKNUT DIVISION

SPS
JENKINTOWN PENNSYLVANIA

CIRCLE ED-283 ON READER-SERVICE CARD FOR MORE INFORMATION

NEW USES FOR STRAITS TIN

DIP SOLDERING PRINTED CIRCUITS

Printed circuits are a key factor in modern automation. Dip soldering—with high tin-content solders—saves time and costs. It's another of hundreds of new ways Straits Tin from Malaya is helping American industry. For new ways Straits Tin can help you, write:

MALAYAN TIN BUREAU

The Malayan Tin Bureau
Dept. 12H, 1028 Connecticut Ave.,
Washington 6, D.C.

CIRCLE ED-284 ON READER-SERVICE CARD FOR MORE INFORMATION

Gear Motors 285

A new bulletin offers availability data on gear train-control motor combinations. The complete list of gear ratios available, for sizes 9, 11, 15, and 18 control motors, is keyed for immediate and quick delivery. The bulletin also presents numerous servo control ideas used in servo assemblies that have been custom designed to solve particular problems. Transicoil Corp., Worcester, Montgomery County, Pa.

Magnetic Storage Device 286

A new type magnetic storage device which combines the advantages of a magnetic drum and tape recorder is detailed in a new folder. Principal applications of the instrument are in the fields of inventory control, data reduction, trend recording, and table storage. Brush Electronics Co., 3405 Perkins Ave., Cleveland 14, Ohio.

Environmental Testing Facilities 287

Facilities for environmental testing of components are described in a 4-page brochure. Included are tables of parameters measured, range of measurement, and accuracy of measurement. American Electronic Laboratories, Inc., 641 Arch St., Philadelphia 6, Pa.

Experimental Transistors 414

Bulletin No. G-50A describes this firm's new low-priced transistor RR125, which has been especially designed to meet the demand for a transistor which can be used by an experimenter to familiarize himself with various circuits using these devices. The bulletin contains specifications and a diagram for an experimental crystal receiver with one stage of transistor audio amplification. Semi-Conductor Div., Radio Receptor Co., Inc., 251 W. 19th St., New York 11, N. Y.

Power Supplies 415

Catalog No. 4 describes and illustrates power supplies made by this firm. The use of power supplies in d-c overpotential testing is discussed. A complete listing of both a-c and d-c power supplies according to voltage range is provided in tabular form. Beta Electric Corp., 333 E. 103rd St., New York 29, N. Y.

Resistors and Controls 416

Resistors, controls, and resistance devices are listed in Catalog No. 55. Among the items are assortments of wire-wound resistors mounted in display cards; fuse-type resistors for the protection of TV components; deposited-carbon precision resistors; industrial-type and precision controls designed specifically for laboratory, instrument, and other semi-critical applications. Clarostat Mfg. Co., Inc., Dover, N. H.

1 Reliable Source for All

Insulating Compounds

VARNISHES
Insulating Varnishes
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Melamine-Fortified Varnishes
Phenolic Varnishes
Isonel® Varnishes
Varnishes to MIL Specifications

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Cements
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Polystyrene Derivatives
Cellulose Lacquers

SPECIAL COMPOUNDS
Wire Enamels
Wax Solutions
Wax Sealants
Rubber-Base Coatings

insl-x
SCHENECTADY

Products of the Schenectady Varnish Company and The Insl-X Company now available in any quantity to electronic equipment manufacturers through:

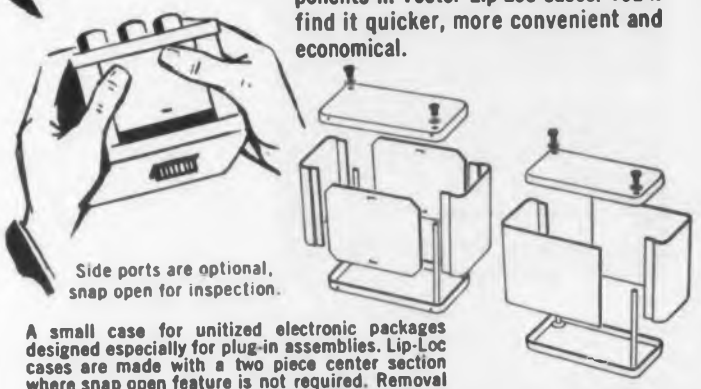
Insl-x Sales Company 26 Rittenhouse Place, Ardmore, Pa.

CIRCLE ED-289 ON READER-SERVICE CARD FOR MORE INFORMATION

Vector

LIP-LOC CASES*
with Snap-open
SIDE PORTS

For a perfectly designed, handsome and compact plug-in, assemble your components in Vector Lip-Loc cases. You'll find it quicker, more convenient and economical.



Side ports are optional, snap open for inspection.

A small case for unitized electronic packages designed especially for plug-in assemblies. Lip-Loc cases are made with a two piece center section where snap open feature is not required. Removal of only two screws allows complete disassembly of both types.

Available with a choice of plugs, quarter turn locks, ventilated of solid wall, and in a variety of sizes. Vector Socket-Turrets are available in many types—Post, Ceck, Wall or Tinker-Turrets—provide ideal internal structure to carry circuitry.

Write for free catalog.

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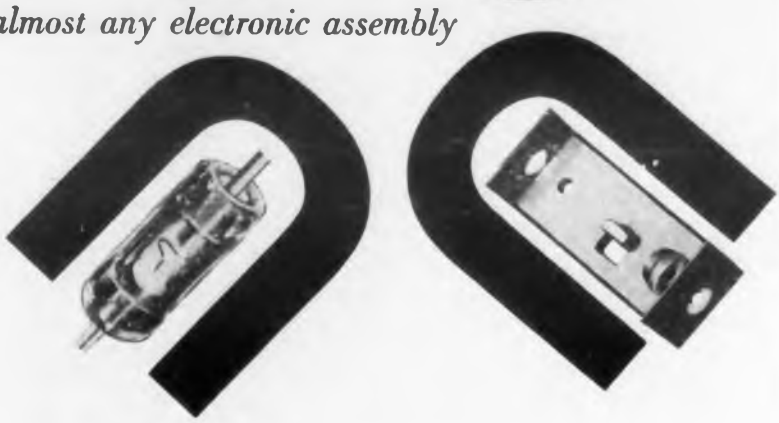
TELEPHONE CLeveland 7-8237

CIRCLE ED-290 ON READER-SERVICE CARD FOR MORE INFORMATION

Now you can

WELD *almost any electronic assembly*



Ultra-fine whiskers in semi-conductor devices, shunts and header pins in relays, slit and filament assemblies for isotron and mass spectrometer guns, and electronic sub-assemblies of wide variation are now reliably and precisely joined at greatly increased production rates by the WELDMATIC Model 1015

Unitek WELDMATIC

The WELDMATIC Model 1015 is a bench-mounted precision resistance welder, compactly self-contained. Weldmatic's stored-energy principle permits welding of copper, silver, high-carbon steel, tungsten, molybdenum, and other "difficult" materials. Weldmatic millisecond weld-time insures reliable welds without discoloration, excessive deformation, or metallurgical change. Dissimilar metals and parts of widely different thicknesses are joined with ease. The Model 1015 performs outstandingly in both laboratory and production line operation

Write for Complete Technical Information on Stored Energy Welding

UNITEK CORPORATION

265 North Halstead • Pasadena 8, California

Visit Booth 242-243 Wescon Show, San Francisco

CIRCLE ED-293 ON READER-SERVICE CARD FOR MORE INFORMATION

Electro-Mechanical Products 294

A 28-page booklet describes engineering and production facilities for a wide range of electro-mechanical products. Such products as space radio equipment, communications components, and electronic test instruments are illustrated. Munston Manufacturing & Service, Inc., Beech St., Islip, N. Y.

Flexible Hose 295

A high-temperature, light-weight, corrosion-proof hose is described in a new bulletin. This hose may be used for cooling lines employed to circulate the coolant used in the operation of power tubes and transformers. Hose assemblies are illustrated and charts give specifications. Resistoflex Corp., Belleville 9, N. J.

Plastics Welding 296

"Plastics Weldor and Fabricator" is a new external house organ which will detail specific phases of plastic welding and fabrication. It will cover new production techniques, literature, and new products. American Agile Corp., 5461 Dunham Rd., Maple Heights, Ohio.

Laboratory Instruments 297

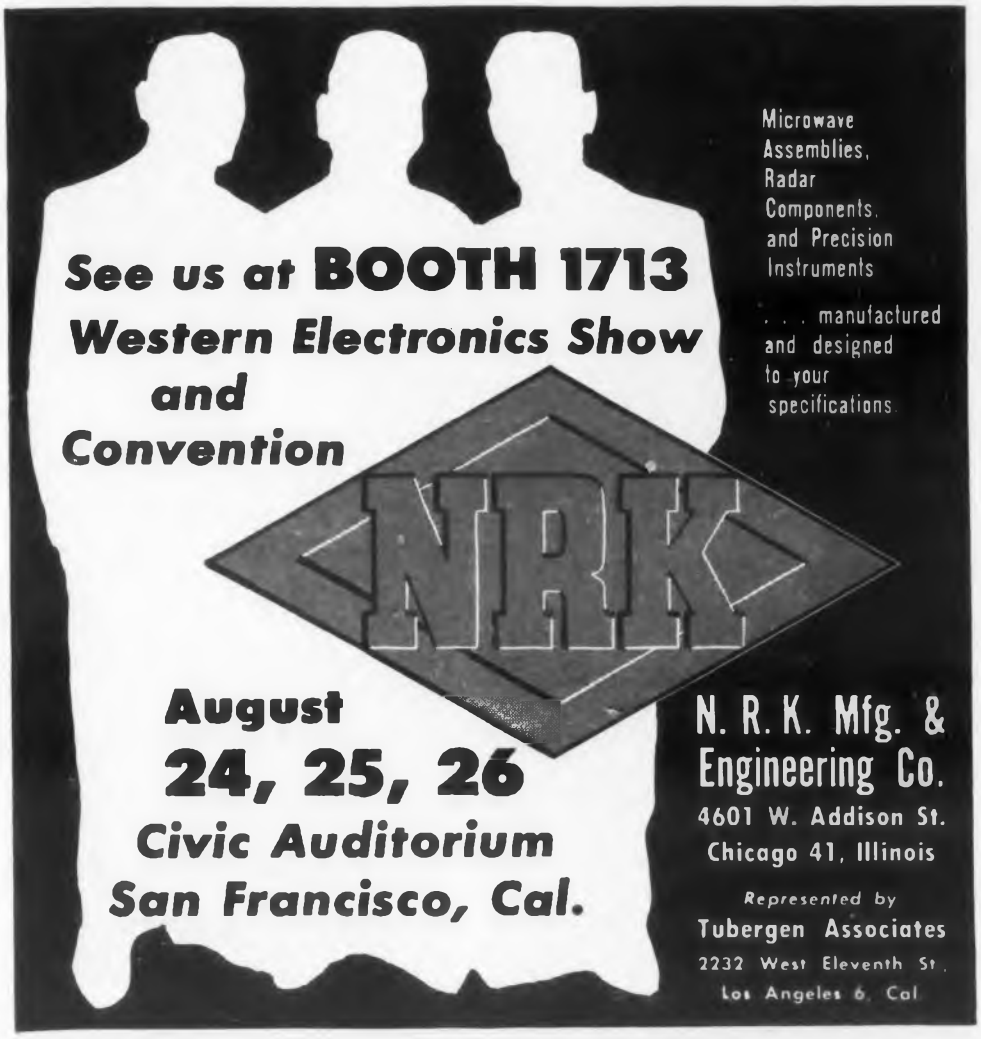
Laboratory standard instruments and standard cells are illustrated and described in catalog No. A46A. Included is expanded information on frequency coverage, frequency compensation, and wave form effect of Model 326 voltmeters, ammeters, and wattmeters. Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.

