

ELECT
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RONIC E S I G N

NO. 1000000000
SEP 18 1956



FREEED

offers for Immediate Delivery

FAST RESPONSE MAGNETIC AMPLIFIERS

Z response Phase reversible

Cat. No.	Supply Freq. C.P.S.	Power Out. Watts	Volt. Out. V. AC	Sig. req'd for full outp. V. AC-DC	
				R in 10K	R in 1K
MAF-1	60	13	110	1.0	—
MAF-6	400	5	57.5	1.2	0.4
MAF-6	400	10	57.5	1.6	0.6
MAF-7	400	15	57.5	2.5	1.0

MAGNETIC AMPLIFIERS

Single ended

Cat. No.	Supply Freq. C.P.S.	Power Out. Watts	Sig. req'd for full outp. MA-DC	Total resis. Contr. wdg. KΩ	Load resis. ohms
MAO-2	60	20.	1.8	1.3	700
MAO-4	60	400.	9.0	10.0	25
MAO-5	60	575.	6.0	10.0	25

MAGNETIC AMPLIFIERS

Push-pull Phase reversible

Cat. No.	Supply Freq. C.P.S.	Power Out. Watts	Volt. Out. V. AC	Sig. req'd for full outp. MA-DC	Total resis. Contr. wdg. KΩ
MAP-2	60	15.	115	1.6	2.4
MAP-3	60	50.	115	2.0	0.5
MAP-3-1	60	50.	115	7.0	2.9
MAP-4	60	175.	115	8.0	6.0
MAP-7	400	15.	115	0.6	2.8
MAP-8	400	50.	110	1.75	0.6

SATURABLE TRANSFORMER

Phase reversible

Cat. No.	Supply Freq. C.P.S.	Power Out. Watts	Volt. Out. V. AC	Sig. req'd for full outp. MA-DC	Total resis. Contr. wdg. KΩ
MAS-2	400	6	115	4.0	10
MAS-5	400	2.7	26	4.0	3.2
MAS-6	400	30	115	4.0	8.0
MAS-7	400	40	115	5.5	8.0



FREEED NULL DETECTOR AMPLIFIER TYPE 1140-A

USES

A sensitive null indicator for bridge measurements, providing visual null indications or aural when used in conjunction with headphones. The unit may also be used as a high gain amplifier for general laboratory work.

DESCRIPTION

Functionally the instrument consists of a high gain linear amplifier with a 30 db. input attenuator in addition to the variable gain control. A four-inch panel meter provides visual null indications, the response of the meter circuit is approximately logarithmic over a 40 db. voltage range. Resonant circuits tuned to 60, 400 and 1000 cycles limit the amplifier transmission characteristics to the three audio frequencies commonly used for bridge measurements or it may be used as a non-selective amplifier with filter "off."

SPECIFICATIONS

Input Impedance: 1 megohm in parallel with 25 mmf. GAIN: 98 db. with 1 megohm load (8 mmf. shunt capacity), down 1.5 db. at 25,000 cycles, down 5 db. at 50,000 cycles, down 2 db. at 20 cycles.
Null Detector Sensitivity: At 1 kc. 100 microvolts will give a 15% meter deflection.
Selective Amplifier: 26 db. second harmonic attenuation at 60, 400 and 1000 cycles.
Power Supply: 105-125 volts. 50-60 cycles. 35 watts consumption.
Dimensions: 13 1/2" x 8 1/2" x 10"



FOR PRECISION LABORATORY OR PRODUCTION TESTING FREEED 1110-AB INCREMENTAL INDUCTANCE BRIDGE AND ACCESSORIES

Accurate inductance measurement with or without superimposed D.C., for all types of iron core components.

Inductance: 1 Millihenry to 1000 Henry
Frequency: 20 to 10,000 Cycles
Accuracy: 1% to 1000 Cycles, 2% to 10K Cycles
Conductance: 1 Micromho to 1 MHO
"Q": 0.5 to 100
Superimposed D.C.: Up to 1 Ampere
Direct Reading: For use by unskilled operators.

ACCESSORIES AVAILABLE:

1140-A Null Detector
1210-A Null Detector — V.T.V.M.
1170 D.C. Supply and 1180 A.C. Supply

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Write for detailed listing, or special requirements, and copies of complete Transformer and Laboratory Test Instrument Catalogs

FREEED TRANSFORMER CO., INC.

1727 Weirfield St., Brooklyn (Ridgewood) 27, N. Y.

ELECTRONIC DESIGN

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75 INCHES PER SECOND

3 MSEC STARTS AND STOPS



Model 905 Digital Magnetic Tape Handler

The Ultimate in Digital Tape Handlers for High-Speed Computers, Electronic Business Machines, Industrial Control and Other EDP Applications.

Regardless of cost, many features are exclusive with Potter

Speed and ease of operation—Up to 75"/sec in a variety of dual speed combinations, with 3 msec starts and stops. Tape widths from $\frac{1}{4}$ " to $1\frac{1}{4}$ " are accommodated. Automatic threading, fast rewind, end-of-tape sensing, and front panel or remote control provide unmatched flexibility and ease of operation.

Standard 19" Rack Mounting—Hinged front panel provides quick access to mechanical parts and plug-in electronic components. Transparent dust cover protects tape and moving parts without hindering visual observation of tape track.

Auxiliary Equipment—A complete line of digital data-handling accessories is available, including *record-playback heads* (Model 6400) in numerous channel number and tape width combinations. *Record-playback amplifiers* can be furnished as individual plug-in units (Models 52, 53) or in *complete systems* (Model 920) for return-to-zero or non-return-to-zero recording. *Shift registers, high speed printers and other data-handling components* are available separately or in integrated systems for solving specific data-processing problems.

WRITE FOR INFORMATIVE BULLETIN . . . and feel free to consult Potter engineers on your data-handling problems. No obligation, of course.



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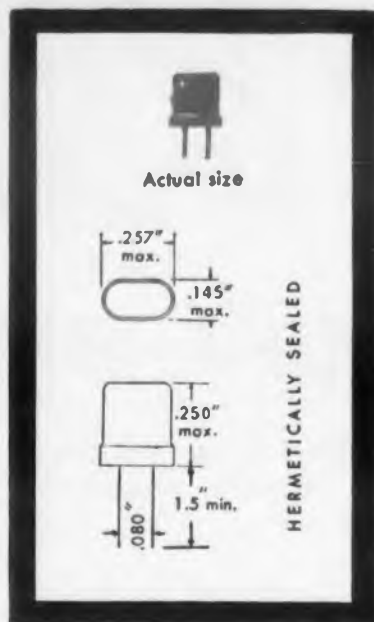
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CIRCLE 2 ON READER-SERVICE CARD FOR MORE INFORMATION

It's **RAYTHEON** for RELIABILITY

in BONDED
SILICON
DIODES



THESE FIVE TESTS TELL THE STORY

1. **Temperature**
4 hours at -55°C , then instant transfer to 4 hours at $+150^{\circ}\text{C}$ — twenty-five times
2. **Vibration**
25G., 40 to 2000 cps, along each of the three mutually perpendicular axes. Five 3-minute sweeps through the range
3. **Shock**
500G shocks of one millisecond duration through each of the three mutually perpendicular axes
4. **Noise**
145DB random acoustical noise application, 200 cps to 20 kc
5. **Life**
2000 hour tests, run as rectifier with both maximum reverse voltage and maximum rectified current

Samples of RAYTHEON BONDED SILICON DIODES show no failures when subjected to all five of these tests

Type	Peak Inv. Voltage 25°C	Forward Current at +1.0 V (min.) Current 25°C	Reverse Current at -10 V (max.) Current 25°C	Reverse Current (max.) in μA at specified voltage			Rectified Current (max.)		
				Volts	25°C	100°C	25°C	100°C	150°C
1N300	15 V	15 mA	.001 μA	10	0.001	0.1	65 mA	40 mA	18 mA
1N300A	15	30	.001	10	0.001	0.1	80	50	25
1N432	40	10	.005	10	0.005	0.1	55	30	15
1N432A	40	20	.005	10	0.005	0.1	70	48	22
1N301	70	5	.01	50	0.05	1.0	45	25	12
1N301A	70	18	.01	50	0.05	1.0	65	45	20
1N460	90	5	.01	75	0.1	1.0	45	25	12
1N460A	90	15	.01	75	0.1	1.0	60	40	18
1N303	125	3	.01	100	0.1	2.0	40	20	10
1N303A	125	12	.01	100	0.1	2.0	55	35	16
1N433	145	3	.01	125	0.1	3.0	40	20	10
1N433A	145	10	.01	125	0.1	3.0	50	30	16
1N434	180	2	.01	150	0.1	4.0	35	18	10
1N434A	180	7	.01	150	0.1	4.0	45	25	15
1N302	225	1	.01	200	0.2	5.0	30	14	8
1N302A	225	5	.01	200	0.2	5.0	40	22	13
CK863	300	1	.01	275	0.3	8.0	20	12	6
CK863A	300	3	.01	275	0.3	8.0	30	20	8

VISIT RAYTHEON BOOTHS NOS. 35, 36, 37,
NATIONAL ELECTRONICS CONFERENCE, CHICAGO



mfg. co.

SEMICONDUCTOR DIVISION

Silicon and Germanium Diodes and Transistors • Silicon Power Diodes

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CIRCLE 3 ON READER-SERVICE CARD FOR MORE INFORMATION

Editorial

Reliability—At What Price?

Everything wears out. We all know that and prepare for it. Programs of planned maintenance act to reduce the possibility of unexpected equipment failures. But it's the sudden unexpected failures that can be disastrous.

Unfortunately, electronic equipment has long been tagged unreliable by many engineers who prefer mechanical to electrical contrivances. Vacuum tube burnouts, resistor and condenser failures and transformer burnouts and shorts have all too often contributed to that reputation.

More and more emphasis is now being placed upon the design of electronic equipment that won't fail suddenly. With the advent of pilotless aircraft, unattended radio transmitters and other equipment not watched over by an engineer, failure of one component can result in a costly loss.

All this brings us to an important aspect of reliability. That is, how much should we spend on reliability?

One of the first considerations in designing a piece of electronic equipment is to weigh the results of its possible failure. For example, if an automatic pilot should fail, the human pilot can take over and bring the aircraft safely home. That certainly wouldn't be classed as a 100 per cent failure. But if a vital part of a guided missile should stop functioning, the missile may not reach its destination, and may even fall on friendly territory with disastrous results. That, certainly, is 100 per cent failure.

Even the same piece of equipment may be classed as 100 per cent failure under certain conditions and only a small percentage under other conditions. A good example is an aircraft radar landing system. Failure of the system under conditions of fair visibility wouldn't have the same effect as its failure under conditions of zero visibility.

It's certainly agreed that 100 per cent reliability costs money. In the recent push to increase reliability, there is a danger of carrying it too far. All of the conditions under which the equipment will operate must be considered. Naturally, the most obvious rule to follow is to determine what will happen if the device suddenly fails. Is a human operator at hand to take over? Can the effects of the failure be compensated in other ways? The answers to these questions should determine the amount of money spent in designing reliability into electronic equipment.

Electronic News

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

methods for evaluating the contacts, squareness, bow and other critical tolerances. In the photograph an optical device is checking reflections from the surface.

New Hi-Power "Avalanche" Diodes

Techniques for making diffused junction silicon "avalanche" diodes with lower impedance and higher power capability than have been previously available have been developed by Bell Telephone Laboratories. The breakdown voltage can be controlled over a range of about 5 to 500 v by controlling the junction impurity gradient. Knowledge of this gradient permits close

form a p-n rectifying junction. The ohmic junction on the other side of the wafer is formed by diffusing boron into the silicon, then plating with nickel. Current prior to breakdown is on the order of one microampere or less for units rated 10 v and above. At breakdown, the impedance is reduced to a few ohms for currents in the milliamperage range, and can be on the order of a fraction of an ohm for high current surges.

Limited quantities are available for experimental purposes in military applications. For further details contact the Radio Division at 120 Broadway, New York, N. Y.

Heat Treating Without Distortion

Distortion-free and discoloration-free heat treating of small stainless parts is possible with this special furnace developed by Allied Products Division of Hamilton Watch Company. Instrument manufacturers can thus finish machine parts and later harden them without fear of discoloration or dimensional distortion.



Test is being made of a medium-power "avalanche" diode. This particular unit breaks down at 20 v, and is capable of dissipating 6 w with an appropriate heat sink. Oscilloscope trace shows abrupt "avalanche" effect.

prediction of breakdown voltage. Lowering the impurity gradient by increasing the depth of penetration increases the breakdown voltage.

Phosphorus is diffused into a p-type silicon wafer to



Biggest Waveguide Yet?