Shock, Vibration Isolator 298

A data sheet contains preliminary technical data on a new miniature All-Ang shock and vibration isolator developed for use in jets and guided missiles. The bulletin includes information on dimensions load ranges, natural frequencies, etc Barry Controls, Inc., 700 Pleasant St. Watertown, Mass.

Shaft Seal 299

Effective shaft sealing in minimum space under extreme operating conditions are advantages of the IIII Type shaft seal described in a data folder. The cutaway photos and cross-section drawings are included. Gits Bros. Mfg Co., 1866 S. Kilbourn Ave., Chicago 23, Ill.



CIRCLE ED-300 ON READER-SERVICE CARD FOR MORE INFORMATION

Electrical Control System 410

A revised 4-page booklet lists 44 colloidal and semi-collodial dispersions for electronics, electrical manufacturing, and related industries. These products include dispersions of graphite, molybdenum disulfide, vermiculite zinc oxide, and acetylene black. Carriers and diluents are given for each product, along with typical applications and physical data. Acheson Colloids Co., Div. of Acheson Industries, Inc., 950 Washington Ave., Port Huron, Mich.

Dispersions 411

A new electrical control system for predetermined repeat or non-repeat cycle on any machine with a mechanical tripping mechanism is described in Bulletin No. 55-1. A typical installation is illustrated and mounting dimensions are shown. Security Controls, Inc., 225 Franklin St., Buffalo 2, N. Y.

Delay Lines 412

The passive, jitter-free, continuously variable Helidel delay line is the subject of this technical paper. Entitled, "A Precise, Wide-band, Continuously Variable Delay Line," the paper includes performance curves, graphs, and delay line configurations. Helipot Corp., 916 Meridian Ave., S. Pasadena, Calif.

Prototype Production 305

This firm's method of producing short run and development parts is illustrated and described in a 4-page bulletin. The method may be used for accurate forming and drawing of stainless steel, Inconel, cold rolled steel, aluminum, copper, brass, and other alloys. C. B. Kaupp & Sons, Newark Way, Maplewood, N. J.

Squaring Circuit 306

The Z-90049 squaring circuit designed to operate from 0 to 1Mc is described in this technical data sheet. It takes a sine or complex waveform input and provides a square or restangular wave output. A circuit diagram, connections, and electrical and mechanical specications are provided. Eeco Production Co., 827 S. Vermont Ave., Los Angeles 5, Calif.

TV Camera and Equipment 307

These technical bulletins describe this firm's "Vitascan" TV camera equipment. A comparison of the Vitascan system and the Image Orthicon Camera system is given. A description of the system and its application and components and a color system planning chart and price list are also included. Television Transmitter Dept., Allen B. Du Mont Laboratories, Inc., 1500 Main Ave., Clifton, N. J.

This is a Birtcher KOOL KLAMP. It does two jobs. Being made of 99½% pure heat treated silver, it reduces bulb temperature. It also serves to hold miniature and subminiature tubes secure against shock and vibration. If you have a problem of heat and/or retention write today for a catalog and complete details to The Birtcher Corporation, Industrial Division, 4371 Valley Blvd., Los Angeles 32, California.

CIRCLE ED-409 ON READER-SERVICE CARD FOR MORE INFORMATION

transistor and digital computer techniques

APPLIED TO THE DESIGN, DEVELOPMENT AND APPLICATION OF

AUTOMATIC RADAR DATA PROCESSING, TRANSMISSION AND CORRELATION IN LARGE GROUND NETWORKS

Engineers & Physicists

Digital computers similar to successful Hughes airborne fire control computers are being applied by the Ground Systems Department to the information processing and computing functions of large ground radar weapons control systems.

The application of digital and transistor techniques to the problems of large ground radar networks has created new positions at all levels in the Ground Systems Department. Engineers and physicists with experience in the fields listed, or with exceptional ability, are invited to consider joining us.

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CIRCLE ED-314 ON READER-SERVICE CARD FOR MORE INFORMATION

Spot Welder 315

Bulletin No. 334-3 describes this firm's Type PMCO 2 ST air operated, press type, patented 3-phase modu-wave spot welder. It is complete with charts, photographs, schematic drawings, and tabular data describing this welder. Sciaky Bros., Inc., 4915 W. 67th St., Chicago, Ill.

Radiation Instruments 316

A 20-page catalog illustrates and describes new radiation instruments. Included are such laboratory instruments as liquid phosphor counters, scalers, linear amplifiers, ratemeters, ultrastable power supplies, scintillation detectors, and crystals. Technical Measurement Corp., 140 State St., New Haven 11, Conn.

Potentiometers 317

This 2-page, illustrated color bulletin covers features, technical data, and outline drawings of new high resolution potentiometers designed for low torque, high function angle applications. Electronic Sales Div., DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.

Rivet Selector 318

A rivet selector provides dimensional information in "slide rule" form. It gives specific dimensions, clinch allowances, and clearances for standard rivets. Selector is divided into four parts for bifurcated, cutlery, drilled and extruded rivets, and contains information not previously available. Milford Rivet Co., Milford, Conn.

Metal Stamping Service 319

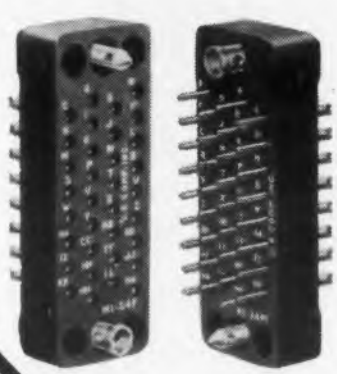
This company's small lot metal stamping service is described in a new illustrated bulletin. The Bulletin (No. F-230) features typical examples of short run stampings from ferrous and non-ferrous metals. Dayton Rogers Manufacturing Co., 2824 13th Ave. S., Minneapolis 7, Minn.

Catalog Page 320

A new catalog sheet illustrates and describes an automatic variable pitch space winder and wire insulating equipment. Complete technical, functional, equipment, and mounting data on both units is provided. Geo. Stevens Mfg. Co., Inc., Pulaski Rd. at Peterson, Chicago 30, Ill.

U.S.C. MINIATURE CONNECTORS

Quality Controlled Contact Dependability



MI-34F MI-34M

Individual processing of each contact assures quality control throughout with 100% dependability of contact.

Guide pins have the feature of a 1/16" D hole to provide easy assembly to chassis or hood with as simple a tool as a paper clip. This eliminates possible distortion of Guide pin.

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CIRCLE ED-321 ON READER-SERVICE CARD FOR MORE INFORMATION

Capacitors 323

The various types of capacitors made by this company and the company's plant facilities are described in a 12-page booklet. The importance of research and development work are emphasized. Micamold Electronics Manufacturing Co., 1087 Flushing Ave., Brooklyn, N. Y.

Emulsifying Agent 324

A data sheet describes properties and applications of DGL, a diethylene glycol mono laurate with broad function properties as an emulsifying agent. It may be used in metal working, plasticizing, resins, and paints. Witco Chemical Co., 122 E. 42nd St., New York 17, N. Y.

Extruded Plastic Tubing 325

An 8-page catalog contains technical data, descriptions, photographs, and application information on extruded plastic tube and resinous sheeting and tape for electrical insulating purposes. Insulation Manufacturers Corp., 565 W. Washington Blvd., Chicago 6, Ill.

Transformers 326

A 24-page catalog of transformers for replacement and original equipment lists 543 transformers and related components. It contains detailed electrical and physical specifications for each unit. Illustrations of each transformer type appear on the same page with the transformer listing. Chicago Standard Transformer Corp., Addison & Elston Ave., Chicago 18, Ill.

Desiccant 327

A new high absorption packaging desiccant and static dehumidifier is described in this data sheet. Charts give flexible and rigid moisture barriers and typical problems are presented to illustrate uses. Culligan, Inc., Northbrook, Ill.

Radio-TV Products 328

A fully illustrated, 16-page catalog provides detailed descriptions of this firm's line of TV and radio products, including all kinds of knobs for replacement, experiment and original equipment use, switches, and other service items. Gee-Lar Manufacturing Co., 819 Elm St., Rockford, Ill.

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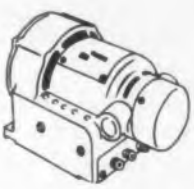

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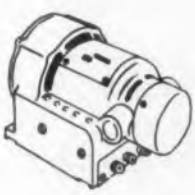
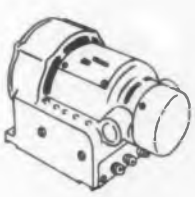
AC voltage regulation within ± 5%; frequency within ± 1% (at .9 power factor).



COMPACT

100 volt-ampere size weighs only seven pounds; measures just 6.4 x 4.6 x 4.4 inches.



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1000 hours of trouble-free service; withstand 10 G's acceleration and temperature from −55° to 71° C.

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CIRCLE ED-333 ON READER-SERVICE CARD FOR MORE INFORMATION

Accelerometers 334

Bulletin No. 29 is a reprint of "A Basic Method of Determining the Dynamic Characteristics of Accelerometers by Rotation". Charts are used to show response characteristics. Statham Laboratories, 12-401 W. Olympic Blvd., Los Angeles 64, Calif.

Rivets 335

A data book for designers and engineers describes and illustrates this firm's "Rivnut", a one-piece blind rivet with threads. The various types are shown and typical applications are given. Charts give engineering data and sizes. Rivnut Div., B. F. Goodrich Co., 500 S. Main St., Akron, O.

Compensated Units 336

A new bulletin on temperature compensated units gives complete details on both a-c and d-c compensated units. Circuit diagrams and graphs of temperature compensation are provided. Electric Regulator Corp., 502 Pearl St., Norwalk, Conn.

Airline Connectors 337

Airline tubes for use in place of current carrying circuits but using standard AN type shells and coupling nuts are cataloged in Bulletin No. SR-AL-1. Dimensional drawings and diagrams are included. Cannon Electric Co., 422 W. Avenue 33, Los Angeles 31, Calif.

Clips and Insulators 338

A new, revised catalog of a complete line of electrical and electronic clips and insulators has been issued. The illustrated catalog covers all late revisions, including miniaturized and special insulated clips. Mueller Electric Co., 1580H E. 31st St., Cleveland 14, Ohio.

V-Drive Belts 339

This company's complete line of fractional horsepower and heavy duty multiple V-drive belts are described in a 24-page catalog. Each type of V-belt is completely described as to its construction and applications. Maurey Manufacturing Corp., 2907-23 S. Wabash Ave., Chicago 16, Ill.

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CIRCLE ED-340 ON READER-SERVICE CARD FOR MORE INFORMATION

343 Oscilloscopes, Preamplifiers

A 16-page booklet describes the Type 530-Series oscilloscopes, Type 53 plug-in units, and Type 53/54 plug-in units. The booklet gives complete descriptions and specifications of three oscilloscopes and six plug-in preamplifiers. Tektronix, Inc., P. O. Box 831, Portland 7, Ore.

344 Printed Circuit Data

Various components and principles in making printed circuits are described in these technical bulletins. Four types of printed circuit kits are described. Complete instructions for using the kits are given. Techniques, Inc., 135 Belmont St., Englewood, N. J.

345 Punch Press

A 16-page bulletin describes the R-61 heavy duty turret punch press. The illustrated bulletin gives the features of the machine. Typical turret layouts are shown. Wiedemann Machine Co., Dept. 116, P. O. Box 6794, 4272 Wissahickon Ave., Philadelphia 32, Pa.

346 Receivers and Generators

Two types of WWV receivers and audio generators are described in a product data sheet. Applications and specifications are included. Also shown on the data sheet are a preadboard speed chassis and rotating production table. Specific Products, 14515 Dickens St., Sherman Oaks, Calif.

347 Power Motor-Gear Train

A new catalog sheet illustrates and completely describes a power motor-gear train. Technical data includes dimensional drawings, performance features, and a table giving motor length, gear train length, and related data. John Oster Manufacturing Co., 1 Main St., Racine, Wis.

348 Notch Diplexer

This technical data sheet illustrates and describes the v-h-f notch diplexer. Electrical and mechanical specifications and installation instructions are provided, as well as front and side views of the installation. Prodelin, Inc., 307 Bergen Ave., Kearney, N. J.

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WHY? Because this Barry mount is independent of operating or mounting position. Through every operational maneuver of jets, VTO's, and missiles, the ALL-ANGL gives the same effective shock and vibration protection as in level flight.

These are the vital performance characteristics of the ALL-ANGL Mount:

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Maximum load ratings of Size 0 ALL-ANGL mounts now available are 0.5 to 3.0 pounds per mount, in four ranges.

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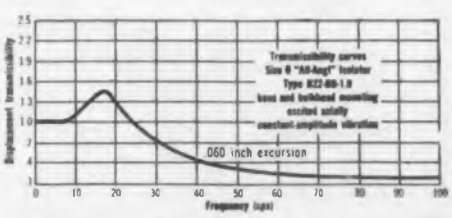

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RHEEM SUBMINIATURE VOLTAGE REGULATOR Model REL-11

Specifications

Size ..... 1-3/4" x 2-5/16" x 4-3/8"
Weight ..... 14 ounces
Output Voltage ..... Any nominal voltage from 135 to 230 volts, adjustable range ±10% of the nominal voltage
Current ..... Up to 200 milliamperes
Ripple Reduction Factor ..... 5×10^{-4}
Output Impedance .. Will not exceed 2 ohms from 1 cps to 200,000 cps
Regulation ..... Within .05% for load variations of ±25% and input variations of ±20%
Minimum DC Input Voltage ..... Equal to 100 volts greater than the regulated output voltage

AIRBORNE POWER SUPPLY REL-14 (-1, -2, -3)

Special Features

*Size	7" x 7" x 5"
Weight	14 lbs.

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ELECTRICAL CHARACTERISTICS

	—1	—2	—3
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Voltage	150 V DC	150 V DC	150 V DC
Current	150 ma	250 ma	300 ma
Ripple	5 MV rms	5 MV rms	5 MV rms
Impedance	2 ohms	2 ohms	2 ohms
Regulation	0.5%	0.5%	0.5%
Unregulated output			
Voltage	250 V DC	250 V DC	250 V DC
Current	100 ma	100 ma	200 ma
Power requirement			
Input voltage	27 V DC ±10%	27 V DC ±10%	27 V DC ±10%
Input current	6 amps	10 amps	14 amps

RHEEM AIRBORNE POWER SUPPLY Model REL-16

Specifications

Input ..... 115 V, 400 cycle, single phase
Regulated Output ..... 150 V, dc at 200 ma
Regulation ..... Within 0.05% for Load Variations of ±25% and input variations of ±20%
Ripple ..... 5MV rms
Output Impedance ..... Will not exceed 2 ohms from 1 cps to 200,000 cps
Size ..... 8-3/4" x 2-5/16" x 3-1/8"
Weight ..... 2 lbs., 13 ounces
Environmental Operation ..... Meets existing aircraft and missile environmental specifications of vibration, temperature, acceleration, shock and altitude.

RHEEM Instrumentation Units are:

...Designed to operate under the most rigorous environmental conditions and to meet the most exacting specifications required by modern systems.

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CIRCLE ED-353 ON READER-SERVICE CARD FOR MORE INFORMATION

Engineering Services 354

The services this company offers in the field of nuclear science and engineering are illustrated and described in this booklet. The laboratory and experimental facilities are shown, and the types of work which can be done are detailed. Nuclear Science and Engineering Corp., P. O. Box 10901, Pittsburgh, Pa.

Mounting Systems 355

Special mounting systems for shock and vibration control for airborne equipment are illustrated and described in this booklet. Complete units, as well as individual parts, are illustrated and characteristics and applications given. Robinson Aviation Inc., Teterboro, N. J.

Pulse Transformers 356

Plug-in type pulse transformers are described in a new data sheet. A combination base and circuit diagram, a typical blocking oscillator diagram, and characteristics are included. Berkshire Laboratories, 578 Bank Village, Greenville, N. H.

Electrical Quick-Disconnects 35

A new bulletin describes this compan improved electrical quick-disconnect. T bulletin contains information on how t quick-disconnect works and a descrip i of the insulation material, pin and soc contacts. Specification information i cludes a brief description of vario shells and dimensions. The Deutsch C 7000 Avalon Blvd., Los Angeles, Calif.

Audio Frequency Carrier 35

A new low cost signaling system d signed specifically to fill sub-audio or d signaling needs is described in a 4-pa bulletin. The bulletin contains phot graphs and specifications of system. Nor Electric Co., Galion, Ohio.

Factors in Management 35

Psychological factors in man manag ment is the subject of a conference seri outlined in this booklet. The various s sions of the course are described. Dunl & Associates, Inc., 429 Atlantic St., Sta ford, Conn.

CIRCLE ED-360 ON READER-SERVICE CARD FOR MORE INFORMATION

Molding Compounds 363

Proper tools, equipment, and techniques for best results with alkyd molding compounds are covered in a revised 8-page booklet. Putty, granular, and reinforced alkyds are discussed with specific recommendations made for each type of material. Graphs illustrating minimum cure time vs. temperature for the three types are given. Barrett Div. Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

Rectifiers 364

A new 8-page folder describes "unitized rectifiers". These unitized rectifiers provide a highly dependable high-voltage d-c source. Magnatran Inc., Kearny, N. J.

Drafting Template 365

A new drafting template covers the full line of this firm's line of miniature all metal, self-locking nuts. The template covers all configurations, all sizes of anchor nuts, including the standard hex nuts and gang channel. The Kaynar Co., Kaylock Div., 820 E. 16th St., Los Angeles, Calif.

Servo Components 366

This 16-page manual gives specifications and characteristics of over 130 synchros, servo motors, resolvers, and tools and adapters. Dimensional drawings and photographs are included. Norden - Ketay Corp., 555 Broadway, New York 12, N. Y.

Louvers 367

The use of louvers to correct moisture blistering of paint and for fungas control is described in a bulletin. Installation procedures are illustrated and specifications listed. Midget Louver Co., 6-8 Wall St., Norwalk, Conn.

Silicon Junction Diodes 368

An illustrated 8-page bulletin lists and describes eight types of silicon junction diodes. The bulletin contains specifications and characteristics of these subminiature devices, which are fusion-sealed in glass and have an ambient operating temperature range of from —80 to +200°C. Semiconductor Div., Hughes Aircraft Co., Culver City, Calif.

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PULSE TRANSFORMERS
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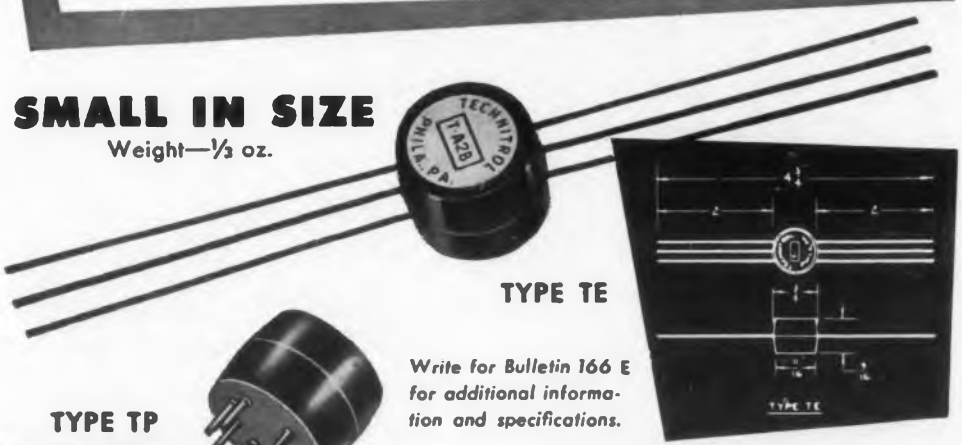

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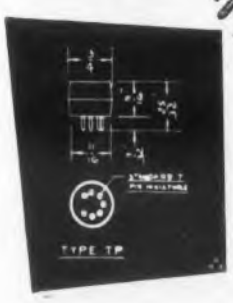

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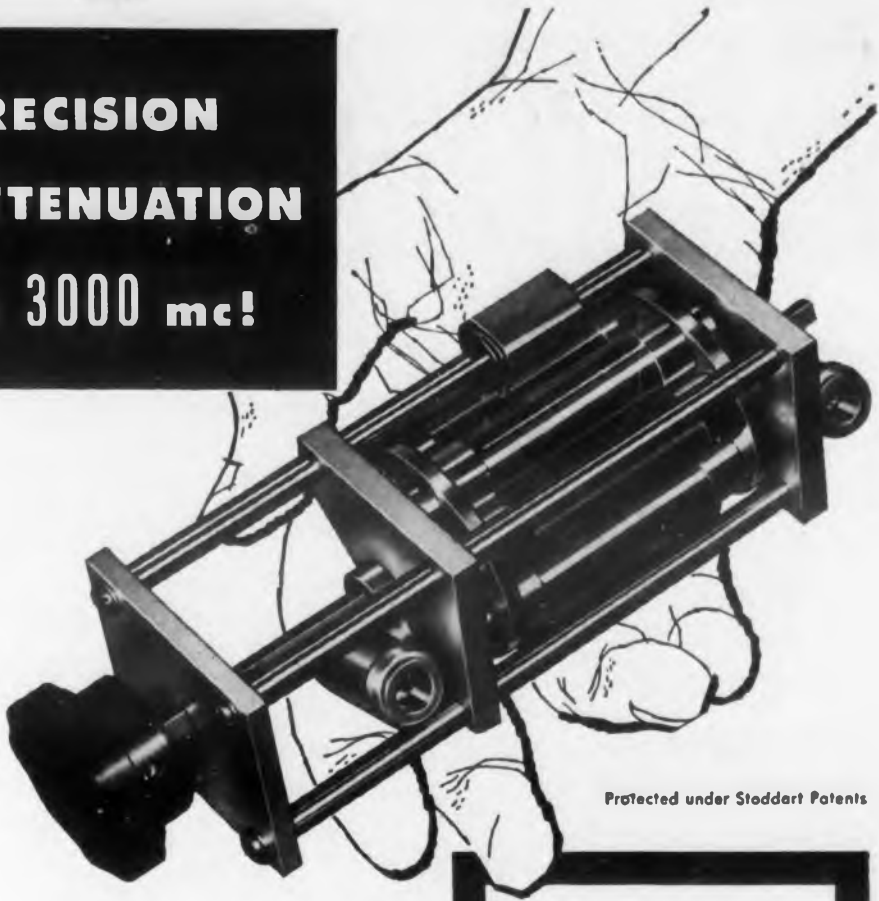

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six-position
TURRET ATTENUATOR
featuring **PULL-TURN-PUSH** *action*

FREQUENCY RANGE: dc to 3000 mc.
CHARACTERISTIC IMPEDANCE: 50 ohms.
CONNECTORS: Type "N" Coaxial female fittings each end.
AVAILABLE ATTENUATION: Any value from 1 db to 60 db.
VSWR: 1.2 max., dc to 3000 mc/s, values from 10 to 60 db. As value decreases below 10 db, VSWR increases to not over 1.5.
ACCURACY: ± 0.5 db.
POWER RATING: One watt sine wave power dissipation.