Waveguides For VHF TV

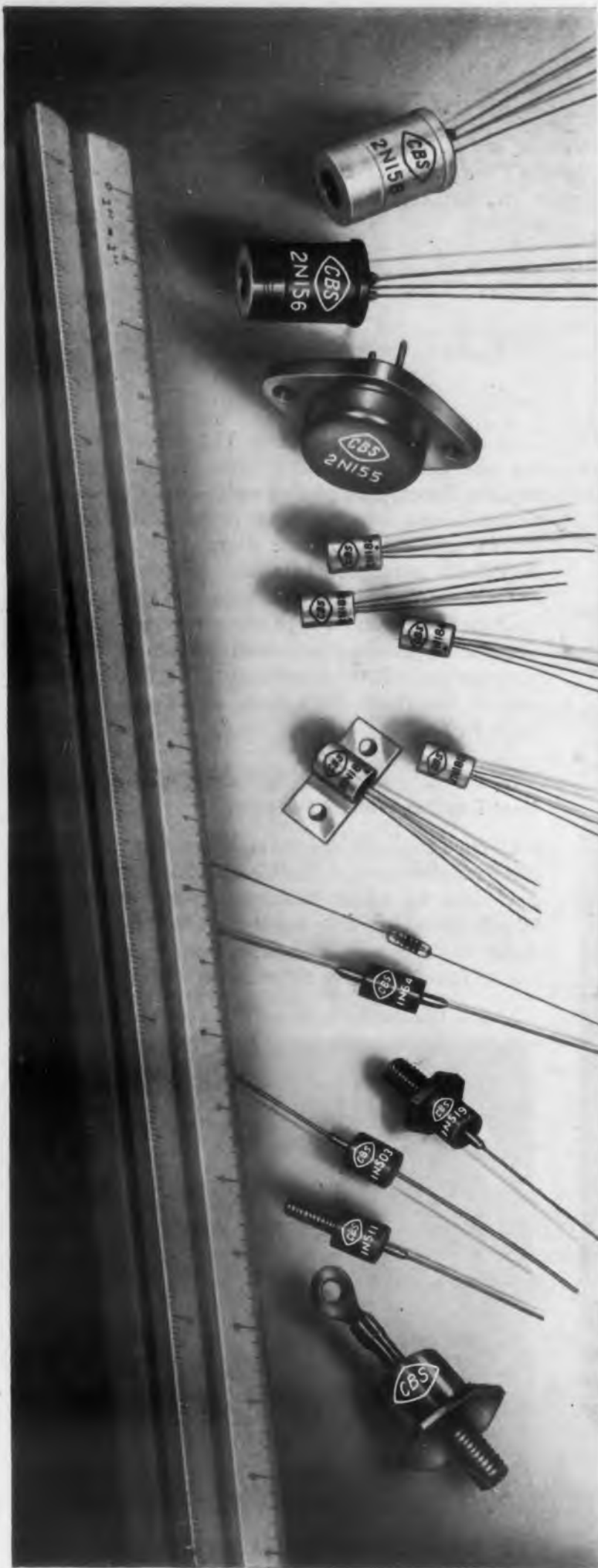
A new invention for making corner joints has resulted in a perfect surface for rf power transmission. Megawatts of power can be channeled down the huge waveguide illustrated — ordinarily this amount of power would melt a welded joint. In the new joint, metal actually bites into the sides of the waveguide.

Manufacturing techniques have been worked out by Brach Electronics Div. of General Bronze Corp., 711 Stewart Ave., Garden City, N. Y., so that 21 by 10-1/2 in. by 10 ft waveguides (300 Mc) can be constructed with tolerances that could only be obtained previously by extrusions. It is expected that 5-ft guides for 50 Mc will prove feasible. Extremely high-power radar transmission is practical now.

Biggest use is expected to be in coupling between transmitter and antennas for over-the-horizon scatter propagation. General Bronze has developed inspection



Furnace for heat treating stainless parts



growing line of CBS semiconductors features uniformity and reliability

Users rate the rapidly expanding line of CBS semiconductors as "exceptionally uniform and reliable." They have also discovered that CBS' mass production insures dependable delivery and competitive prices. You, too, will prefer advance-engineered CBS semiconductors. Write for data and quotation on the types you need.

Power Transistors Popular auto-radio type 2N155. General-purpose 2N156 (12-volt) and 2N158 (28-volt). And *new higher-power and higher-voltage versions* for larger audio output systems and power supplies.

High-Frequency Transistors Uniform and reliable performance up to 20 mc. CBS 2N182, 2N183, 2N184 are NPN symmetrical, permitting unusual applications.

General-Purpose Transistors CBS 2N180 and 2N181 are noted for outstanding dependability. Integral C-clamp mounting of 2N181 permits dissipation up to 250 mw.

Diodes A complete line from one source: Glass . . . plastic . . . point-contact . . . bonded-junction . . . entertainment . . . general-purpose . . . and computer.

Silicon Power Rectifiers Series 1N503-1N508 rated at $\frac{1}{2}$ amp . . . 1N511-1N516 at 1 amp . . . 1N519-1N524 at $1\frac{1}{2}$ amp. Also *a new much higher-current series* for heavy-duty power supplies.

*Reliable products
through Advanced-Engineering*



semiconductors

CBS-HYTRON

Semiconductor Products, Lowell, Mass.
A DIVISION OF COLUMBIA BROADCASTING SYSTEM, INC.

CIRCLE 4 ON READER-SERVICE CARD FOR MORE INFORMATION



Mobile control tower can be flown to advance air strips.

Airport Tower Rides High

Key to airport operations is the control tower and its associated electronic equipment. By making this unit mobile, communications between aircraft and airport can be set up in a hurry.

This mobile control tower can be flown to an advance air strip and put into operation in 30 min. Two men can operate the system. Developed by Craig Systems, Inc., the tower is made of aluminum skins bonded to a plastic foam core. Total weight is less than 2500 lb including heating and ventilating equipment.

Components included in the tower are uhf and vhf receivers and transmitters. High and low-frequency receivers and radio and telephone control panels are also included. Other equipment includes the usual weather instruments, signal lights, and clocks. Only the electrical power source is outside. Antenna masts, antenna and wind indicators, stored inside for transport, are quickly assembled.

Instruments have "Sixth Sense"

Special instruments equipped with a "sixth sense" have been designed to help control complicated chemical manufacturing processes at the Atomic Energy Commission's Hanford plant.

Developed by General Electric Co.'s engineers in Schenectady, N.Y., the instruments measure properties of chemical solutions continually during production runs, helping operating engineers keep close control over results and helping obtain a uniform operation.

Data from the instruments is available for immediate use and process correction. Formerly, several hours were often necessary to obtain analytical results from laboratory tests.

One of the instruments uses a by-product of plutonium production as a help in gathering data necessary to control that production. Atomic rays given off by a radioactive isotope are used to measure properties of materials under processing. By measuring the amount of radioactivity absorbed by the material, technicians can determine changes in the flow of materials under process.

Outlook for Copper is for Greater, More Stable Supply

Copper industry gives indication of maintaining steady growth for years to come.

"Greater output from mines, sustained consumption, new uses for metals, a trend to more stable prices, and copper's inherent suitability for many applications, cause the copper industry to remain optimistic about the future," said Theodore E. Veltfort, manager, Copper and Brass Research Association. Markets for any material, particularly metal, Mr. Veltfort believes, are mainly determined by: (1) economic conditions prevailing at the time a material is being considered and (2) properties and characteristics of the material. As they relate to copper, both factors portend a bright future.

It is reasonable to forecast a steady increase in copper consumption throughout the world as other countries gradually improve their living standards by developing more complex machine technologies and mass production concepts.

However, the copper supply pattern will become more favorable as greater capacity is realized from current expansion programs and newly developed free-world copper mines during the next three to five years.

High Power Transducer Perfected

Efficiency of a small ultrasonic magnetostriction type transducer has been increased by Acoustica Associates, Glenwood Landing, N. Y. to produce 66 acoustic watts per sq in. This development makes more feasible large scale ultrasonic cleaning, degreasing, descaling, plating, and other metalworking and finishing operations. By grouping 400-w, 25-kc transducers externally on present process equipment and driving them in tandem, power up to 150 kw can be produced. Magnetostriction transducers can be used with liquids above the boiling point.

New efficient transducer this small-in-size as hand-held unit shows. Tank in background is equipped with two earlier models.



**2 TO 36
VOLTS
@ 15 AMPS
DC POWER SUPPLY**

The **NEW PERKIN**

MODEL MR532-15A

with $\pm 1/2\%$ REGULATION

**IMMEDIATE
DELIVERY!**



Now...for Your Laboratory...the most versatile TUBELESS, Regulated and Filtered Power Supply

- REMOTE SENSING • VERNIER VOLTAGE CONTROL
- NO TUBES, MOVING PARTS OR VIBRATING CONTACTS

Specifications . . .

REGULATION: 5-32V Range: $\pm 1/2\%$ for combined line changes of 105-125VAC and load of 0-15A. DC.

2-5V Range: $\pm 2\%$ for combined line changes of 105-125VAC and load changes of 0-15A. DC.

32-36V Range: $\pm 2\%$ for combined line changes of 110-125VAC and load changes of 0-15A. DC.

RIPPLE: 1% rms max. @ 36 volts and full load. Increases to 2% @ 2 volts and full load.

AC INPUT: 105 to 125 volts, 1 phase, 60 cps. (8 amps, Input)

RESPONSE TIME: 0.1 to 0.2 seconds maximum.

DIMENSIONS: 19 1/2" wide x 15 1/2" deep x 13 1/4" high with cabinet. (19" wide x 14 3/4" deep x 12 1/4" high rack panel construction)

FINISH: Gray Hammerlone **WEIGHT:** Approx. 135 lbs.

Representatives in principal cities throughout the country.
Wire collect for complete price information.

OTHER STANDARD MODELS AVAILABLE:

VOLTS	AMPS	REG.	MODEL
0-32	25	$\pm 1\%$	M60V
24-32	10	$\pm 1/2\%$	2B-10WX
24-32	30	$\pm 1/2\%$	2B-30WX
5-40	30	$\pm 1\%$	MR 1040A
24-32	100	$\pm 1/2\%$	100 XA

Ripple on all above models: 1% rms
6, 12 and 115 V models also available. Write for complete specifications on all models listed above.



PERKIN ENGINEERING CORP.

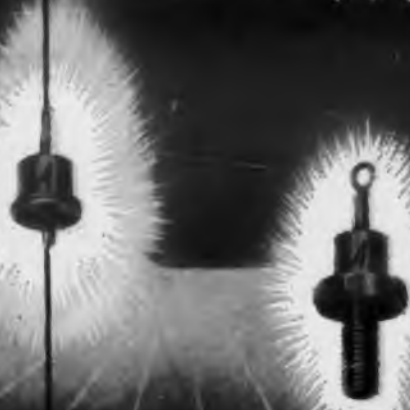
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CIRCLE 5 ON READER-SERVICE CARD FOR MORE INFORMATION

AUTOMATIC

silicon power rectifiers

MAXIMUM PERFORMANCE IN *Midget* SIZE



TYPICAL VALUES AT 100°C

Type No.	P. I. V. (volts)	Average DC Output Current (mA)	Reverse Leakage At Rated P. I. V. (μ A)	Mounting
1N440	100	300	0.03	Pigtail Leads
1N441	200	300	0.075	"
1N442	300	300	0.10	"
1N443	400	300	0.15	"
1N444	500	300	0.18	"
1N445	600	300	0.20	"
1N530	100	300	0.30	"
1N531	200	300	0.75	"
1N532	300	300	1.00	"
1N533	400	300	1.50	"
1N534	500	300	1.80	"

TYPICAL VALUES AT 100°C

Type No.	P. I. V. (volts)	Average DC Output Current (mA)	Reverse Leakage At Rated P. I. V. (μ A)	Mounting
1N535	600	300	2.00	Pigtail Leads
1N560	800	300	1.50	"
1N561	1,000	300	2.00	"
1N550	100	500	.05	Stud-Mount
1N551	200	500	.10	"
1N552	300	500	.15	"
1N553	400	500	.20	"
1N554	500	500	.25	"
1N555	600	500	.30	"
1N562	800	500	1.50	"
1N563	1,000	500	2.00	"

● Now, improve all your equipment designs . . . here from one complete source, both stud mount and pigtail rectifiers . . . designed for dependable operation at ambient temperatures in the range of - 55° to + 150° C

Twenty-two types are now available in quantity.

- These All-Welded units perform efficiently at all frequencies encountered in power applications — have negligible reverse currents — withstand severe atmospheric conditions — have excellent resistance to shock and vibration — display no aging characteristics over extended periods of time.
- Quality Automatic Silicon Rectifiers are particularly suited for magnetic amplifier and power supply applications which require superior forward conductance, low reverse leakage currents and exceptionally high efficiencies and rectification ratios. Their small size and light weight make them ideal for use in all types of miniaturized equipment.

- Write today for performance data sheets giving complete technical details.



MASS PRODUCERS OF
ELECTRONIC COMPONENTS

DIVISION OF GENERAL INSTRUMENT CORPORATION
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S. L. SPRAGGINS
373 SOUTH ROBERTSON BLVD. BEVERLY HILLS, CALIFORNIA PHONE: CRESTVIEW

Admiral Buys Raytheon's TV and Radio Set Operation . . . Admiral

Corp., Chicago, Ill., has acquired Raytheon's Belmont TV and radio manufacturing operations for \$2,000,000. The price includes two plants, inventories, and equipment.

According to Ross D. Siragusa, Admiral president, the company will complete the transaction with its own capital, no stock transfer or outside capital being involved.