SINGLE "IN-THE-LINE" ATTENUATOR PADS and 50 ohm COAXIAL TERMINATIONS

This new group of pads and terminations features the popular Type C and Type N connectors, and permits any conceivable combination of the two styles. For example, the two connector types, either male or female, can be mounted on the same attenuator pad, with or without flanges, so that it may serve as an adapter as well as an attenuator. Frequency range, impedance, attenuation, VSWR, accuracy and power rating are as designated above. Send for free bulletin entitled "Measurement of RF Attenuation."

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BROAD BAND PULSESCOPE

by Waterman

MODEL S-6-A

DC CALIBRATION MARKERS 1-1000 μs
0-5 mc

Size:
8½" x 6¾" x 13¾"
22 Pounds

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The S-6-A BROAD BAND Scope is a PULSESCOPE in performance, POCKETSCOPE in size, and it compares more than favorably with oscilloscopes that are *transportable*, instead of portable. The instrument measures DC as well as AC signals. Unique DC calibration methods permit rapid measurements of either positive or negative AC or DC signals. The scope uses a 3XP1 tube with 1500 volts on the second anode, thus providing a brilliant trace for high speed transients even at low repetition rates. Vertical amplifier sensitivity of 0.2v rms/inch, and response to 5 mc within 3DB . . . pulse rise time of 0.1 μs . . . internal intensity markers from 1 to 1000 μs . . . repetitive or trigger sweep from 5 cycles to 500 KC with 5X sweep expansion . . . sweep, marker and DC calibrating voltage available externally. Size 8½ x 6¾ x 13¾ in. Weight 22 lbs. Operates from 50 to 400 cycles at 115 volts AC.

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S-15-A TWIN TUBE POCKETSCOPE
RAYONIC® Cathode Ray Tubes
and Other Associated Equipment

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Patents

By John Montstream

Semiconductor Current Control Device . . . *Patent No. 2,689,930. R. N. Hall (Assigned to General Electric Company, New York, N. Y.)*

Improved highpower rectifier performance and highpower transistor performance has been secured with the p-n junction semi-conductor unit manufactured in the manner described in the patent. This unit has both a high reverse voltage characteristic and a high forward current characteristic. For example, a rectifier having a barrier area of one square centimeter will pass a forward current of 500amp with a one volt potential difference and has withstood potentials of 500v in the negative conductance direction.

An ingot of germanium or silicon is grown by preparing a melt to which a trace of an acceptor impurity, such as indium, aluminum or gallium, has been added and also a trace of a donor impurity such as antimony or arsenic. Then by controlling the growth rate of the ingot by successfully varying the temperature of the melt in the range where the impurities

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Catalog illustrates prototype transformer in detail to:

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simplify and assure more accurate specifying of your requirements

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18240 Harwood Avenue,
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(Suburb of Chicago)

GTC

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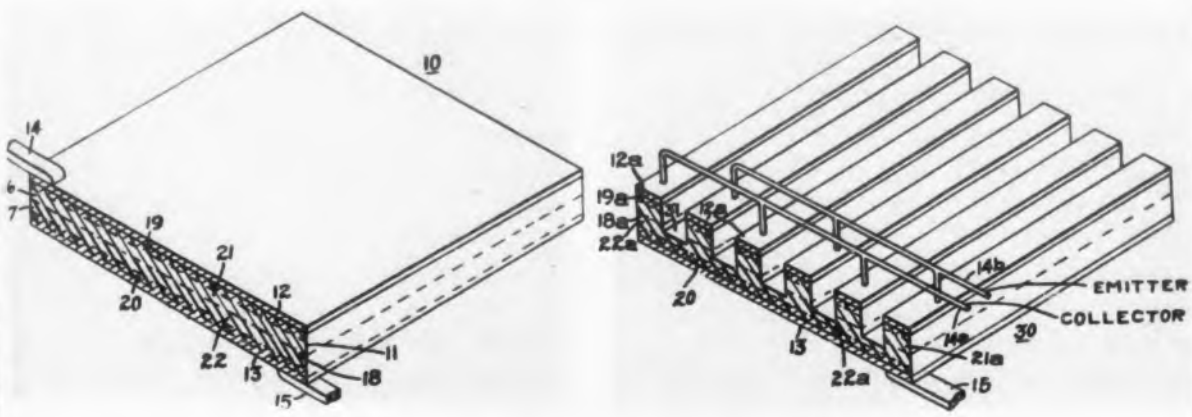
ave different assimilation rates. At one temperature the donor impurity is assimilated in excess to provide an n-type region and at another temperature the acceptor impurity is assimilated in excess to provide a p-type region so that a series of barrier junctions form in the ingot as it grows.

A unit (*11*) is extracted from the ingot so that it has a barrier junction (*18*) as illustrated with moderate impurities in regions *16* and *17*. An acceptor electrode (*12*) is fused to p portion *16* of the crystal and heat treated to provide a region (*19*) having strong impregnation of acceptor material. A donor electrode (*13*) is fused to n portion *17* of the crystal to provide a region (*20*) having a strong impregnation of donor material. The conductors *14* and *15* are then attached to the electrodes. For a transistor, the unit has grooves (*31*) ground in it to a depth beyond the barrier junction to formed raised steps as illustrated. One set of alternate steps are connected with a collector electrode (*14a*) and the other set is connected with an emitter electrode (*14b*) to form the transistor.



Cross-sections of a rectifier (left) and transistor (right) made by the new process.

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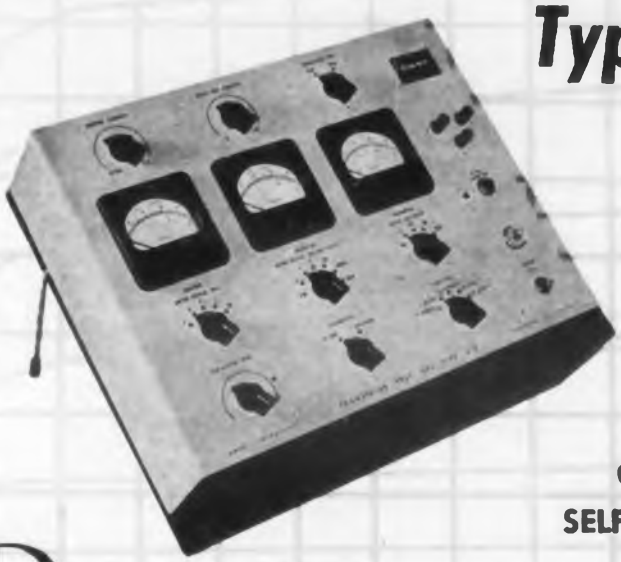
TRANSISTOR TEST SET

Type 210



ACCURATE •
CONVENIENT •
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DESIGNED for those using transistors, this test set is particularly adapted to the needs of the circuit development laboratory and the incoming inspection department. Operation is simple and straightforward, and no auxiliary equipment is required. The Type 210 is completely a-c powered, and contains no batteries or other short-life components.

The "h" parameters, as standardized upon by transistor manufacturers, are quickly measured over a wide range of d-c conditions. Base-input current amplification and collector saturation current are also directly indicated.

A transistor socket adaptor and a test adaptor for making a variety of other measurements using accessory instruments are furnished with the test set. Write for complete data, or call the nearest representative listed below for a demonstration.

CONDENSED SPECIFICATIONS

Transistor types: • PNP or NPN junction or point contact.

D-C operating conditions: • constant emitter current, zero to 7.5 ma; constant collector voltage, zero to 75 volts.

A-C operating conditions: • measurements made at 1.5 kc. Parameter meter (a-c voltmeter) sensitivity is one millivolt rms full-scale.

Parameters measured: •
h_{11}, input impedance.
h_{12}, voltage feedback ratio.
h_{22}, output impedance.
h_{21}, current gain with emitter input (α).
β, current gain with base input.
I_{co}, collector saturation current.

and with external variable-frequency oscillator and voltmeter:

Alpha cut-off frequency.
Beta cut-off frequency.
Collector capacitance.

Size: • 15 x 13 x 4 inches. Weight approximately 18 lbs.

Price: • $475, f.o.b. Pasadena.

Chicago: • JKM Inc., Whitehall 4-6345
Cleveland: • S. Sterling Co., Evergreen 2-4114
Detroit: • S. Sterling Co., Broadway 3-2900
Los Angeles: • Luscombe Engineering Co., Madison 6-0211
New York-Newark: • Gawler-Knoop Co., Digby 4-8417, Caldwell 6-4545
Philadelphia: • Gawler-Knoop Co., Livingston 8-5480, Ogontz 8805
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There is no one "cure all" for system instability. The desired stability of a servo loop is attained through the proper selection of components that satisfy the various conditions under which the loop will operate. Kearfott offers four basic motors and combinations for providing system stability. All feature high speed of response; low inertia and high stall torque.

SYSTEM STABILITY

SERVO MOTORS: Servo motors with high torque to inertia characteristics possessing (built-in) inherent damping ranging in size from ¾" to 1¾" diameter are available. Low speed, low power motors for use in simple instrument servos where high damping and/or low time constant is required can also be provided.

VISCOUS DAMPED SERVO MOTORS: Provide integral viscous damping for simple instrument servos. Any degree of damping can be provided. These units reduce no load speed of standard motors to 50% or 75% of normal, providing 70% or 50% of critical damping respectively.

(shown ⅔ size)


(shown ¾ size)


(shown approximately ½ size)


(shown ⅓ size)

INERTIAL DAMPED MOTORS: Integral inertially damped motors for use in high speed and/or high gain servo systems—damping on acceleration or deceleration basis with little loss in normal no load speed. These units make possible system cut off frequencies up to 25 cps using magnetic amplifiers.

SERVO MOTOR TACHOMETER GENERATORS: For system stabilization by voltage feedback from an integral tachometer generator. May be obtained as damping generators for use in simple rate servos or as rate damping generators for use in very high gain systems. The latter feature high linearity, high output and maximum output to fundamental null ratios.

These servo motors are suitable for most exacting requirements. Write today for descriptive bulletin giving data of components of interest to you.

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Gyros, Servo Motors, Synchros, Servo and Magnetic Amplifiers, Tachometer Generators, Hermetic Rotary Seals, Aircraft Navigational Systems, and other high accuracy mechanical, electrical and electronic components.

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AEC Patents For Industry

Additional patents owned by the Government and held by the Atomic Energy Commission have been made available for licensing on a non-exclusive, royalty free basis. Applicants should apply to the Chief, Patent Branch, Office of the General Counsel, U. S. Atomic Energy Commission, Washington 25, D. C. Of the 20 patents released, the following ones are particularly interesting to electronic design and development engineers.

Electronic Adder-Accumulator (Patent No. 2,705,108); Joseph J. Stone, Jr., inventor. The patent relates to a novel electrical adder-accumulator, which operates in a parallel manner on the digits of numbers to be added. Simultaneous addition on computers using decimal notation in part has been found to be impractical because of the necessity of applying a variable correction factor. The present device is provided with a plurality of parallel adder groups, one for each decimal digit of the numbers to be added. Each unit is subdivided into four adder units, each of which has associated with it an accumulator in which is stored a number, and a gate tube which will pass a pulse changing the accumulator total by one if a predetermined combination of input voltage levels is obtained.

Voltage Stabilized Oscillator (Patent No. 2,701,330); Thomas F. Marker, inventor. This invention relates to a means for voltage stabilization in oscillators and amplifiers which will operate successfully with a high impedance potential source at a relatively low expenditure of power. The circuit comprises an amplifying vacuum tube, a source of alternating voltage, and the means for stabilizing this voltage. A pair of diodes having dissimilar back resistance characteristics are conected in series opposition to each other and in series with an r-c network. The diode and network are connected between the control grid and the cathode of the vacuum tube.