TV and radio set sales have been averaging about 10% of Raytheon total sales of about \$175,000,000 in the past three years. However, in the current fiscal year, sales have been less than 10%. The company said that the operation has been unprofitable. Admiral will not only expand this manufacturing operation, but will move into the Hi-Fi field as well.

Lear Licensed to Build British Fuel System

Lear, Inc., has entered into a 10-year exclusive license agreement to manufacture and sell in the U. S. the turbine engine control equipment developed by Ultra Electric, Ltd., of London.

The Ultra system for advanced turbine engines uses temperature sensitive elements to monitor a jet engine's fuel input so as to maintain turbine speed and temperature in the range of maximum efficiency. Fuel flow is varied by remote positioning which utilizes an electrical connection between the cockpit and the engine, thus eliminating the need for mechanical controls.

Four-Transistor Radio

One of the transistor radios in the new Bulova series is a pocket-sized model. The volume and sensitivity is equal to most six transistor sets now on the market. It contains but four transistors however, and a crystal diode. Power is obtained from a single 9 v dry cell battery which provides 950 hours of intermittent playing time. Dimensions are: 3-3/8 in. high, 6-1/8 in. wide and 1-3/4 in. deep. It weighs 22 oz.

◀ CIRCLE 6 ON READER-SERVICE CARD

ELECTRO SNAP

NEW SWITCH NEWS

FOR CIRCUIT DESIGNERS

New subminiature sealed switch is environment-free; mounts interchangeably with MS25085

**MODEL EF-3**

Single Pole, Double Throw
 Move. Differential, .004 Max.
 Overtravel, .003 Min.
 Oper. Force, 5 to 17 oz.
 Release Force, 60 gram
 Elec. Life Ratings:
 150,000 ops. @ 125/250 V. A.C.,
 2.5 AMP.
 100,000 ops. @ 125/250 V. A.C.,
 5.0 AMP.
 50,000 ops. @ 30 V. D.C.,
 (2.5 AMP., IND.; 4.0 AMP., RES.)
 Amb. Temp., -65° to +180° F.

Sealed in a corrosion-resistant, treated aluminum enclosure, this tiny switch is environment-free; highly vibration and shock resistant. It carries 5 amps. at 125/250 V.A.C. with an electrical life rating of 100,000 operations. Low operating force and small movement differential make it ideal for bi-metal temperature, diaphragm operated and other "feather-touch" devices, while small size permits mounting singly or ganged in restricted space. Rugged and dependable, it has positive snap action.

Tiny, new 40 amp. basic switch has high capacity, longer life and constant stability of tolerances

Measuring only 1 3/4" x 43/64" x 43/64", the new Electro-Snap G3-8 Basic Switch handles current ratings up to 40 amps. A new method of combining Electro-Snap's double-break action with a heavy-duty switching element assures electrical and mechanical life of

**MODEL G3-8**

100,000 cycles at large capacities; also provides constant stability of tolerances and accurate repeatability. New plastic compound case gives the switch an ambient temperature rating of -65° to +300° F. with extreme shock resistance. Small size makes it ideal for motor controls and compact automation set-ups. A wide range of actuators is available.

OPERATING CHARACTERISTICS

Single Pole, Double Throw
 40 AMPS @ 125/250 V. A.C.
 @ 30 V. D.C. Res.

Oper. Force, 30 ozs.
 Overtravel, .025" Min.
 Move. Differ., .055 ± .010

New simultaneous triple-pole switch interrupts 3-phase ac. circuits; 6-circuit control in a small package

**MODEL K3-4**

Triple-Pole, Double Throw
 15 AMP., 125/250 V. A.C.
 30 V., D.C. Res.
 10 AMP., 30 V., D.C., Ind.
 Overtravel, .015 Min.
 Move. Diff., .028 ± .007
 Mech. Life, 1,000,000 ops.
 Elec. Life, 500,000 ops.

This completely new Electro-Snap triple-pole switch simultaneously reverses current flow through three windings of a 3-phase motor up to 1 H.P. and interrupts other types of multi-switching installations. Instantaneous "make" and "break" snap-action of the three poles is independent of the speed of actuation—even extremely slow moving cams can be used.

The K3-4 Series offers designers a wide variety of 3-phase circuit hookups for servo-controls, to limit movement of machine members and as a start-and-stop switch which formerly were possible only with complicated relays or a number of separate switches. A large selection of standard actuators is available.

New small basic switch is low cost; directly interchangeable with AN3234 Specs

The new Electro-Snap F2 Series snap action switches are extra-compact with extremely high electrical capacity for their size. Mechanical and electrical life at 1/32" overtravel is 150,000 operations, minimum, with accurate repeatability and constant stability of tolerances. Self-aligning springs provide contact wiping action rare in a switch of this size.

**F2 SERIES**

Durable case of special plastic gives the switch an ambient temperature rating of -100° to +275° F. or +375° F. Available, at low cost, in three basic models with a wide selection of actuators.

SERIES F2 BASIC SWITCH: F2-3: Single Pole, Double Throw
 F2-2: Single Pole, Normally Open; F2-1: Single Pole, Normally Closed

OPERATING CHARACTERISTICS

Electrical Rating: 10 AMP. 125/250 V. A.C. 60 cycles
 30 V. D.C. inductive and resistive (6 AMP, 30 V. D.C. for Airborne Application)
 Operating Force, 7 to 12 oz. Movement Differential, .011 ± .005
 Reset Force, 4 oz. Min. Overtravel, 1/32 Min.
 Pretravel, 3/64 Max.

SEND COUPON FOR MORE DATA

ELECTRO-SNAP SWITCH & MFG. COMPANY
 2410 W. Lake St., Chicago 24, Ill.

Please send data sheets on switches checked:

- EF-3 — subminiature sealed
 G3 — 40 Amp. basic
 K3 — Triple-pole
 F2 — Extra-small basic

NAME _____

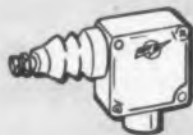
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PRECISION SWITCHES

**BASIC SWITCHES****DIECAST ENCLOSED SWITCHES****HERMETICALLY SEALED LIMIT SWITCHES**

CONFORM TO MIL & AM SPECIFICATIONS

New Factories Overnight

Sixteen defense experts, representing the Eastern Seaboard Armed Services Industrial Mobilization Council, witnessed the Alden Systems Co.'s answer to the problem of keeping production rolling when factories have been bombed out or wiped out by any disaster. From a bare floor start, actual production operation was set up with all equipment, operators moved in, and production was coming off the line within 29 minutes. It is feasible to set up a 100-operator factory completely in less than twelve hours. Twenty men, in less than twelve hours, could set up a 1000-position factory. A socket wrench is the only tool needed.

GE Reduces Prices On Ten New Transistors

Price reductions ranging up to 27% on ten new entertainment transistors was recently disclosed by the General Electric Co., Syracuse, N.Y., as a result of initial heavy demand and accelerated production.

The transistors affected by the price cut are used in portable and table model radios and high fidelity audio systems. They first went into production only two months ago.

The new lowered prices on these transistors could eventually be reflected in price reductions of as much as 20% on transistorized portable radios in the 1957 models.

Fire-Control for Starfighter

The Radio Corp. of America has developed and is producing a compact, lightweight electronic fire-control radar system for the world's fastest combat plane, the Air Force's new F-104 Starfighter jet.

The radar provides a continuous flow of information about the enemy plane's movement, electronically computed in terms of position, range and rate of closing.

A major feature of the system is a bright radar display which will enable a pilot to view the radar picture in broad daylight without the encumbrance of a light-shielding hood.

CIRCLE 7 ON READER-SERVICE CARD ➤



Two small units, inset, make up the Signal Corp's transistorized helmet walkie-talkie. Entire unit is inside the soldier's helmet.

Head Scratchers Confuse Enemy

Designed to provide individualized communication between soldiers, a transistorized transceiver has been fitted into a combat helmet. Limited information may be relayed by surreptitiously pressing a button on the side of the helmet. This, says the Signal Corps, makes the enemy think the soldier is merely scratching his head. In reality, they add, vital messages may be flowing back and forth.

Two metal cases, including batteries fit inside a modified combat helmet. To talk, the user flips a button and speaks into a miniature microphone. If he's in a spot where he can't talk, he touches another button on his helmet. This sends an acknowledging "beep" to his listeners, without giving his position away.

Weighing about a pound, the battery-powered device is designed for relatively short range. With an antenna atop the helmet, range can be increased to one mile. Batteries will operate the set for about five hours.

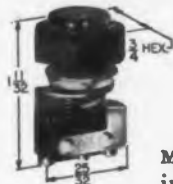
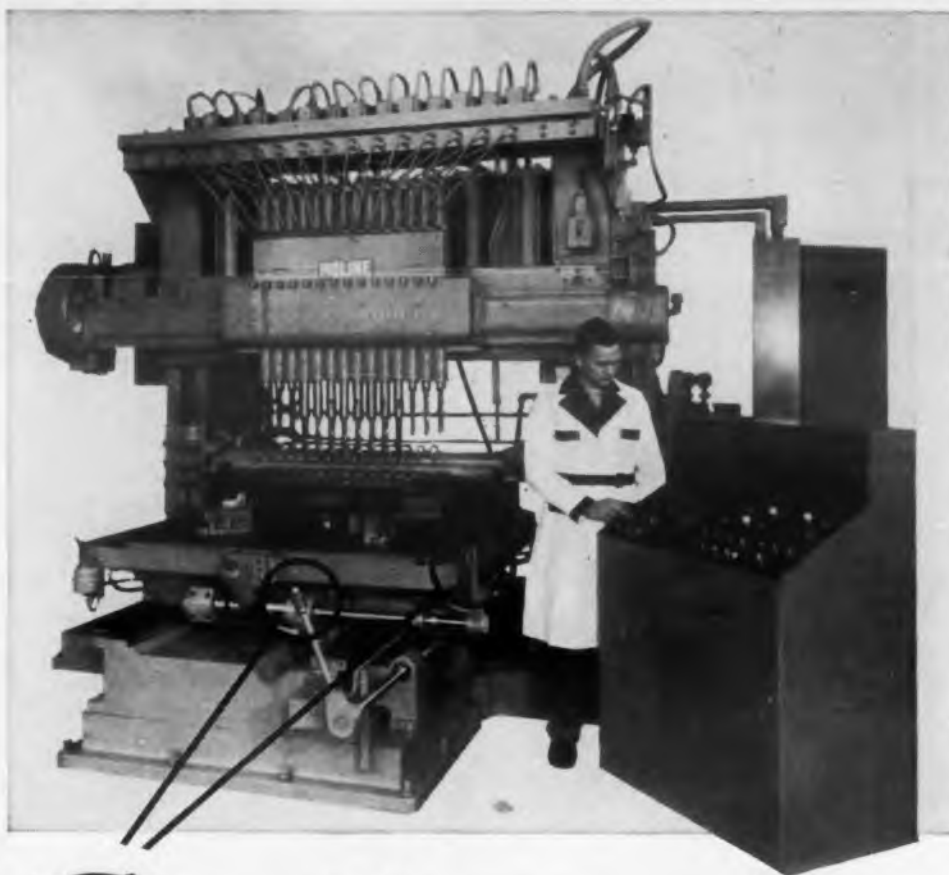
GE Cuts Prices on Rectifiers

A price reduction averaging 10 per cent on 48 different medium power germanium rectifiers has been announced by General Electric's Semiconductor Products Dept., Syracuse, N. Y. The new prices of these rectifiers bring them down to the lowest price level of such devices to date and well within the price range of other equivalent dry rectifiers.

The rectifiers affected are in the 5 to 10 amp medium power series. The growing use of these rectifiers and lower manufacturing costs in greater volume production made possible the reduction in price.

MICRO precision switches

... THEIR USE IS A PRINCIPLE OF GOOD DESIGN



Hydraulic rail feed driller of Moline Tool Company for drilling, reaming and chamfering tube plates in heat transfer equipment. MICRO "PB" series push button switches are wired into the end of the hand levers.

MICRO "PB" series push button subminiature switch is outstanding because of its small size and the fact that after the push button is mounted on a panel, the switching unit can be wired and then easily snapped into place. The push button is sealed to keep dirt and moisture from penetrating to the back of the panel.

Sealed small-size subminiature push button switches are easily wired into lever handles of Machine Controls

Two MICRO "PB" series push button subminiature switches are used by Moline Tool Company on their HD68 machine for drilling header plates or tube sheets. A switch is located in the end of each hand lever to relieve hydraulic pressure and permit easy movement of the lever in turning the index bar to relocate the work table.

Moline Tool engineers selected these MICRO SWITCH units because of their small size, the fact that they are sealed to prevent dirt and moisture from penetrating the back of the panel and be-

cause they can be wired first and then easily snapped into place behind the panel.

Though small in size, these switches have the ruggedness to give reliable, precise operation as components for heavy machines and equipment.

Other MICRO precision switches of different types are used to control the automatic feed cycles of the drills, as a limit for the vertical movement of the drilling unit and to perform other important functions.

Send for Catalog 75
on "Subminiature Switches"

"MICRO's wide variety let us pick exactly the right switch"

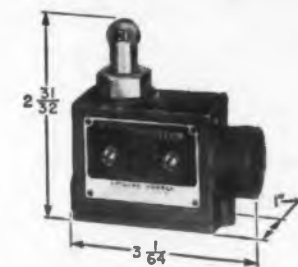


This manufacturer of an automatic reaming machine had to have a sturdy, ruggedly housed switch to withstand hammerlike impact actuation. It had to be small and compact, well sealed and with leads factory-sealed at the conduit openings. MICRO "LN" series switches proved exactly right. Two of them are installed to control depth of the reaming cycle, two others restart the clamping cycle. Four other MICRO precision switches of different types perform other important functions.

Said the Chief Engineer—"We came to MICRO SWITCH because their wide variety of switches let us select the switch best fitted to our need."

Send for Catalog 83
on "Industrial Enclosed Switches"

Accurate and rugged to guard dies on 250-ton press



Safety of expensive dies on a huge 250-ton press depend on the faultless performance of two MICRO precision switches.

Extremely accurate and enclosed in rugged die cast housings, the switches were chosen by the press designers for this highly critical function. The switches gauge the thickness of blanks fed into the machine at the rate of 1000 an hour. If more than one blank is fed in at a time, the switches stop the press instantly.

Send for Catalog 83
on "Industrial Enclosed Switches"

CIRCLE 8 ON READER-SERVICE CARD FOR MORE INFORMATION

...have uses unlimited



MICRO SWITCH Engineering Service can be a short cut to better design

MICRO SWITCH Engineering Service is made up of experts on just one thing—precision switching problems.

Whatever your design problem, its solution may easily be expedited by consultation with an engineering service that has helped in the solution of many complex electrical switching problems.

MICRO SWITCH may have already solved a problem similar to yours—for somebody else. Should your problem turn out to be entirely new, MICRO SWITCH can—and will—develop the switch you need.

Environment-proof for water pump controls



Designers of liquid level and pressure controls for automatic pump controls found all five of the vital requirements for switches in such a device in Honeywell Mercury Switches.

These were: (1) high resistance to humidity; (2) unaffected by corrosive gases; (3) operation by low energy input; (4) capacity for wide overtravel; and (5) flexible in adjustment.

The switch used in this application is capable of a maximum tilt of 5 degrees. Switches are operated by revolving discs.

Send for Catalog 90 on
"Honeywell Mercury Switches"

Absolute dependability— free from maintenance



Wired into the shear gauge dial, two small but extremely rugged and reliable

ble MICRO precision switches keep the travel of a giant metal shear within precise limits.

The designers required small, precise snap-action switches that must be accurate in performance, built for long-life operation and absolutely dependable—with little or no maintenance.

They found these vital factors in the MICRO precision switches selected. When the gauge has traveled to its maximum setting, the limit switch stops the motor and prevents damage to the back gauge screws. On the forward movement, the limit switch prevents the gauge from running into the shear knife.

Send for Catalog 62 on
"Basic Switches for Industrial
and Commercial Applications"

"No needle breakage since we installed the switches"



Sometimes it happens that a designer discovers a spot where MICRO precision switches will make his product better and more productive as a result of his customer's installation.

In this case a southern textile mill owner found a way to prevent needle breakage and reduce jams on his carrier rack by using MICRO precision switches.

One is installed so that it stops the machinery at once in the event of any misadjustment or mechanical failure. The other stops machinery if the narrowing fingers approach each other so closely as to tear up the needle bed.

Send for Catalog 83 on
"Industrial Enclosed Switches"

How new "EN" Series Sealed switches provide Unusual design flexibility

MICRO Series "EN" switches are capable of reliable, long-life performance under extreme conditions. They are completely sealed, are cylindrical in shape and can be mounted wherever a through hole can be provided.



Roller plunger
actuator for actuation
by cams and slides



Spring return
adjustable actuator
for cam or
slide actuation



Positive drive
adjustable
actuator for
linkage
operation



Plunger actuator
for in-line
motion actuation

MICRO SWITCH Engineering Service is available to help you select the exact switch to meet your design problems. Call the MICRO SWITCH branch nearest you.

MICRO SWITCH

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Bendix Pacific Acquires Canada Rights to Decca

Canadian rights to the manufacture and sales of the Bendix-Decca navigator system, now in use in an area 1500 miles long across Europe, have been licensed to the Pacific division of Bendix Aviation Corp. American rights were obtained in 1954.

The low frequency radiowave "grid" system provides a continuous, all-weather flight-position picture. It is particularly suited to helicopters which often fly close to the ground in areas not covered by high-frequency patterns.

High Intensity Fluoroscope

A new high-intensity fluoroscope has been developed by the Navy to permit faster detection of flaws in aircraft metal castings. The new inspection device, developed by the Naval Ordnance Laboratory at White Oak, Md., for the Bureau of Aeronautics, is being tested by Chance Vought Aircraft. At the request of BuAer, Vought is evaluating the unit on a production basis to determine its accuracy in flaw detection. Its rate of detection and general aircraft usefulness is being determined as a preliminary to modification of fluoroscopy specifications.

Small castings to be inspected in the new machine are placed in plastic globes and held in position inside it by a cushion of small rubber balloons. The sealed globe is positioned between the fluoroscope's X-ray tube and 8-in. viewing screen. Through controls in the shielded booth, the plastic ball is rotated in any direction so that it can be inspected from all angles.

Control panel of the Navy's new high-intensity fluoroscope.



Check Catalogs or Data Sheets Desired.
Sign on margin, tear off bottom of page and mail.

Catalogs					Data Sheet
75	83	90	101	62	105

CIRCLE 8 ON READER-SERVICE CARD FOR MORE INFORMATION

International

Selenium Photo-Cells and Sun Batteries



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solar energy converter per
milliwatt of output!



Write for the new
72 Page booklet entitled
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and Sun Batteries"**

This handbook, of interest to scientists, engineers and experimenters, contains the basic theory and typical applications of photovoltaic cells. Copies are available for \$1.50 from our Product Information Dept.

For over 8 years, International Rectifier Corporation has been a recognized leader in the development and production of high quality selenium photoelectric cells for industrial applications. Drawing from 15 years experience in this field, International's research engineers have pioneered many of the recent advancements in the field devoted to the conversion of solar energy to electrical power. The resulting selenium sun batteries now available provide performance equal to any type of solar energy converter commercially available to industry today, *at a cost up to 50% below that of units utilizing other generating materials!*

International Rectifier Photo-Cells and Sun Batteries are available in a wide variety of sizes, mounted or unmounted. Hermetically sealed units can be supplied to operate

submerged in liquids or for outdoor applications where protection from corrosion is required. When applied and mounted properly, International's photovoltaic cells provide virtually unlimited life expectancy, evidence no irreversible fatigue or aging.

Whatever your application, from light measurement and control devices of all types to supplying power for transistorized equipment, you will find the most economical unit to specify is an International Photovoltaic cell.

For complete technical data on incident illumination intensity ranges, spectral response, ambient temperature range, etc., write on your letterhead to the Product Information Department for bulletins on all types of photocells available.



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Computer Remembers Hotel Rooms

No longer will weary travelers have to depend upon the memory of a hotel reservation clerk to be assured of a room for the night. Room reservations are one of the hotel operations which may be handled by a magnetic memory system devised by Teleregister Corp.

Automatic processing of room reservations up to 1 year in advance will be possible. Information on vacant space will be instantly available. Using a special display board, reservation clerks can keep watch on current-day room status.

Other operations, including billing, accounting, and inventory control may be accommodated. Restaurant sales, laundry, and telephone calls may be posted instantly on the guest accounts. By keeping bills up to the minute, checkout delays will be reduced.



Twenty-five foot antenna, background, with electronic equipment in the jeep makes up one station in a newly developed radar surveying system.

Radar Surveyor

George Washington would hardly recognize the state of the surveying art today. Electronics has moved into the field long exclusive to optical instruments.

Radar is being put to use to measure distances

far beyond the range of optical instruments. Fifty miles can be measured in a single jump instead of the 20 to 30 small hops previously required. Accuracy is reported to be within a few feet at 50 miles. Poor visibility and foliage are said not to interfere with the operation of the system.

Designed by Motorola for the Signal Corps, the system consists of two mobile radar sets. One set is used at each end of the distance to be measured. Distance measurements are based upon the time it takes a signal to make the trip between the two stations.

Each mobile set consists of a collapsible antenna and three cases filled with electronic equipment. The entire assembly weighs 200 lb. One man can set up and operate each set.

Seven Scholarships Established by Borg-Warner

Seven scholarships to Illinois Institute of Technology have been established by Borg-Warner Corp. "to develop engineering, manufacturing, and business leadership for industry." High school seniors who combine academic and technical excellence with qualities of character and leadership are eligible to apply for these scholarships.

Recipients will receive up to \$750.00 to cover full tuition and will be eligible to apply for a renewal of their scholarship each year. They may also apply for summer employment in one of the company's divisions or subsidiaries.

Application for these scholarships should be addressed to Chairman of the Scholarship Committee, Illinois Institute of Technology, 3300 S. Federal, Chicago, Ill.

Electronic Components Bombarded

Tests are being conducted to determine the effect of nuclear radiation on electronic components. Admiral Corp., conducting the study for the Air Force, is using the facilities of the Argonne reactor.

Neutrons, a byproduct of the Argonne unit, are used to bombard all types of components. After six days of exposure, the components are carried in lead shielded boxes to the laboratory. Special shielded rooms in the lab contain the test equipment. Apparatus in the room is operated by remote control. Operators view the tests through special windows 2-ft thick.

Components are being tested both before and after radiation. Extent and nature of radiation damage will be determined. Recommendations will be made to the Air Force for preventing or reducing radiation damage. This study is important in the design of atomic-powered rockets and satellites where radiation will be a major factor.



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*that meets the exacting requirements
of the GOLD standard*

These subminiature glass diodes, the result of Radio Receptor's controlled gold bonding process, are long lived and dependable. They include such desirable characteristics as high conductance, low leakage and fast reverse recovery, all at a low cost that makes them practical for every type of service. Individually tested in our factory, RRco. gold bonded diodes give superior service in the field under the most rigorous conditions.

*Production quantities
available for immediate delivery*

general purpose types

high temperature types

high conductance types

computer types

military types



typical characteristic charts and additional information pertaining to our complete line.



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D

CIRCLE 10 ON READER-SERVICE CARD FOR MORE INFORMATION

more for your money
from the leader in the field!



MODEL 7360 — 0 cps to 1 mc range

DESCRIPTION

These truly universal instruments combine high-speed electronic counting with a precision time base in multi-purpose circuitry. They function as counters, timers, time-interval meters, EPUT* meters, frequency, frequency ratio or period meters, or as secondary frequency standards. No other single instruments yet devised offers their wide range of usefulness in the laboratory or test stand.

All models have provision for standardization against WWV and may be coupled to external frequency standards. Connections are provided for driving Berkeley digital printers, data converters, or in-line remote readout units.

FEATURES

- 1 0.1 v rms sensitivity
- 2 Step attenuators; trigger-adjusted noise discriminators
- 3 More stable frequency dividers
- 4 Electronic (not relay) reset
- 5 External frequency standard input connection
- 6 AC or DC coupling of all input circuits; 10 megohm input impedance
- 7 Multivoltage accessory socket to power photocells, etc.
- 8 Binary-coded output with direct connection to digital printers, data converters, inline readouts, etc.
- 9 Crystal-controlled time marker output
- 10 Unitized modular design
- 11 Larger, brighter readout numbers
- 12 Modern-styled all-aluminum cabinets

BRIEF SPECIFICATIONS

	Model 7350	Model 7360
Ranges—Frequency:	0 cps to 100 kc	0 cps to 1 mc
Time Interval:	10 μ sec to 10 ⁶ sec	1 μ sec to 10 ⁷ sec
Period:	0 cps to 100 kc	0 cps to 1 mc
Time Bases:	10 μ sec to 10 sec	1 μ sec to 10 sec
Accuracy:	± 1 count, \pm crystal stability	
Crystal Stability:	± 3 parts in 10 ⁶ per week ± 3 parts in 10 ⁷ per week	
Input Requirements:	0.1 v rms, 10 megohm impedance, dc or ac — coupled	
Display Time:	Adjustable, 0.1 to 5 seconds (automatic reset). Manual reset also provided.	
Dimensions:	10 $\frac{1}{4}$ " H x 20 $\frac{3}{4}$ " W x 16 $\frac{1}{2}$ " D (cabinet mount; rack mount available)	
Price: (f.o.b. factory)	\$890.00	\$1,175.00

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NEW

Berkeley

MODELS
7350 and 7360

**UNIVERSAL
EPUT*
& TIMERS**



MODEL 7350 — 0 cps to 100 kc range



MODEL 5916 IN-LINE REMOTE READOUT offers large illuminated in-line figures all on one plane which can be read from any angle. Reduces error and fatigue; ideal for remote observation of data.



MODEL 1452 DIGITAL PRINTER prints data on standard adding machine tape. 7000-Series instruments also drive data converters to operate card punches or electric typewriters.



Accessibility is an important feature of BERKELEY 7000-Series instruments. Modular chassis design permits rapid checking or replacement of components and sub-assemblies.