VARIABLE FREQUENCY POWER SUPPLY
Model VP-400

APPLICATIONS: Model VP-400 is used for testing military and non-military electrical and electronic equipment requiring line frequencies not available where the equipment is being tested. Thus a line frequency of 50 cycles can be obtained from the instrument to permit the evaluation of apparatus for use abroad.

The supply also provides primary power for gear built for installation in aircraft requiring 400 cycles or higher.

For military equipment intended to operate over a wide power frequency range, such as 50 to 1200 CPS, only this type of electronic generator can furnish the variation of power frequencies.

This instrument is also a source of variable frequency high audio power for general laboratory use.

Since this supply does not use any moving parts, it provides silent operation and is not subject to mechanical wear and tear.

FREQUENCY RANGE: 47 to 6000 cycles, continuously variable in two ranges. Jack for external drive is provided.

POWER OUTPUT (continuous operation, into resistive load):
500 watts maximum.
400 watts low distortion.

HARMONIC DISTORTION (for 400 watts into resistive load):
5% maximum, total.

VOLTAGE REGULATION: 2% from no-load to full load.

OUTPUT VOLTAGE RANGES: 75 to 150 volts and 150 to 300 volts.

PRIMARY POWER REQUIREMENTS: 115 volts, 60 cycles (1300 volt-amperes).

DIMENSIONS: 42" high, 22" wide, 18" deep.

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Saturable Reactor (Patent No. 2,709,791); Robert L. Anderson, Jr., inventor. This patent relates to a novel saturable reactor for controlling an electric current of improved design having but a single winding, which is simple in construction, capable of carrying a very heavy direct control current with very low losses, and also capable of efficiently operating upon a radio frequency voltage.

Ion Producing Mechanism (Patent No. 2,704,335); John S. Luce, inventor. The patent relates to an ion producing mechanism provided with a curved filament and a curved defining slot in the plate, which coact so as to provide an arc of curved cross section. This arc incloses the ion exit passage and permits maximum operating efficiency and prevents the leakage of neutral vapors from the ionizing chamber.

Insulator Clamping Device (Patent No. 2,703,337); William L. Scott, Jr., inventor. This patent covers a device for holding in accurate alignment electrodes, or other elements which will be subjected to a considerable temperature range and possibly also a strong magnetic field. Supporting means are provided comprising a clamping arrangement formed of material having a different coefficient of expansion than the material of the insulator and embodying a resiliently deformable member which compensates, when an increase in temperature occurs, for the differential in coefficients of expansion. The clamping device may be arranged so as to be spring loaded, or it may be accurate in shape having a radius of curvature less than that of an adjacent portion of the insulator.

Ion Source (Patent No. 2,700,107); John S. Luce, inventor. The patent pertains to an improved ion source that gives greater efficiency than old devices in delivering positive ions. Means for providing oscillating electron motion are incorporated with a critically positioned defining slot. A substantial reduction is accomplished in the amount of recombination of ionized particles. A more uniform ion distribution is attained, and the amount of deposition of ions and molecules on the source walls is reduced.

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Impedance: 1 μh to 1100 henrys

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SPECIFICATIONS

- CUT-OFF RANGE — 20 cps to 200 KC
- SECTIONS — 2—can be high, low and band pass
- ATTENUATIONS — 36 db/octave maximum
- INSERTION LOSS . 0 db
- NOISE LEVEL — 80 db below 1 volt
- FREQUENCY RESPONSE — 2 cps to 4 MC

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

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Books . . .

Engineering Cybernetics . . . *H. S. Tsien, 289 pages, McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N. Y. $6.50*

The purpose of this work is to establish a new engineering science, the science of control. The author adopts the name selected by Norbert Weiner in his famous book "Cybernetics" (John Wiley & Sons, Inc., New York, 1948). The scope of this new field, engineering cybernetics, covers the design principles that are the basis for control systems. Theoretical analysis and advanced mathematics are the tools of this discipline; components are not discussed.

Included in the comprehensive treatment are such interesting subjects as: non-interacting controls of many variable systems; non-linear servomechanisms; linear systems with time lag, including Satche diagrams; design by perturbation theory; noise filtering and detection; optimalizing control; ultrastability and multistability of homeostatic systems; and von Neumann's theory of error control.

Knowledge of complex integration, variational calculus, and ordinary differential equations are needed for an understanding of this work. The book was written for a course on "Theory of Stability and Control" given by the author at the California Institute of Technology.

A Growth Survey of the Atomic Industry 1955-1965 . . . *paper-bound, 64 pages. Atomic Industrial Forum, Inc., 260 Madison Ave., New York 16, N. Y. $7.00.*

The primary value of this volume is to the sales department as an aid in estimating the potential market for electronic devices in the atomic and nuclear in-

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MAXIMUM RATINGS (ABSOLUTE VALUES)

D.C. Operating Current (cont.)	3.5 Max. ma
Ambient Temperature Range	−55 to +150°C
Shock Impact	450 G. 1 ms

ELECTRICAL CHARACTERISTICS

	MIN.	AVER.	MAX.
D.C. Starting Voltage in Light	95	106	115
D.C. Starting Voltage in Dark	95	106	115
D.C. Operating Voltage (at 1.5 ma)	82.0	84.5	—
D.C. Operating Voltage (at 2.5 ma)	83.5	85.3	—
D.C. Operating Voltage (at 3.5 ma)	—	86.0	88.0

WRITE FOR COMPLETE INFORMATION AND ILLUSTRATED BULLETINS

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dustries. The survey is based on questionnaires sent to 1000 organizations known to be active or interested in the atomic energy program to support research and development activities. However, the results are of interest to design engineers who wish to keep informed of the extent of the industrial development based on nuclear discoveries. This information might stimulate some new designs.

Design department directors will find the statistics on personnel needs in the field of interest. The Atomic Industrial Forum is a non-profit organization which hopes to advance the development of atomic energy.

Determination of Leakage Values of Seals . . . *Bjorksten Research Laboratories, Inc. 156 pages. Available from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. (Publication PB 111545) $4.00.*

This volume presents the results of tests on the most effective types of air-tight seals for high-speed, high-altitude aircraft. Fusion, adhesive, gasket, and lapped-type seals on 449 specimens were tested by a research laboratory for Wright Air Development Center. The seals were made in aluminum, brass, and steel specimens. The non-destructive testing of electronic components on the production line prior to a simple sealing procedure is also discussed.

Sonics . . . *By Theodor F. Huetter and Richard H. Bolt. 456 pages. John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $10.00.*

This book was written for the engineer in manufacturing plants who desires to improve some processing or testing procedure by means of vibrating energy. It therefore, could help to give the design engineer some idea of needed sonic generators or test instruments. Some unusual material on magnetostrictive transducers is presented. Both authors are associated with Massachusetts Institute of Technology, Cambridge, Mass.

Misnamed Author

On p. 136 of the June issue of ELECTRONIC DESIGN the name of the author of "Storage Batteries" was erroneously given as George Vinal Wood. The author's name is George Wood Vinal.

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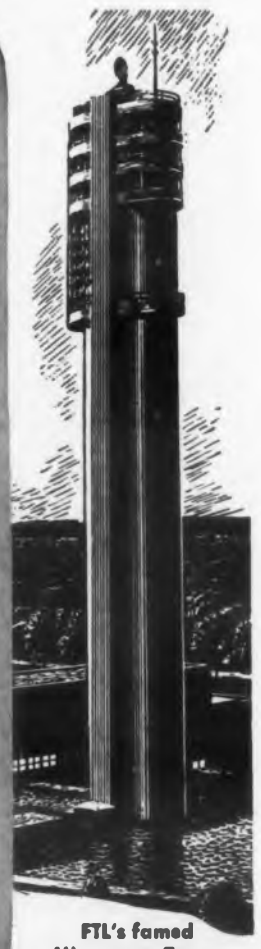

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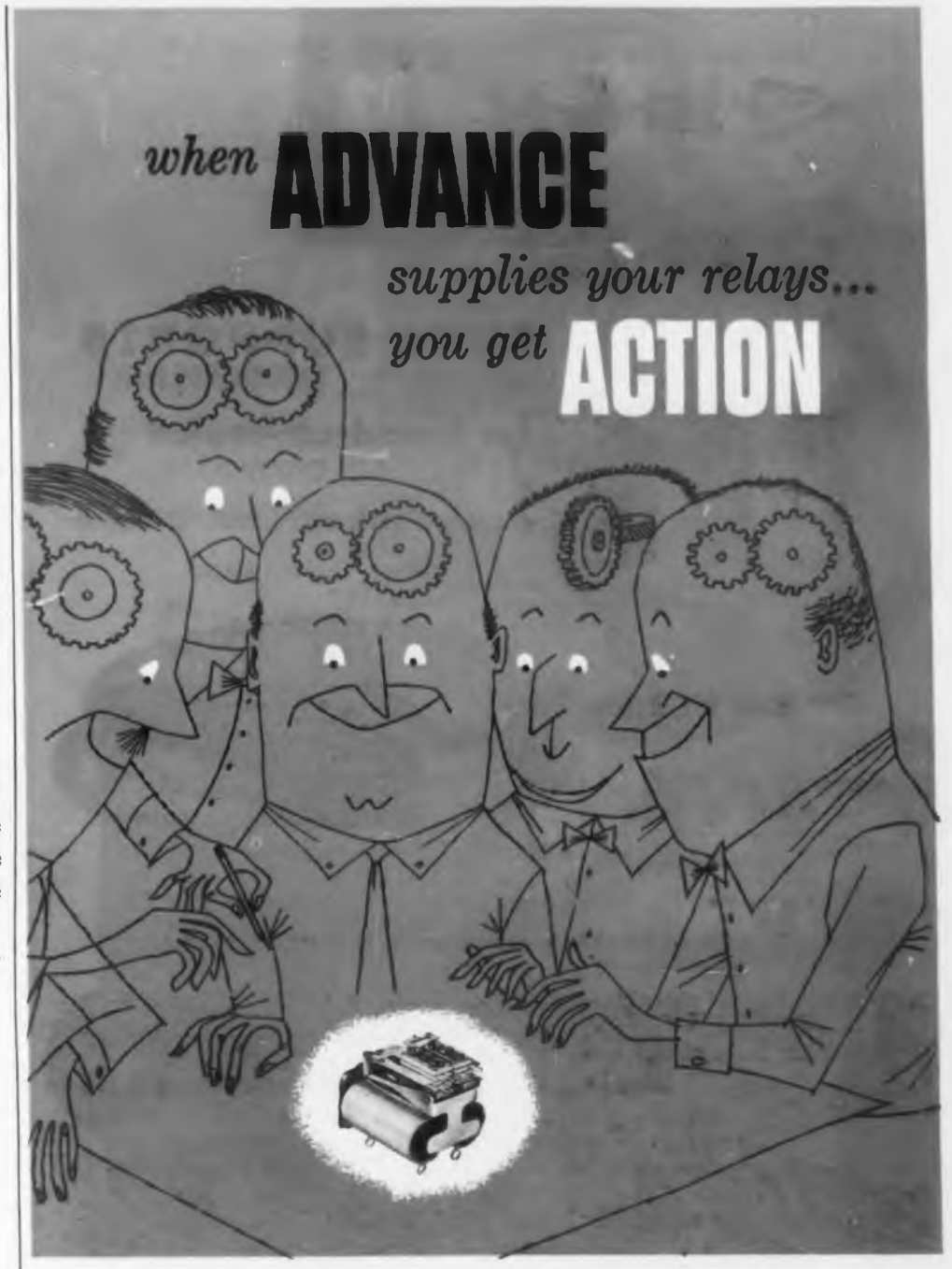

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Lapp

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Abstracts

Pertinent condensations from foreign journals, house organs, reports, and periodicals of related technologies.