Move to Get Retired Engineers to Teach

The Advisory Committee on Science Manpower, appointed by the New York City Board of Education, is considering the possibility of recommending the employment of retired scientists and engineers to meet the present shortage of science and mathematics teachers. Dr. Joseph W. Barker, president of the Research Corp., presently president of The American Society of Mechanical Engineers, and a member of the advisory Committee, recently made the suggestion.

Dr. William Jansen, Superintendent of Schools said: "If, as Dr. Barker suggests, there are a considerable number of retired scientists and engineers under the age of 70, who are willing to come to the assistance of our high schools in this emergency, I will be happy to urge Dr. James E. Allen, New York State's Commissioner of Education to consider modification of the present regulations (8 semester hours in education) in order to enable these men to teach on a part time and emergency basis.

"In order to determine if such supply of prospective teachers exists, I urge all interested scientists and engineers to write to Mr. Samuel Schenberg, Board of Education, 110 Livingston St., Brooklyn, N. Y. and enclose a brief biographical sketch of their educational qualifications and scientific and industrial experience."

Year's Outstanding "Ham" Sought

The fifth annual nation-wide search for the amateur radio operator who performs the most outstanding public service during the year is now underway.

A principal winner and several special citation recipients will be chosen in January from the nation's 140,000 licensed radio amateurs, said L. Berkley Davis, award committee chairman and general manager of the electronic components division of General Electric, sponsor of the Edison Radio Amateur Award.

Judging will be based on the amount of sacrifice, ingenuity, and greatest benefit displayed by amateurs in employing amateur radio in the public interest.

The Edison Award Trophy and a check for \$500 will be presented to the principal winner at a banquet ceremony in Washington, D. C., next February. The official award rules permit any responsible person or organization to nominate a licensed radio amateur who is known to have performed an outstanding public service. The service must have been performed while the candidate pursued his hobby within the continental limits of the U. S. during the 1956 calendar year. Copies of the rules and a guide to preparing nominations are available from the secretary of the Edison Radio Amateur Award Committee, Electronic Components Division, General Electric, Schenectady, N. Y.

Washington Report

Albert Warren

Pursuit of Air Safety

Shock of Grand Canyon 2-plane collision continues to produce determined govt efforts to prevent repetition of such accidents. Among actions: (1) Congress promptly gave President Eisenhower the extra \$68,000,000 he asked, so that Civil Aeronautics Administration can speed up its 5-year plan for improving air safety. Of the appropriation, \$54,000,000 is for installation of air navigation facilities, \$14,000,000 for operation & regulation. (2) CAA will obtain from Air Force a B-57, aims by Oct. 1 to have it operating as "a flying guinea pig for all elements of the high altitude control project—navigation aids, communications, radar, and traffic control procedures." (3) Radio Technical Commission for Aeronautics subcommittee has distributed to members a series of requirements it believes should be minimum for reducing dangers of air collisions. These minimum requirements, RTCA says, should warn pilot of penetration by another plane of space 10 mi horizontally, 800 ft above and below for altitudes up to 30,000 ft, 1600 ft above and below for altitudes above 30,000 ft (4) Air Coordinating Committee reported that during 34-day period at Washington National Airport there was complete saturation of all 10 vhf and 4 uhf radio frequencies. Periods of saturation range from 3 min to 4 hours, totaled 8 hours, 12 min during the 34 days.

Washington Trends & Briefs

Defense Dept has specified new procedure for military agencies to employ in approving new electronic systems and equipment. Procedure requires that pilot production be undertaken to insure that design makes sense from a production standpoint; that enough models be supplied to permit statistically sound determination of reliability; that opportunity for design correction be provided before quantity production is started. Novel instructional TV system, termed I-TV-S, has been developed by Naval Training Device Center. It comprises either vidicon or image orthicon camera mounted directly on console which in turn is on casters for maneuverability. In routine operation, it requires only one cameraman-technician per console. Advantage of equipment over regular broadcast setups, as described by Center's TV requirements coordinator Ken Thomas: "It is a self-contained system, more compact and rugged in construction, and low in cost and personnel requirements. It is completely portable, ready to plug in and operate ashore or aboard ship. The cost is considerably less than that of commercial systems and the number of men required for operation and maintenance is less than one-third. Training and operation are also greatly simplified for an instructional closed-circuit TV."

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Here, for the first time, is complete information on ISOMICA micaceous electrical insulation—100% pure continuous processed mica built up with epoxy, silicone and organic binders. Complete new system of electrical insulation offers many opportunities for improving design and performance... cutting costs.

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easily rack mounted,
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in such demanding
applications as
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production-line testing
calibration reference
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Here's a closely regulated D-C Power Supply accurate enough for the most exacting laboratory use, yet sufficiently rugged to use out in the plant for production testing and quality-control work. Back of this unusual combination is the Leach MAGNIVOLT's construction... it uses only static components, contains no vacuum tubes or other fragile parts. Heart of the unit is a design based on magnetic amplifiers and selenium rectifiers, assurance of stability today and long, maintenance-free dependability for years to come.

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A-C Input.....120 volts, 60-cycle, single phase
D-C Output.....3-32 volts (continuously adjustable)
at 0 to full-rated amperage
Ratings Available.....5 to 30 amperes (max.)
Voltage Regulation... $\pm 1/2\%$ from 24 to 32 volts for load
change of no-load to full-load and for supply-voltage
change from 105 to 125 volts
Ripple.....less than 1% r.m.s.
Recovery Time...less than 0.2 seconds to reach 1% of
regulated voltage
(no-load to full-load or full-load to no-load)

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Letters to the Editor

Wants Better Meetings

Gentlemen:

... The (IRE National Convention), because of its excellence, has grown so large... that some rather staggering information transmission problems are developing; these problems need to be faced so that the solutions which best meet the desires of the membership as a whole can be found and used for the benefit of all.

Many of the problems result from the large number of submitted papers which a meeting of this sort is bound to attract if it is accomplishing its purpose. The questions might include the following: Should preference be given any type of paper, say, new research, tutorial, symposium, invited, etc., or should the contributions be given preference, and the balance of the time filled with symposia? Should papers which have already been given a proper hearing be repeated? Should subjects that have been aired to the public press by an organization be accepted, or should such papers be accepted only if the public announcement is made at the time of the meeting? Is there a place in the program for papers presented by title only? What sort of editorial style is most suitable, bearing in mind the fact that the paper is probably being published in the Convention Record? What is the best way to take advantage of a maximum number of contributed papers, and how can the utilization of rejected papers having scientific importance be best accomplished? In addition, should more than one paper from a single author be accepted?

The wide dispersal of the (technical sessions) up-town and down-town has made very difficult the improvement of utilization in the last few years; now, however, with the next meeting once again scheduled to be located in a convenient area, it appears that another look at the problem might be in order.

As... starting point for the discussion, I... suggest several changes... The first is that a new category be established... for papers (presented)... at earlier district meetings. These papers would be read (at the IRE National Convention) by title only to bring to the attention of those attending that the paper was presented by Mr. X of the Y company at the Z meeting, and for further information, contact Mr. X.

... it is (further) suggested that the broad emphasis in the technical meetings be placed on new results of scientific merit and on new research techniques. These papers naturally have to be a combination of tutorial and pure research papers. As a

the majority use T/I transistors!



result, it is suggested that a newspaper form of organization be recommended for these reports, in which the author first explains his new results and their significance to the listeners, and then gives a brief review, non-mathematical in nature, of where and how his work fits into the field. The meat of the paper itself could then be published into the convention record.

... Possibly symposia and tutorial sessions should be scheduled in a way which does not detract from the actual technical sessions, as that might very well make easier the engineer's task of keeping abreast of some of the related fields in which he is interested. If, for example, the morning sessions were scheduled from 0930 to 1200, and the afternoon sessions, except for the last day from 1500 to 1730, then there would be three periods from 1300 to 1430 which could be used either for visiting the show or for one of the then scheduled tutorial sessions. In addition, if a second period for evening symposia were scheduled, namely from 2000 to 2200 on Monday evening in addition to the sessions already scheduled on Tuesday evening, the technical sessions, the symposia and tutorial sessions could be appreciably enlarged.

The presentation of more than one paper by an individual was not permitted for several years. Recently it has again become common. In general, the limitation seems to be desirable since it prevents monopolization of program time. Possibly the thing to do is to accept one paper from an individual in full, and up to two by title only.

... It might be ... beneficial to publish in the convention record the titles and abstracts of all papers ... rejected as ... a definite aid to those working in ... particular fields. ... If the paper was of sufficient general interest, its abstract could be published in the Proceedings. ...

K. P.
Kingsville, Md.

It costs a great deal of time, effort and money to organize and run a meeting. It also costs time, effort, and money to attend a meeting. Both planners and meeting attendees should get their money's worth. This matter deserves widespread discussion, and we welcome further comments from readers.—Ed.



The overwhelming majority of transistorized radios — including these and other brands—use Texas Instruments transistors. This is simple proof of TI's leadership in research, development, and manufacture of transistors.

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Notable Achievements at JPL

FIRST TO FLY FM-FM TELEMETERING... From JPL's 3-band FM-FM telemetering System flown in 1944, to its present extremely versatile, compact, transistorized 18-band system, telemetering has been an important factor in the successful development of JPL guided missiles.

Significant firsts in this field are:

In 1948, a 10-band FM-FM System with 15 measurements.

In 1953, an 18-band FM-FM System with 36 measurements.

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MECHANICAL ENGINEERING

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The success of the Corporal and other JPL guided missile programs is dependent on constantly improved instrumentation techniques. Development, a major portion of the Telemetering Group activity, is directed toward improving system flexibility, accuracy and reliability. This activity is tailored to both immediate and long range instrumentation requirements of the many Laboratory missile programs.

The use of transistors and modern magnetic elements, together with progressive packaging techniques developed from intensive JPL studies, result in greatly improved reliability in missile-borne and ground-recording equipment. In addition, advanced communication studies are being utilized in the design of advanced telemetering equipment to the constant improvement of this art. An example of applied theory, is the use of tracking filter techniques in the communication link—resulting in a significant improvement in telemetering data accuracy.

The size and character of the "Lab" fosters a personal contact and close relationship between data-user and telemetering engineer. This close telemetering support is a basic reason for the development of better ways of measuring drag for the aerodynamicist, motor pressures for the propulsion expert, stresses for the missile designer and of monitoring complex electronic circuits which are the responsibility of the guidance specialist. This close cooperation has become a prime factor in the growth of the laboratory into one of the most successful guided missile development centers in the world.

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A DIVISION OF CALIFORNIA INSTITUTE OF TECHNOLOGY

PASADENA, CALIFORNIA

Meetings

Sept. 11-12: Second RETMA Conference on Reliable Electrical Connections.

University of Pennsylvania, Philadelphia, Pa. Co-sponsored by the Advisory Group on Electrical Parts and the University of Pennsylvania. This conference will provide advanced study above and beyond that presented at the first conference held in Illinois in April, 1954. The technical program is based on the results of several industry surveys to determine specific problems currently in need of attention. For further information write to RETMA Eng. Dept., 11 W. 42nd St., New York 36, N. Y.

Sept. 14-15: Conference on Communications.

Roosevelt Hotel, Cedar Rapids, Iowa. Theme will be "What Will Designs of Tomorrow Have to Accomplish?" There will be exhibits. For information, write to Conference on Communications, P. O. Box 948, Cedar Rapids, Iowa.

Sept. 14-15. Sixth Annual Fall Symposium of the IRE Professional Group on Broadcast Transmission Systems.

Mellon Institute Auditorium, Pittsburgh, Pa. Sessions will feature speakers in the area of TV measurement, TV studio development, and broadcast facilities and operation. Included in TV measurements will be field strength and studio-transmitter equipment proof-of-performance measurements. Sessions on broadcast facilities and operation will include papers on the remote control of directional antennas, installation of non-rigid transmission lines, an arrangement for aural transmitter standby facilities, automatic gain control in video circuitry, sawtooth testing of audio amplifiers, and Conelrad. For information, write to IRE, 1 E. 79th St., New York, N. Y.

Sept. 16-22: Second Pacific Area National Meeting and Apparatus Exhibit.

Hotel Statler, Los Angeles, Calif. Sponsored by the American Society for Testing Materials. For information, write to American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

Sept. 17-18: Transistor Reliability Symposium.

Western Union Auditorium, New York, N. Y. Sponsored by the Working Group on Semiconductor Devices of the Advisory Group on Electron Tubes. Transistor life studies, designing circuits and systems for reliability, preventive maintenance, transistor performance in electronic equipment tests, and design of experiments for reliability studies are the areas for which papers will be presented. Additional information may be obtained from Mr. Howard Moss, Electron Tubes Div., Solid States Devices Branch, Evans Signal Laboratory, Belmar, N. J.

Sept. 17-21: Instrument-Automation Conference and Exhibit.

Coliseum, New York, N. Y. Sponsored by the Instrument Society of America. Technical sessions will offer information concerning design, manufacture, application and operation of instruments and automatic controls. Typical types of instruments and systems will be presented for every application ranging from atomic reactors to sanitation and soap processing. For additional information, write to ISA, 313 Sixth Ave., Pittsburgh 22, Pa.

Sept. 17-21: Second Pacific Area National Meeting and Apparatus Exhibit.