Transistor Phonograph

This amplifier is particularly suited for portable record players. It uses matched transistors operating Class B in the output stage. The average current drain of the amplifier is in the order of 30ma for a maximum power output of approximately 200mw at normal music modulation. Assuming that a 6-v motor has a current drain of approximately 20ma, the total current drawn from the 6-v battery power source is, therefore, approximately 50ma or 0.3w (compared to 30w for a-c models).

Two Amperex transistors, type *OC71*, are used in the input and driver stage and one matched pair of transistors, 2-*OC72* in the Class B, push-pull output stage. This type of output stage gives the most efficient highest obtainable output power. The current drawn depends on the modulation. At a low level of drive the efficiency remains fairly high.

The d-c working point of the input and the driver stage (I_e = 0.4ma and 2ma respectively) are effectively stabilized by feeding the base of both *OC71* transistors by means of voltage dividers connected across the battery and including a resistor in the emitter circuit. The d-c working point of the output transistors ($-I_c$ = 1.5ma) is adjusted by means of R_{15}.

Since a shift of the working point of these transistors, due to temperature fluctuations, would be detrimental to the performance of the amplifier, a resistor with a negative temperature coefficient, R_{13}, is incorporated. The stabilization of the d-c working point of transistor, *OC71*, is described in bulletin "Junction Transistors *OC70* & *OC71* for Hearing Aids and Low Power Audio Applications."

The crystal pick-up which has an output of about 0.3v is "matched" to the input by means of a series resistor R_1 of 330k. Although a considerable amount of energy is dissipated in this resistor, this solution has been chosen because the primary induct-

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Continuously variable thru zero from full output of either polarity to full output of opposite polarity

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- Provisions for modulation by external signal
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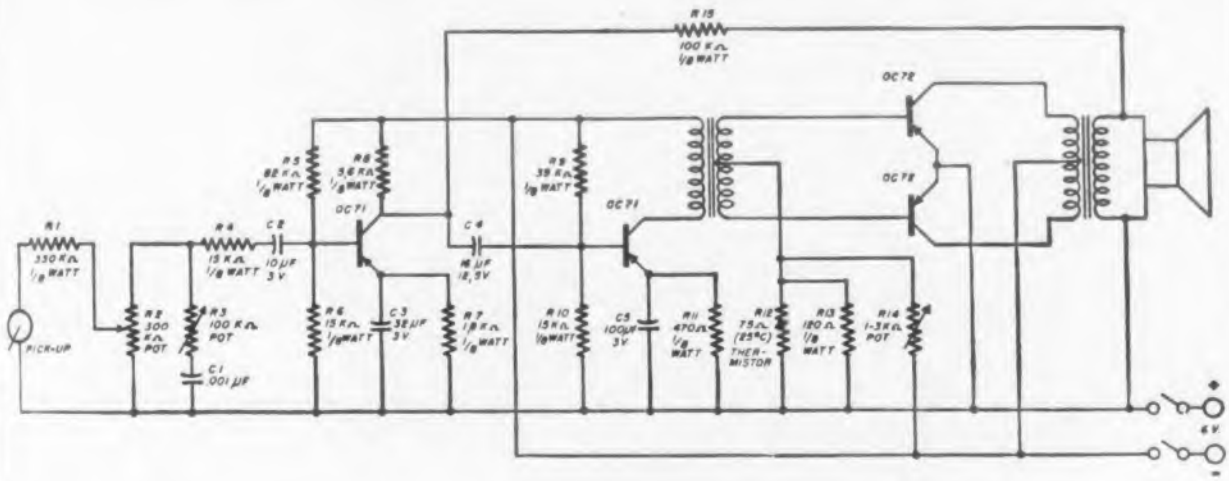
ance of a good matching transformer would have to be 1500h which is not desirable. Volume control preceding the input stage prevents this stage from being over loaded. Tone control is effected by means of a R-C filter in the input circuit.

The driver stage and the output stage are coupled by means of the transformer T_1 having a ratio of 3.5: (1 + 1). This ratio is a compromise between the high gain obtainable at a high transformer ratio and the possibility of current driving of the output stage at a low ratio. For information on available commercial transformers, write the Amperex factory. Since high impedance, center-tapped, moving-coil loudspeakers are not generally available, transformer T_2 matches a 5-ohm loudspeaker.

A small amount of voltage-current feedback, resistor R_7, encompassing the driver and output transistors is applied to reduce distortion. This also counteracts non-linearity of the loudspeaker impedance.—*From a report "Amplifier for Record Player with Four Transistors," Amperex Electronic Corp., 230 Duffy Ave., Hicksville, N. Y.*



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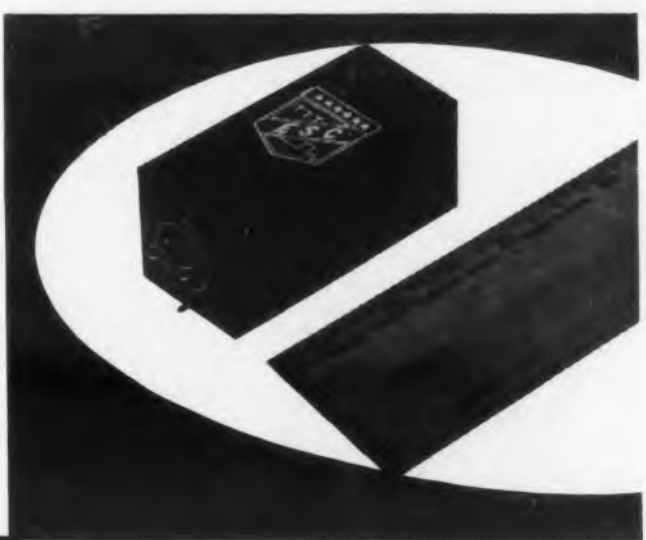

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● SEPARATE COMPONENTS

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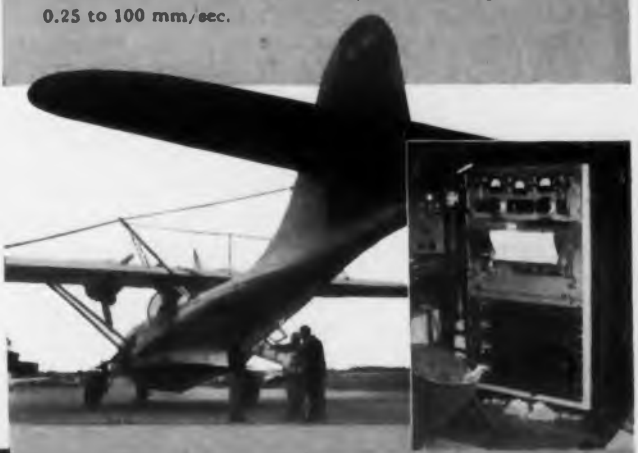
THIS amplifier (Model 150-300/700) is designed for use with low power galvanometer elements (output ±25 ma full scale into 100 ohm load), an oscilloscope and/or a panel meter, individually or simultaneously. Eleven plug-in type, interchangeable Preamplifiers are available for use with it, and include: AC-DC, Carrier, DC Coupling, Servo-Monitor, Log-Audio, Low Level, Input Network, AC Wattmeter, Frequency Deviation, Stabilized DC, and an RMS Volt/Ammeter.

Other available separate components include Recorder Assemblies from 1- to 8-channels, with chart speeds from 0.25 to 100 mm/sec.



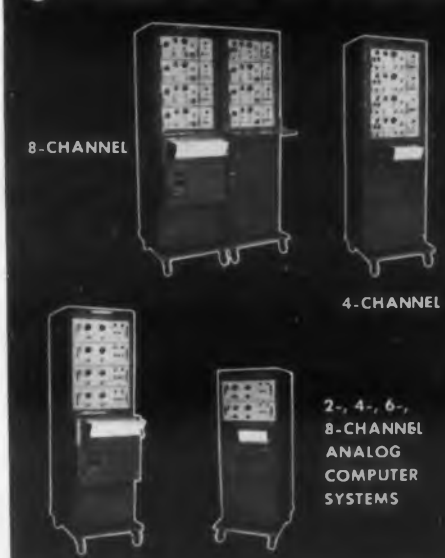
A "component" application

FOUR Model 67-300 DC Amplifiers and a Model 154-100 four-channel Recorder Assembly are integrated with other equipment aboard a "flying geophysical laboratory" by PSC Applied Research, Ltd. of Toronto to record data from dual frequency detector magnetic survey equipment and a radiation detector, plus elevation variations during flight. The simultaneous recording of all four provides valuable reference data when interpretations are being made.

1-CHANNEL

2-CHANNEL

● COMPLETE SYSTEMS



8-CHANNEL

4-CHANNEL

2-, 4-, 6-, 8-CHANNEL ANALOG COMPUTER SYSTEMS

A Sanborn "150" system starts with a choice of an 8-, 6-, 4-, 2- or 1-channel basic assembly, to which the user adds any combination of plug-in type Preamplifiers to meet the numerous and changing recording requirements. Special 8-, 6-, 4-, and 2-channel systems are available for recording the output of analog computers, or other applications involving 1 volt/cm sensitivity. Added to this application versatility and operating flexibility of Sanborn systems are other advantages, such as inkless recording in true rectangular coordinates . . . high torque (200,000 dyne cm) galvanometer . . . time and code marking . . . numerous chart speeds.

Let Sanborn engineers help you solve your recording problems. Write for complete specifications and performance data on any Sanborn component or system.

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Write or call Electronics Division for complete information, Victor Adding Machine Co., 3900 North Rockwell Street, Chicago 18, Ill., Dept. ED-8.

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Victor-McCaskey Limited, Galt, Ontario

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Legible Characters

DESIGNERS of electronic devices that require control panels should insist that all controls be marked legibly. The sample letters and numerals illustrated and the table of character heights can be used in specifying legible indicators and control panel markings.

The width of the letters should be 3/5 of the letter height, except for the "i", which is one stroke in width, and the "m" and "w", which should be about 20% wider than the other letters. The width of the numbers should also be 3/5 of the height except for the "4", which should be drawn one stroke wider and the "1", which is one stroke wide. The stroke width for both letters and numerals should be from 1/6 to 1/8 of the letter height.

Other topics in this report include panel layout, lighting, visual detection, design of warning devices, and legibility of mechanical indicators and cathode-ray tube displays.—*Abstracted from* Visual Presentation of Information, *by Charles A. Baker and Walter F. Grether, Aero Medical Laboratory, Wright Air Development Center, Dayton, Ohio. (This 112-page handbook is available from the Office of Technical Services, Department of Commerce, Washington, D. C. Price: $3.00).*

Recommended numeral and letter heights for a 28" viewing distance. For other viewing distances, multiply the given values by distance in inches divided by 28.

Nature of Markings	Height of Characters in Inches: Low Brightness (down to 0.03 ft-L)	High Brightness (down to 1 ft-L)
Critical markings, position variable	0.20 to 0.30	0.12 to 0.20
Critical markings, postion fixed	0.15 to 0.30	0.10 to 0.20
Non-critical markings	0.05 to 0.20	0.05 to 0.20

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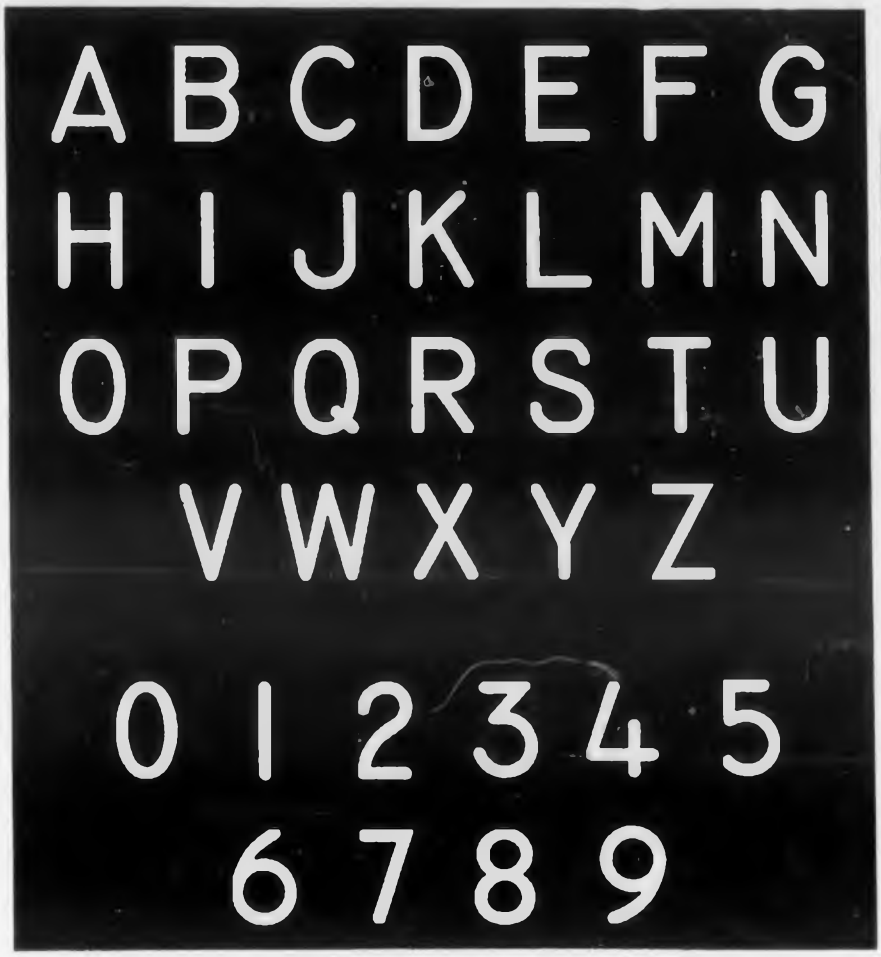
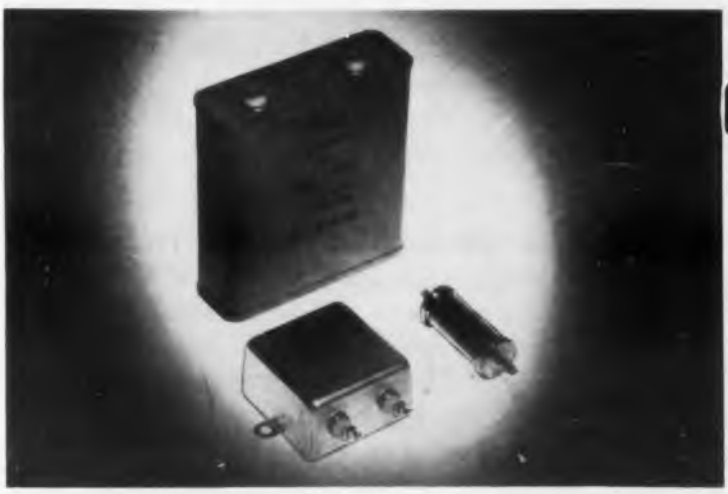
AND 10400 recommended numerals and letters. NAMEL numerals with smaller loops on 6 and 9 are somewhat better; 4 can be closed. Do not use lower case. Futura and Airport, semi-bold or demi-bold, type faces are satisfactory.



POLYSTYRENE CAPACITORS



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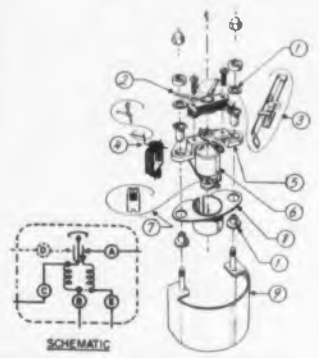
Connections: 9 pin octal style. Dimensions: 1¾ diameter x 2¼ long. Weight: 4 ounces. Sensitivity: Infinite variations from 0.2 Ua. to 10 Amp. or 0.1 Mv. to 500 volts, self contained. Higher volts or amps with external multipliers. A.C. rectifier types. Trip point accuracies to 1%. Differential 1%. The degree of resistance to shock and vibration primarily depends upon sensitivity and type of action wanted. In general, the relays will not be permanently damaged by shocks of 100 G's and vibrations up to 2,000 cps at 3-4 G's. The most sensitive relays may close their contacts under these conditions. Contacts: SPST or SPDT, 5-25 Ma. D.C. Other ratings to ½ Amp. A.C. A locking coil gives high pressure and chatter free contact even under shock and vibration. Prices on the order of $20-$80. Delivery 4 to 6 weeks. Assembly Products, Inc., Chesterland 17, Ohio.

Model 266

Sample specs. are: 0.2 micro-amperes, (12,000 ohms coil) or, 0.1 millivolts, (5 ohms.)



1. Shock mount
2. Contact assemby
3. Contact detail
4. Armature with contact detail
5. Cast bracket
6. Alnico magnet
7. Bearing detail
8. Yoke (steel)
9. Mounting frame

"Booth 416, WESCON SHOW . . . Aug. 24-26"

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Ney manufactures many other precious metal alloys which, like Paliney #7, have ideal electrical characteristics, high resistance to tarnish, and are unaffected by most industrial atmospheres. Ney Precious Metal Alloys have been fabricated into slip rings, wipers, brushes, commutator segments, contacts, and intricate component parts and are used in high precision instruments throughout industry. Should you have a contact problem, a call to the Ney Engineering Department will result in study and recommendations which will improve the output of your electrical or electronic instruments.

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CIRCLE ED-400 ON READER-SERVICE CARD FOR MORE INFORMATION

Standards and Specs

By Sherman H. Hubelbank

This department surveys new issues, revisions, and amendments, covering military and industry standards and specifications. Our sources of information include the Armed Services Electro-Standards Agency (ASESA), the cumulative indexes to Military Specifications, Vols. II, IV, American Standards Association (ASA) and other standards societies.

Design

MIL-E-16400A (SHIPS), GENERAL SPECIFICATION, ELECTRONIC EQUIPMENT, NAVAL SHIP AND SHORE, 15 MARCH 1955 . . . The general requirements applicable to the design and construction of electronic equipment intended for Naval use are covered in this spec. The various detail specs, material specs, inspection specs, and testing specs are also listed. In addition the process required for the selection and application of parts and the procedure for testing the equipment as a whole are outlined. The ambient conditions within which the equipment must operate are also listed. This spec superseded 16E7(SHIPS) and MIL-E-16400(SHIPS).

ANA BULLETIN NO. 400F, APPLICABLE DOCUMENTS FOR AIRCRAFT ELECTRONIC EQUIPMENT, 7 FEBRUARY 1955 (EFFECTIVE DATE) . . . This Air Force-Navy Aeronautical Bulletin lists the latest effective issue of specs, standards, drawings, and publications to be used in the design and construction of airborne electronic equipment. The use of this list is governed by MIL-E-5400.

MIL-STD-242, ELECTRONIC EQUIPMENT PARTS (SELECTED STANDARDS), 15 MARCH 1955 . . . Described in this standard are selected standard parts, such as acoustical components, RF cables, capacitors, cable clamps, RF connectors, insulators, control knobs, electro- mechanical parts, power plugs, resistors, switches, transformers, electron tubes, and quartz crystals. This standard is mandatory for use on Bureau of Ships contracts, by both the prime contractor and subcontractor, in the design of new electronic equipment where spec MIL-E-16400 is specified.

Application Design Notes

ASESA has issued a new index and a set of replacement covers for the publication entitled *Application Design Notes (Electronic Components)*, ASESA 51-4. The index is dated 15 March 1955. Design Notes AND-184, RESISTORS, FIXED WIRE WOUND (LOW POWER) were also revised with the index.

Connectors

MIL-C-3650, CONNECTORS, "LC" FOR RADIO FREQUENCY CABLES, REVISION MS91596, 6 APRIL 1955 . . . This revision issued a five page revised detailed drawing of the LC series of radio frequency cable connector adapters. It supersedes Bureau of Ships drawing RE49F345.

Electron Tube Shields

MIL-S-9372B (USAF), SHIELD, ELECTRON TUBE, HEAT DISSIPATING, 25 FEBRUARY 1955 . . . Requirements for heat dissipating electron tube shields for 7 pin miniature and noval electron tubes are covered in this revision to MIL-S-9372A. The shields covered by this spec are designated type HTS followed by the serial number. Qualification and acceptance tests are a requirement of this spec.

Test Equipment Standards

Three guides were published by the American Institute of Electrical Engineers for the specification of electronic voltmeters (AIEE No. 450), signal sources (AIEE No. 451), and cathode-ray instruments. These guides are proposed recommendations and their purpose is to present a common basis of comparison when specifications are used to present technical data concerning characteristics of various equipment. These guides have been published for trial use and are available from AIEE at 33 West 39th St., New York.

Switches

MIL-S-3950, SWITCHES, TOGGLE, 17 MAY 1955 . . . Some new style toggle switches have been added and some old styles have been deleted. The new technique of packing and packaging in three groupings, immediate use, short time storage, and overseas shipment has been included in this revision. Sand, dust, short circuit, insulation resistance, explosion-proof, and acceleration tests have been added. Separate "MS" Military Standards now form part of this spec. This spec supersedes specs JAN-S-23, MIL-S-6745, and Army Spec 60-975-1.

Electric Controls

IEC RECOMMENDATIONS REGARDING THE COLOUR OF PUSH BUTTONS, PUBLICATION NO. 73-1955 . . . The International Electro-Technical Commission, Geneva, Switzerland has published recommendations as to the colors that should be used in identifying the functions of different push button controls. These recommendations are not intended to discourage the use of techniques of identification other than color. In general, red is recommended for stopping a motor or opening a circuit; green, for starting. Provision is also made for multiple push button controls. This publication is available from ASA for 60 cents.

CIRCLE ED-372 ON READER-SERVICE CARD FOR MORE INFORMATION

CIRCLE ED-401 ON READER-SERVICE CARD FOR MORE INFORMATION

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Voltage Range:	0-100 Volts DC	
Resolution: At least	50 microvolts between	0 and 1 volt
	500 microvolts between	1 and 10 volts
	5 millivolts between	10 and 100 volts
Absolute Accuracy:	± 0.1% of reading	
Input Impedance:	Infinite at null	

Model PVM-4

Voltage Range:	0-600 Volts DC	
Resolution: At least	5 millivolts between	0 and 10 volts
	50 millivolts between	10 and 600 volts
Absolute Accuracy:	± 0.1% of reading	
Input Impedance:	Infinite at null	

The Model LVM-5 may also be used as a deflection potentiometer, a sensitive null indicator and a precision millimicroammeter. Write for catalog PL which describes these instruments completely. Address Dept. ED 8-D.