Hotel Statler, Los Angeles, Calif. Sponsored by the American Society for Testing Materials. Forty-three technical sessions and more than 200 technical papers are scheduled for presentation. For further information, write to American Society for Testing Materials, National Headquarters, 1916 Race St., Philadelphia 3, Pa.

Sept. 24-25: Industrial Electronics Conference. Cleveland, Ohio.

Sponsored by the AIEE, IRE and Institute of Radio Engineers. The technical program will cover such areas as electronic equipment design, automatic production, testing, gaging, process control, and data reduction and analysis. For information, write Carl F. Schunemann, Thompson Products Inc., 2196 Clarkwood Rd., Cleveland 3, Ohio.

Sept. 26-29: Audio Engineering Society Convention.

New York Trade Show Building, New York, N. Y. Sponsored by the AES, and held concurrently with the New York High Fidelity Show. Disc recording and reproduction, magnetic recording, transistor application problems, audio systems and components, loudspeakers and standards and measurements will be the subjects of the sessions. For information, contact G. K. Dahl, 230 W. 41st St., New York 36, N. Y.

Miniaturized rotary selector switch available from **CLAROSTAT**

Series BH Rotary Selector Switch is compact yet versatile. Opens the door to still smaller designs in both military and civilian electronic equipment. Tested under MIL-S-3786 specifications. Meets severe-service requirements with maximum convenience in multiple-switching functions.

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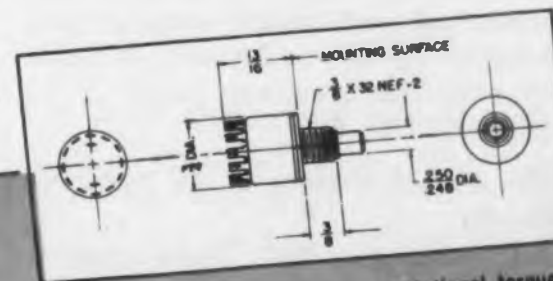


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Featuring...

- ★ In single-pole to and including 12 positions; two-pole to six positions; three-pole to four positions; four-pole to three positions.
- ★ Shorting or non-shorting, as required.
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- ★ Contact resistance: 0.005 ohm. Rotational torque: 12 to 20 oz./in.
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- ★ Available as encapsulated units.

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CIRCLE 16 ON READER-SERVICE CARD FOR MORE INFORMATION

Oct. 1-3: Twelfth Annual National Electronics Conference.

Hotel Sherman, Chicago, Ill. Sponsored by the AIEE, IRE, Illinois Institute of Technology, University of Illinois, and Northwestern University. More than 100 technical papers and 240 commercial exhibits will be featured. For information, write to Victor J. Danilov, Illinois Institute of Technology, Chicago 16, Ill.

Oct. 1-3: Canadian Institute of Radio Engineers Convention.

Automotive Building, Exhibition Park, Toronto, Canada. Technical papers are planned on medical electronics, scatter propagation, application of electronics to atomic energy projects, use of computers in automation and engineering problems, and transistors. An exposition will include many of the latest improvements in radio, radar, TV, control mechanisms, computers, and other electronic items. For information, write to Grant Smedmor, Convention Manager, 745 Mount Pleasant Rd., Toronto 12, Canada.

Oct. 1-5: AIEE Fall General Meeting.

Morrison Hotel, Chicago, Ill. Tentative schedule includes sessions on rotating machinery, protective devices, metallic rectifiers, insulated conductors, dielectrics, air transportation, land transportation, switchgear, feedback and control systems, electronics, computing devices, nucleonics, and management. For information, write to AIEE, 33 W. 39th St., New York 18, N. Y.

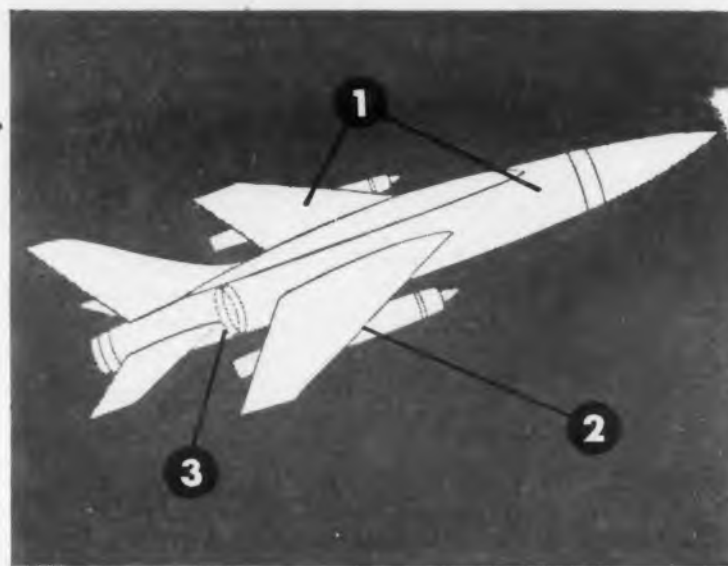
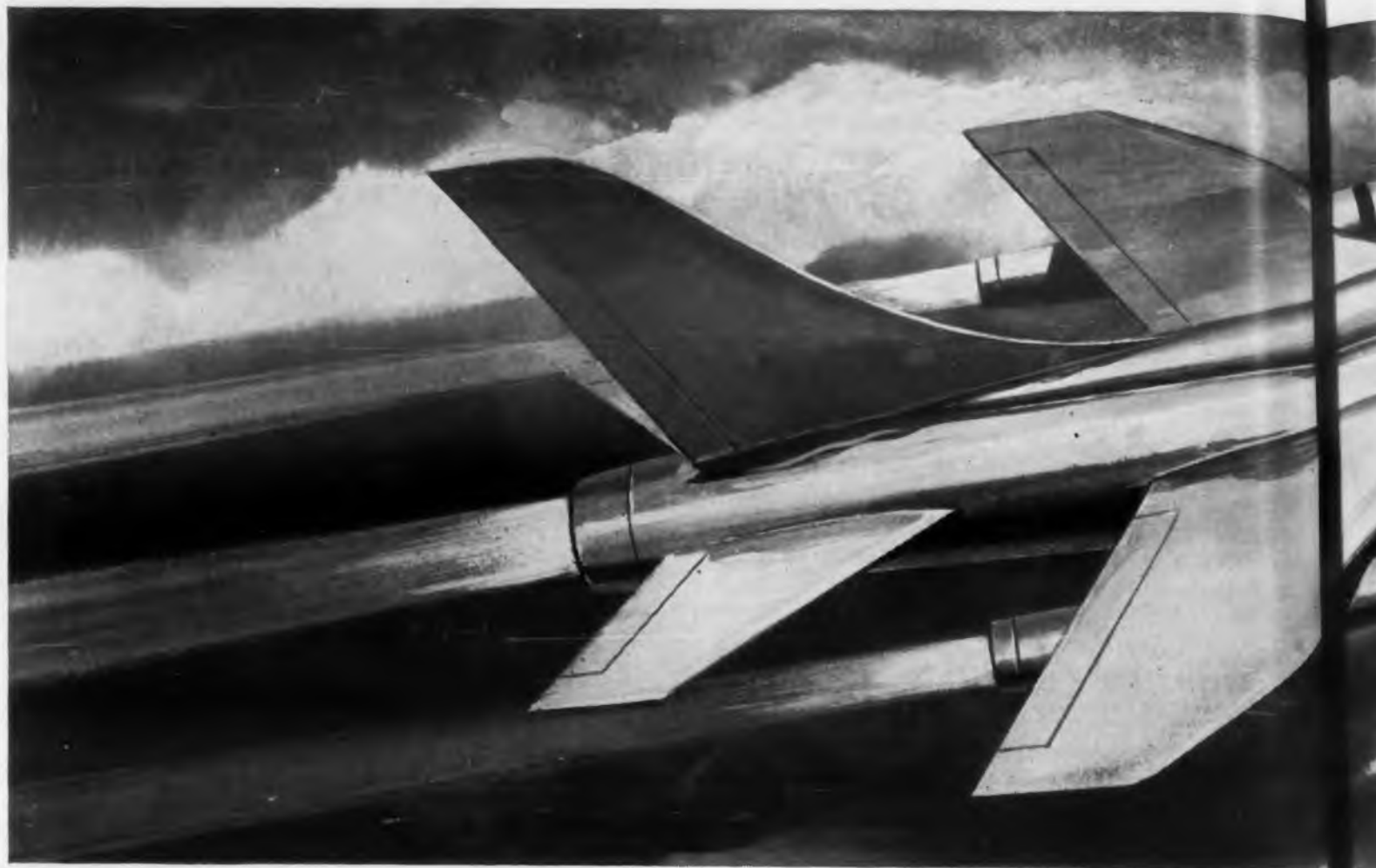
Oct. 3-5: Fifth Annual Meeting of the Standards Engineers Society.

Willard Hotel, Washington, D.C. Topics expected to be of particular interest to standards engineers in the electronic field are the session devoted to "Dynamic Standards for the Median Company" and the session devoted to "Drawing Practice Standardization." Registration fees for the complete three-day meeting, including technical sessions, two social hours, banquet, and luncheon are \$16.00 for a member and \$18.00 for a non-member. Additional information may be obtained from the Washington Section, Standards Engineers Society, 4042 N. 35th Street, Arlington 7, Va.

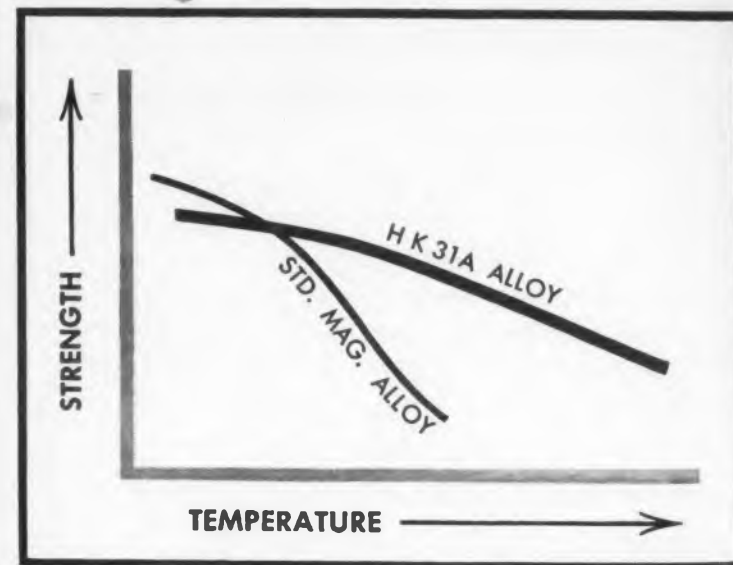
Oct. 8-9: Second Annual Symposium on Aeronautical Communications.

Hotel Utica, Utica, N. Y. Sponsored by the IRE Professional Group on Communications Systems. The symposium will stress communication requirements in support of present and future aeronautical activities. Authors of technical papers to be presented at the conference have already submitted abstracts to the committee for review. Final program and details of the entire conference will soon be available. For additional information, write to R. C. Benoit, Jr., 138 Riverview Parkway N., Rome, N. Y.

NEW DOW MAGNESIUM ALLOYS



Now suggested for a broad range of uses in missiles and aircraft, the new Dow magnesium alloys are available in the form of (1) sheet or plate, (2) extrusions, (3) castings.



Maintenance of strength at high temperatures is illustrated by this chart. Performance data on the new alloys at elevated temperatures can be obtained by request.

CIRCLE 17 ON READER-SERVICE CARD FOR MORE INFORMATION

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High temperature magnesium alloys are available to lighten aircraft and missile structures

Once again the horizons for aircraft structural design have been widened. Dow has developed a series of high temperature magnesium alloys which are already in pre-production use on aircraft, missile and engine structures. These alloys show advantages at temperatures up to 700° F. Limited test data on properties up to 800° F. are available for some of these alloys.

The new alloys save precious pounds because of their good combination of modulus and properties, including creep strength, at temperature. Shop characteristics include good formability and weldability.

One of the available alloys is the magnesium-thorium composition, HK31A, which is manufactured in rolled and cast form. Under development is a similar alloy for extruded shapes and forgings. HK31A sheet and plate are available from stock and from current mill delivery schedules in standard sizes from 0.016" to 2".

These new magnesium alloys by Dow should be considered for your high temperature requirements. Contact your nearest Dow sales office or write THE DOW CHEMICAL COMPANY, Magnesium Sales Dept., MA 361B, Midland, Michigan.

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CIRCLE 17 ON READER-SERVICE CARD FOR MORE INFORMATION

Oct. 8-12: Society of Motion Picture and Television Engineers Convention.

Los Angeles, Calif. A technical session will be devoted to a program of papers on transistors and their applications to motion pictures and television. For additional information, write John B. Olsson, Houston-Fearless, 11801 W. Olympic Blvd., Los Angeles 64, Calif.

Oct. 9-10: Computer Applications Symposium.

Morrison Hotel, Chicago, Ill. Sponsored by the Armour Research Foundation of Illinois Institute of Technology. Problems and experiences with medium-sized electronic computers will be the theme of the third annual symposium. For information, contact J. J. Kowal, Conference Secretary, Armour Research Foundation of Illinois Institute of Technology, 10 W. 35th St., Chicago 16, Ill.