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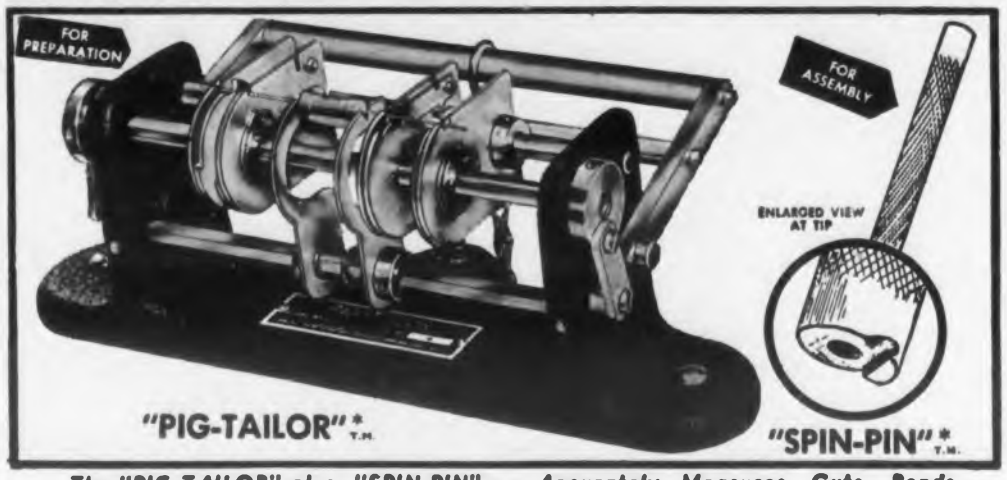

The "PIG-TAILOR" plus "SPIN-PIN" — Accurately Measures, Cuts, Bends, Ejects and Assembles both leads simultaneously to individual lengths and shapes — 3 minute set-up — No accessories — Foot operated — 1 hour training time.

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9. Invaluable labor saving.
10. Immediate cost recovery.

PIG-TAILORING eliminates:

1. Diagonal cutters.
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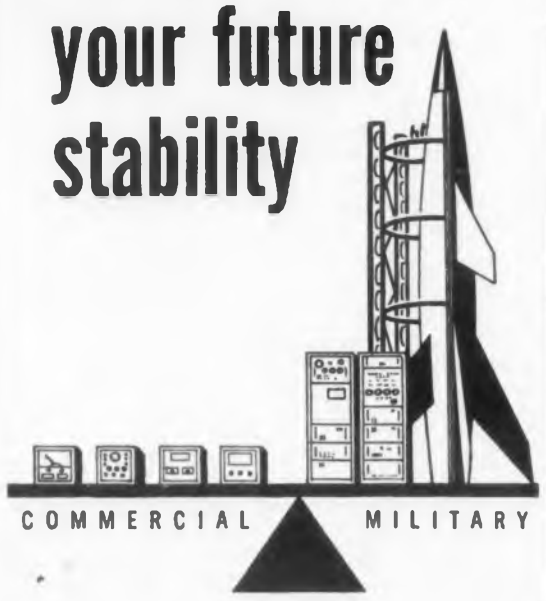

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SERVOMECHANISM AND ANALOG COMPUTER DESIGN... control systems, magnetic amplifiers, and similar fields.

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CIRCLE ED-403 ON READER-SERVICE CARD FOR MORE INFORMATION

Capacitors

MIL-C-18211 (NAVY), CAPACITORS, FIXED, ELECTROLYTIC, TANTALUM, 21 FEBRUARY 1955 . . . Fixed, tantalum, electrolytic capacitors for use in filter and by-pass applications requiring large capacitance values but not close tolerances are covered in this spec. The capacitors are suitable for operation over temperature ranges from —55 to 85°C and —55 to 175°C as applicable. These capacitors are designated by the two letters CW. Eight individual military spec sheets were also issued.

Qualification Approval

The three services have approved a new program for qualifications tests to speed up qualification approval time. The program calls for the Military Services to maintain better up-to-date data on these approvals. Four optional methods of obtaining approval, subject to the authorization of ASESA, are now available to the manufacturer. The necessary tests may now be performed at any of the following: his own plant, a commerical test facility and his own plant or at more than one commerical test facility, or a government laboratory. The complete procedures may be obtained by requesting bulletin 43 from ASESA.

Color Coding

MIL-STD-174, COLORS FOR CODING ELECTRONIC PARTS, 10 FEBRUARY 1955 . . . This standard establishes uniform colors designating the various characteristics of electronic parts, excepting wire and cable. The colors used on electronic parts such as resistors and capacitors for the purpose of characteristic designation shall conform to Federal spec TT-C-595, Colors for Ready Mixed Paints.

Connectors

MIL-C-5015B, AMENDMENT 1, CONNECTORS, ELECTRICAL, "AN" TYPE, 14 JANUARY 1955 . . . The requirement that the plastic insert material be a mineral-filled type conforming to MIL-P-14 has been changed by deleting the mineral filled clause. The identification provisions have been changed to agree with the classification of connectors as defined on the first page of the spec. Sampling plan B has been changed from at least once each month to after every 200,000 connectors but not more often than once each month and at least once every three months.

Specifications listed on these pages are for information only and government contractors should be guided by their contracts. Copies of military specs should be obtained from sources recommended by procuring officers. ASESA bulletins may be obtained from Fort Monmouth, N. J. ASA standards may be obtained from American Standards Agency, 70 E. 45th St., New York 17, N. Y., unless otherwise noted.

Meetings

Aug. 15-19: *AIEE Pacific General Meeting*, Butte, Mont. More than 70 papers will be presented on such subjects as TV and radio broadcasting, relays, cathode protection, and magnetic amplifiers. For information, write to AIEE, 33 W. 39th St., New York 36, N. Y.

Aug. 22-23: *Symposium on Electronics and Automatic Production*, San Francisco, Calif. Jointly sponsored by Stanford Research Institute and the National Industrial Conference Board. Current technical developments, social and economic implications, and the outlook for automation in the national technology will be discussed. For information, write to Stanford Research Institute, Palo Alto, Calif., or the National Industrial Conference Board, 247 Park Ave., New York, N. Y.

Aug. 24-26: *Western Electronics Show and Convention*, Civic Auditorium, San Francisco, Calif. Sponsored by the West Coast Electronic Manufacturers' Association and the Seventh Region of the IRE. Over 100 papers on such topics as circuit theory, instrumentation, electron tubes, computers, etc. will be presented at 24 sessions. More than 550 exhibits are planned. For information on exhibits, write Mal Mobley, Jr., 344 N. LaBrea Ave., Los Angeles, Calif.

Sept. 12-16: *Tenth Annual Instrument-Automation Conference and Exhibit*, Shrine Exposition Hall and Shrine Auditorium, Los Angeles, Calif. Sponsored by the Instrument Society of America. Analytical Instrument, Computer, and Maintenance Clinics will be held during the conference. Theme of the conference is "Instrumentation Paces Automation". For information, write to Dr. Arnold O. Beckman, 3443 S. Hill St., Los Angeles, Calif.

Sept. 14-16: *Annual Meeting of the Association for Computing Machinery*, Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, Pa. The use of computers in scientific applications, industrial control, and automation will be discussed. For information, write to Association for Computing Machinery, 2 E. 63rd St., New York 23, N. Y.

Sept. 26-27: *Sixth Annual Meeting and Conference of the IRE Professional Group on Vehicular Communications*, Multnomah Hotel, Portland, Ore. An industrial exhibit will be held in conjunction with the technical sessions. For information, write to IRE, 1 E. 79th St., New York, N. Y.

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PRESET INTERVAL GENERATOR

MODEL 564
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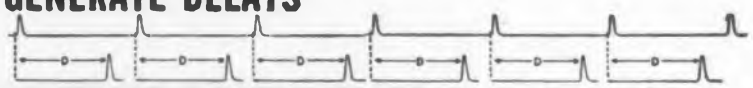

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- Internal 1 megacycle crystal oscillator time base
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- Fast reset—recycles in 50 microseconds
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Sept. 26-27: *Symposium on Electronics for Automation and Automation for Electronics,* Irvine Auditorium, University of Pennsylvania, Philadelphia, Pa. Sponsored by the Radio-Electronics-Television Manufacturers Association. Papers will be presented on the status of development of systems, machinery, and components to aid in automatic fabrication of electronic equipment and the parts played by electronics in automation of other industries. For information, write to RETMA, 777 14th St., N. W., Washington 5, D. C.

Sept. 26-30: *Meeting on Marketing the Products of Atomic Energy and Trade Fair,* Sheraton-Park Hotel, Washington, D. C. Sponsored by the Atomic Industrial Forum. The Fair will demonstrate the extent to which atomic energy has been advanced, with displays of control systems, package power, reactors, and components. For information, write to Atomic Industrial Forum, Inc., 260 Madison Ave., New York 16, N. Y.

Sept. 28-29: *Industrial Electronics Conference,* Rackham Memorial Auditorium, Detroit, Mich. Sponsored jointly by the Michigan Section of the AIEE and the Professional Group on Industrial Electronics of the IRE. Sixteen papers have been scheduled for the four technical sessions which will discuss automation, industrial measurement problems, and new control system applications. For information, write to AIEE, 33 W. 39th St., New York, N. Y.

Oct. 3-5: *Eleventh Annual National Electronics Conference,* Hotel Sherman, Chicago, Ill. Ninety-six technical papers and 180 exhibits will be featured. For information, write to J. Kocik, c/o Illinois Bell Telephone Co., 208 W. Washington St., Chicago 6, Ill.

Oct. 5-9: *World Plastics Fair and Trade Exposition,* National Guard Armory, Los Angeles, Calif. Oct. 6 will be Electronics, Military and Industrial Day, featuring applications of plastics in electronics, including tooling, instruments, and machinery. For information, write to Philip M. Kent, managing director, World Plastics Fair and Trade Exposition, 8762 Holloway Drive, Los Angeles 46, Calif.

Oct. 6-7: *Eleventh Annual Meeting and Design Conference of the Society of Industrial Designers,* the Woodner, Washington, D. C. The impact of automation on industrial design will be among the topics discussed. For information, write to the Society of Industrial Designers, 48 E. 49th St., New York 17, N. Y.

Oct. 12-15: *1955 Convention and Audio Fair*, Hotel New Yorker, New York, N. Y. Sponsored by the Audio Engineering Society. The convention will include panel discussions on transistors, amplifier design, and tape recording. For information, write to G. K. Dahl, 230 W. 41st St., New York 36, N. Y.

Oct. 24-25: *First Annual Technical Meeting of the Professional Group on Electron Devices of the IRE*, Shoreham Hotel, Washington, D. C. Developments and applications of electron tubes and transistors in radio, TV, business machines, and military equipment will be discussed. For information, write to IRE, 1 E. 79th St., New York, N. Y.

Oct. 24-26: *Sixth National Conference on Standards*, Sheraton Park Hotel, Washington, D. C. Sponsored jointly by the American Standards Association and the National Bureau of Standards. Co-ordination of Government and industry requirements for manufactured products will be discussed. A series of exhibits will show how standardization programs may be co-ordinated. For information, write to the American Standards Association, 70 E. 45th St., New York 17, N. Y.

Oct. 31-Nov. 1: *1955 East Coast Conference on Aeronautical and Navigational Electronics*, Lord Baltimore Hotel, Baltimore, Md. Sponsored by the Baltimore Section of the IRE and the IRE Professional Group on Aeronautical and Navigational Electronics. For information, write to IRE, 1 E. 79th St., New York 21, N. Y.

Nov. 1-5: *World Symposium on Applied Solar Energy*, Westward Ho Hotel, Phoenix, Ariz. Sponsored by the Association for Applied Solar Energy, Stanford Research Institute, and the University of Arizona. Conversion techniques and applications of solar energy will be discussed. An exhibit is planned. For information, write to W. C. Estler, Stanford Research Institute, Stanford, Calif.

Nov. 2-4: *Classified Symposium on Guided Missile Reliability*, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio. Topics to be covered include problems in establishing and implementing missile reliability programs; responsibilities for reliability during development and production; establishing requirements for predicting and measuring the reliability of systems and components. Organizations or individuals desiring to present papers at the symposium should contact R. L. Dingle, Directorate of Weapon Systems Operations, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio.

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