Oct. 11-12: Noise Abatement Symposium.

Hotel Sherman, Chicago, Ill. Co-sponsored by Armour Research Foundation, Acoustical Society of America, American Society of Safety Engineers, National Noise Abatement Council, American Society of Planning Officials, American Industrial Hygiene Association, Acoustical Materials Association. For information, contact G. J. Sanders, Armour Research Foundation of Illinois Institute of Technology, 35 W. 33rd St., Chicago 16, Ill.

Oct. 22-26: National Industrial Exposition.

Artillery Armory, Detroit, Mich. "Atomic-Electronics Day" will be held on Oct. 24, 1956. A management-engineering conference will cover new ideas for industry. The exposition will feature industrial products, new methods and research developments. For further information, write to Denham & Co., 925 Book Bldg., Detroit 26, Mich.

Oct. 16-18: Conference on Magnetism and Magnetic Materials.

Hotel Statler, Boston, Mass. Sponsored by the AIEE, IRE, American Physical Society, American Institute of Mining and Metallurgical Engineers. Presentation of technical papers and abstracts on latest developments is proposed. For further information, write to T. O. Paine, Measurements Laboratory, General Electric Co., W. Lynn, Mass.

Oct. 18-19: Third Annual International Meeting of the Institute of Management Sciences.

Statler Hotel, Los Angeles, Calif. Theme of the conference is "Management Sciences—A Progress Report." Program plans include the presentation of technical papers on the latest developments in the application of advanced sciences to business and industrial management. For further information, please contact Al N. Seares, Vice President Remington Rand, Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y.

BEAM switching tubes are being applied in a wide variety of applications such as loran, radar, guided missiles, coding, electronic controls, communications systems, and computers. Described here is a new low-voltage beam switching tube, which replaces many standard tubes or transistors and their associated components. Also covered are recent advances in circuit technique, tube performance, design criteria, and various unique features provided by the basic electrical characteristics of the beam switching tube.

A cross-section of the new Burroughs or MBS tube (type 6701) is shown in Fig. 1. It was developed by the Burroughs Research Center and is now manufactured by the Electronic Tube Div. of Burroughs Corp. in Plainfield, N. J. This device consists of ten identical arrays symmetrically located about an oxide-coated cathode, and operating in the presence of an axial magnetic field. This magnetic field is provided by a small cylindrical magnet which is permanently "bonded" to the glass envelope with a "rubberized" silicone cement. Each array consists of a spade which forms and locks the beam, a target which is essentially a constant-current source, and a grid which serves to switch the beam from array to array.

While the magnetic field strength for the type 6700, announced previously, is approximately 450 gauss at an operating voltage center of 100 v, type 6701 is designed for operation from available aircraft voltages and those normally associated with transistor operations, at a magnetic field strength of only 150 gauss.

The mode of operation for type 6701 can be explained by referring to the spade characteristics shown in Fig. 2. Curve (1) is a voltage-current characteristic of the *j* spade starting with the "cut-off condition normally associated with magnetrons. Curve (2) is the dynamic or leading spade characteristic and is taken with the lagging spade at cathode potential, simulating conditions that exist during switching. Curve (2) collapses to Curve (1) after the switching transition at a rate determined by its own natural R-C time con-

stant. If a load line R_s (270K) is drawn, it will intersect curve (1) at *a*, *b*, *c*. The intersection at (*a*) and (*c*) represents bi-stable states; (*b*) is unstable. Point (*a*) corresponds to the condition at cut-off with no beam formed; (*c*) represents the low potential state with the beam formed in the *j* position. Load lines R_m and R_M represent two extreme values of R_s . When the slope is greater than R_m , the load line will only intersect the characteristic at point (*a*), the high state and beam formation is not possible. A slope less than for R_M will intersect the leading spade characteristic only in the low potential state (point *d*). Each leading spade in sequence will have a low state, and the beam will

Low Voltage Beam S

Rudolph A. Cola

Burroughs Corp.
Electronic Tube Div.
Plainfield, N.J.

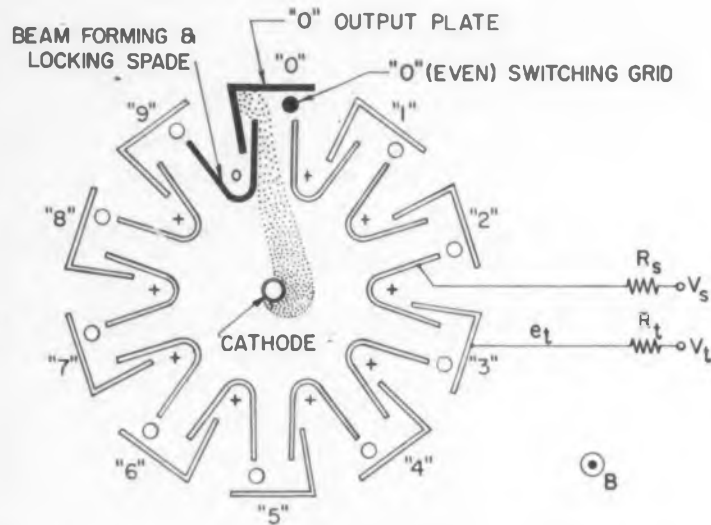


Fig. 1. Cross-section of Burroughs beam switching tube.

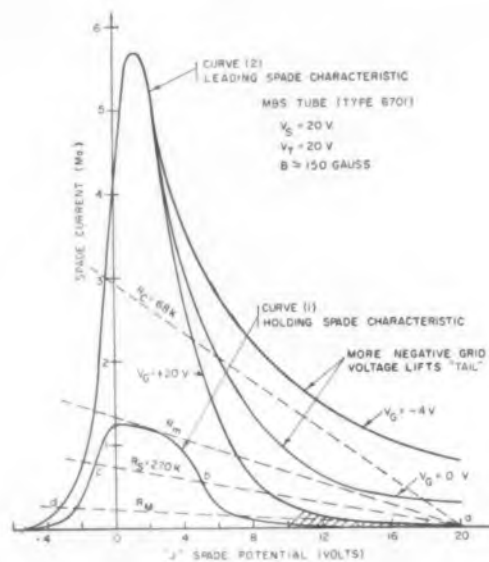


Fig. 2. Spade characteristics for low-voltage type 6701.

"free-run" continuously around the tube.

The switching mechanism by which the grid of the holding array causes the beam to advance to the leading position is shown by curve (2). Note that making the grid more negative in voltage alters the leading spade characteristic. The tail of the characteristic lifts so the load line R_s now intersects the characteristic at the low potential state, thereby causing the beam to switch to the leading position. The complete switching phenomena may occur in tenths of a microsecond.

In many applications it is desirable to have the MBS tube clear itself when the beam arrives in some pre-designated position. The "Switch and Clear" load

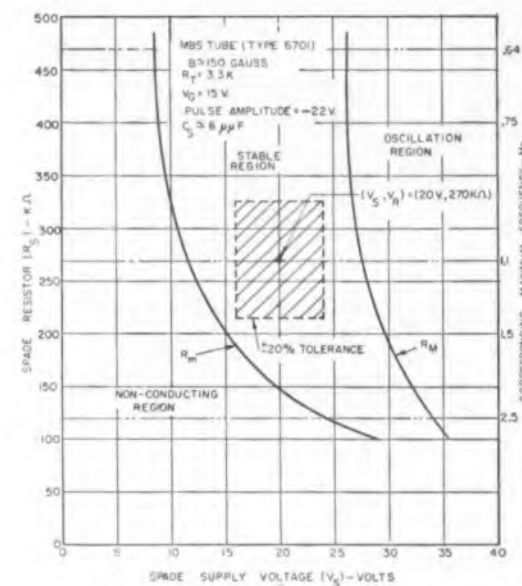


Fig. 3. Tolerance of parameters, shown on $R_s - V_g$ plane. Low-voltage tube.

M Switching Tube

MBS Tube, type 6701. V_s is the voltage of the nine other spades with respect to cathode.

All points to the right of R_M will result in continuous or astable oscillation. Operating points to the left of R_m make beam formation and locking impossible. The region between R_m and R_M represents an area of stable operation. The shaded area represents $\pm 20\%$ variation in tolerances from parameters $R_s=270\text{ K}$ and $V_s=20\text{ v}$; note that it falls well within the stable operating area. A plot of the corresponding maximum frequency for values of R_s is shown by the ordinates on the right; i.e. the maximum frequency for 270 K is 1.1 Mc when the spade capacitance (C_s) is approximately 6 μf .

A plot of the holding-target current-voltage characteristic, Fig. 4, is given for $V_s=16, 20,$ and 24 v . The curves exhibit a pentode-type constant-current characteristic. The target current varies directly with spade voltage by the relationship: $I_t \propto V_s^2$. Approximately 90% of the cathode current may be available as useful output, indicating a high degree of efficiency. The targets may perform such logical functions as gating, driving relays or magnetic cores, vacuum tubes, thyatrons, transistors, or light indicators such as the NE-2, the Haydu Position Indicator "Pixie" or possibly the Numerical Indicator "Nixie". The only restriction imposed on the target is that the load line should intersect the target characteristic in the constant-current region. "Bottoming" may result in erratic switching operation. In general, it may be stated that the dc load line should intersect the target characteristic between $V_s/2$ and $3V_s/2$. For example: When $V_s=20$, the limits for the region of intersection are 10 and 30 v.

In Fig. 5 switching-grid voltage vs target voltage in the holding array is plotted for spade voltages of 16, 20, 24 v. For a given solid line, the area to the right of the characteristic represents the non-switch region in which the beam will remain locked in the holding array for an indefinite period. The area to the left of the solid line represents the switch region for one or more positions. The scatter that exists in the

line, $R_c=68\text{K}$, accomplishes this objective. Because of the higher peak current normally associated with the leading or dynamic spade characteristic, a load line such as R_c may be selected to intersect only the leading spade characteristic in the low potential state. This insures that the beam will switch into the leading array (i.e. when $V_g=-4\text{v}$) and remain there until curve (2) decays toward curve (1). When the "Switch and Clear" load line no longer intersects the leading spade characteristic in the low potential state, the MBS Tube will clear.

In Fig. 3 is a plot relating the variation and tolerance of the spade parameters, R_s-V_s , for the same

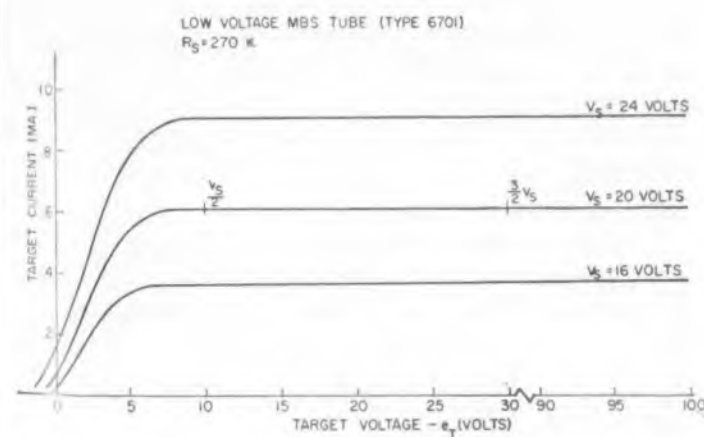


Fig. 4. Output characteristic for type 6701.

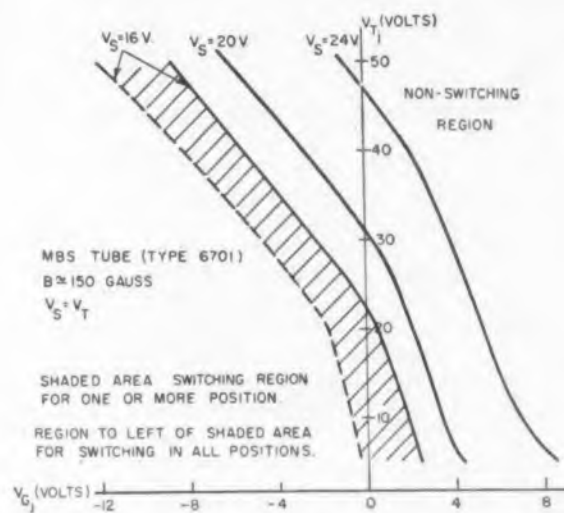


Fig. 5. Switching characteristics, type 6701.

grid switching characteristics from position to position and tube to tube is shown for $V_s=16\text{ v}$. The shaded region indicates an area in which the beam will switch for one or more positions. To the left of the dotted line characteristic is a region where the beam will switch for all positions when $V_s=16\text{ v}$. Note that the grid switching characteristic shifts to the right at higher spade voltages. Since the grids represent a very high impedance, it is suggested that the grid bias be obtained from the spade supply so that the bias voltage varies directly with spade voltage. This tends to maintain the proper relationship between the two parameters despite comparatively large variations in supply voltage.

Applications

With the characteristics shown it is possible to design circuits around the MBS type 6701 tube. A typical example of the tube's versatility and compatibility with transistors is shown in Fig. 6. Repetition rates in the order of the 1 Mc are provided by the transistor flip-flop counter. The tube performs the function of distribution and counting with resolving times in the order of tenths of a microsecond. It is interesting to note that where isolation and distribution is involved, it would take approximately 20 transistors or tubes to perform the same basic functions. The beam switching tube would often be preferred because of its high impedance input, constant-current output, and temperature characteristics.

In many applications it is desirable to have the beam-zero set automatically. Various zero-setting de-

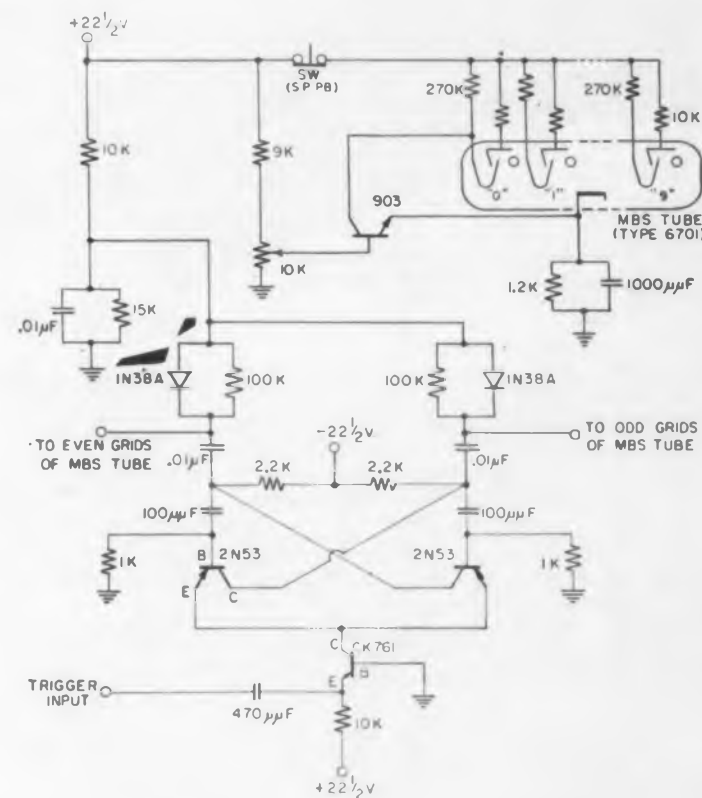


Fig. 6. Transistor driven megacycle counter using low-voltage beam switching tube.

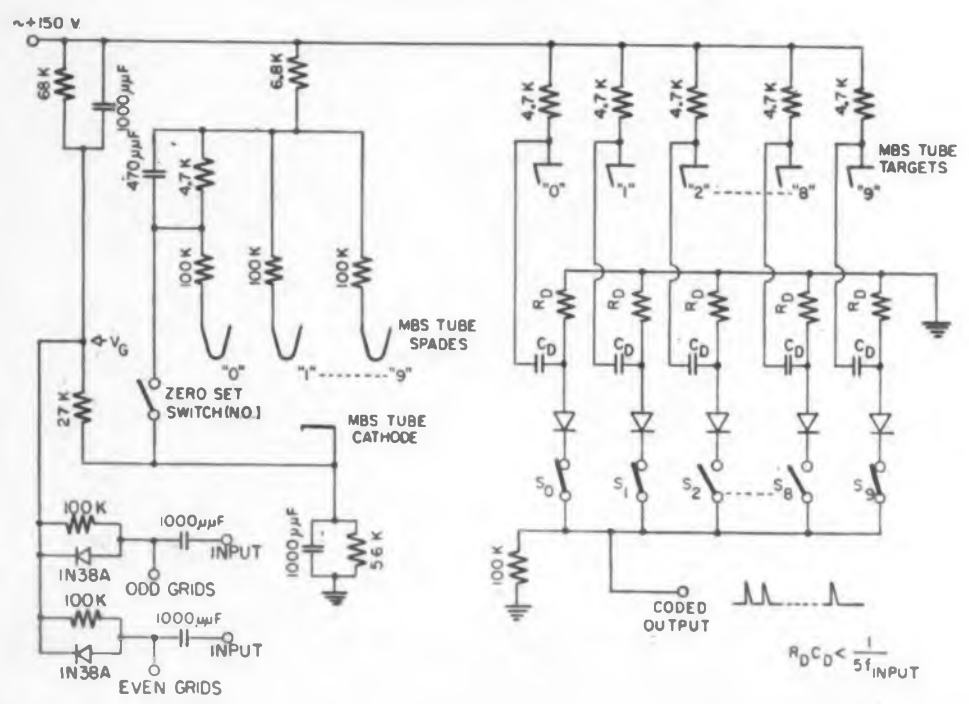
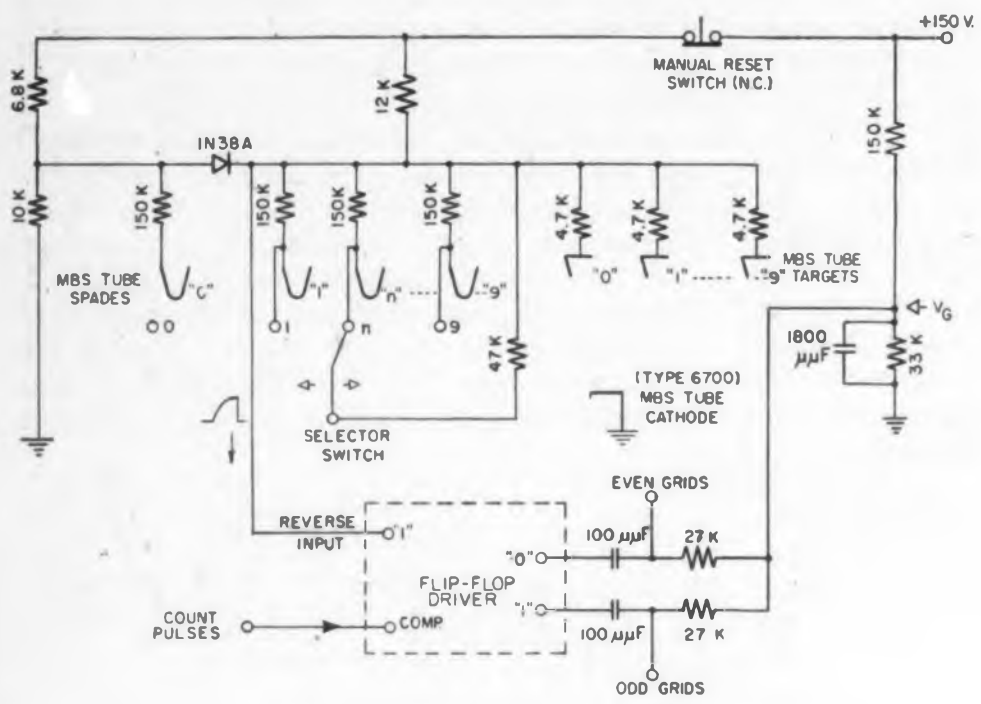
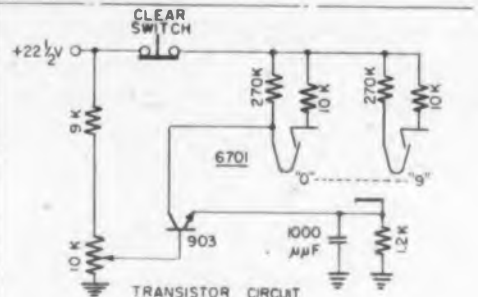
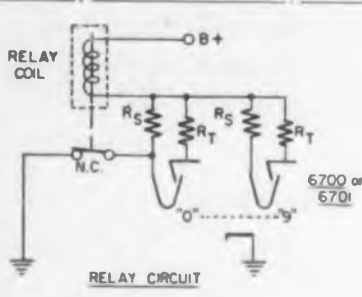
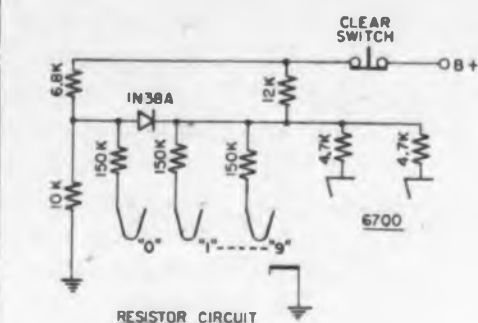
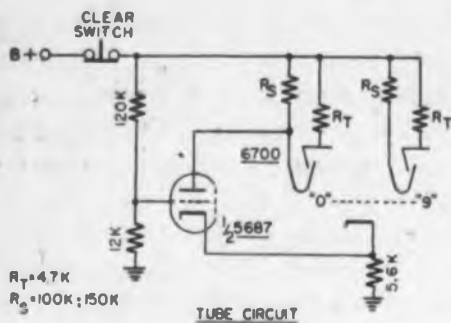


Fig. 7. Basic automatic beam-forming circuits, using Burroughs beam switching tubes.

vices are shown in Fig. 7. The "resistor" circuit may be explained as follows:

Initially when B+ is turned on, the beam tube is in the clear condition. Spades one to nine and targets zero to nine are at B+. The zero spade resistor is tied to a bias voltage determined by the 6.8 K and 10 K bleeder to ground, and the IN38A diode is cut-off. This bias voltage on the zero spade is low enough to cause the beam to form in the zero position. Target zero immediately receives current, causing the bus voltage to drop to some value a little lower than the original bias voltage. The IN38A then conducts and all spades then operate at approximately the same bus voltage.

Circuits have already been published in which beam switching tubes can be interconnected to form a distributor of more than 10 positions.

A unique circuit is shown in Fig. 8 for reducing the numbers of positions in the MBS tube to any number less than 10. This is essentially a variable scale counter distributor which is capable of having its count varied from 1 to 10. The undesired positions are eliminated by simply combining two basic circuits. These are the resistor automatic beam-forming circuit shown in Fig. 7, and a method for selecting the (n-1) useful position. The latter is accomplished by applying a "Switch and Clear" load line (R_c) to the (nth) position with a selector switch.

The circuit is explained as follows: Initially when the supply voltage (+150 v) is turned on, the beam will automatically form in the zero position, as described previously, and the tube will henceforth operate dynamically over the normal expected range of V_a . Input pulses complementing the flip-flop will eventually cause the beam to step into the (n-1) position. The next input pulse will cause the beam to switch into the (nth) position where the spade resistor $R_s=150$ K is reduced to a "Switch and Clear" load line R_c of 35 K by paralleling it with 47 K.

As the (n-1) spade recovers to a higher voltage, the beam tube will suddenly clear. Upon clearing, the bus point for one to nine spades and 0 to 9 target will immediately rise toward +150 v, causing the IN38A diode to cutoff. Soon the bus voltage approaches the initial conditions in which the automatic beam forming circuit will reset the tube in the zero position. The time required in resetting the beam from the (n-1) to the zero position is less than 10 μ sec. Alternate methods using auxiliary tubes can reduce this time to tenths of a microsecond.

Another feature of the circuit is the positive pulse developed at the bus for the time associated with the nth position. This pulse is used to reverse the flip-flop driver when "n" is equal to add numbers, so that the flip-flop is in the proper state for the next input pulse.

In general, with purely resistive circuits it is possible for the beam tube to appear as a distributor with one or more positions, depending only on the number of tubes used.

In certain computer, aircraft, and missile applications, it is desirable to transmit information by gen-

Fig. 8. A basic variable scale counter.

Fig. 9. Pulse-train coding system.

generating a coded pulse train. In Fig. 9 such a system is shown which suggests how the MBS Tube may be so used. By simply closing or opening a single-pole, single throw switch, the differentiated target voltage pulse developed across the 4.7 K target will or will not appear across the output load of 100 K. The diodes are used to isolate the targets and to clip out the negative part of the waveform. Since methods have been presented on how to increase or decrease the number of positions in the beam tube by these techniques, the code structure may be easily expanded or reduced. This tube appears to be the most promising for present methods of pulse-train coding.

Endurance Testers

Life expectancy of the MBS Tube may be safely assumed to be 50,000 hours. Factors which contribute to optimism on long tube life are the absence of a close-spaced control grid and the fact that the current and voltages used are many times less than those for which the cathode is rated. Also, since the holding space is approximately at cathode potential, it will tend to minimize the effects of the ion bombardment on the cathode. Tube operation is insensitive to large filament voltage variations (3.5 to 9 v).

MBS Tubes have successfully taken 350 g shock in all planes and 20 g vibration at fixed frequency.

In an attempt to make the MBS Tube more attractive in space-limited applications, a new technique has been developed which enables the tubes to be stacked almost directly adjacent to each other without any appreciable interference between magnets. Small equalizing bars of a given dimension prevent interaction between adjacent magnetic fields when inserted between stacked units, allowing a considerable reduction in space.

The information presented points out some of the obvious advantages of the "Beam Switching Tube" as a basic element, and its compatibility with hard tubes, thyratrons, transistors, magnetic cores, and relays. The circuit designer will appreciate the simplicity in design procedure, the overall reduction in components, and the MBS Tube's reliability and performance.

The basic advantages of the MBS Tube over previously available tube or transistor techniques should be emphasized. The versatile performance with high impedance input and constant-current output can only be approached or duplicated by using a great number of tubes or transistors and their associated components.

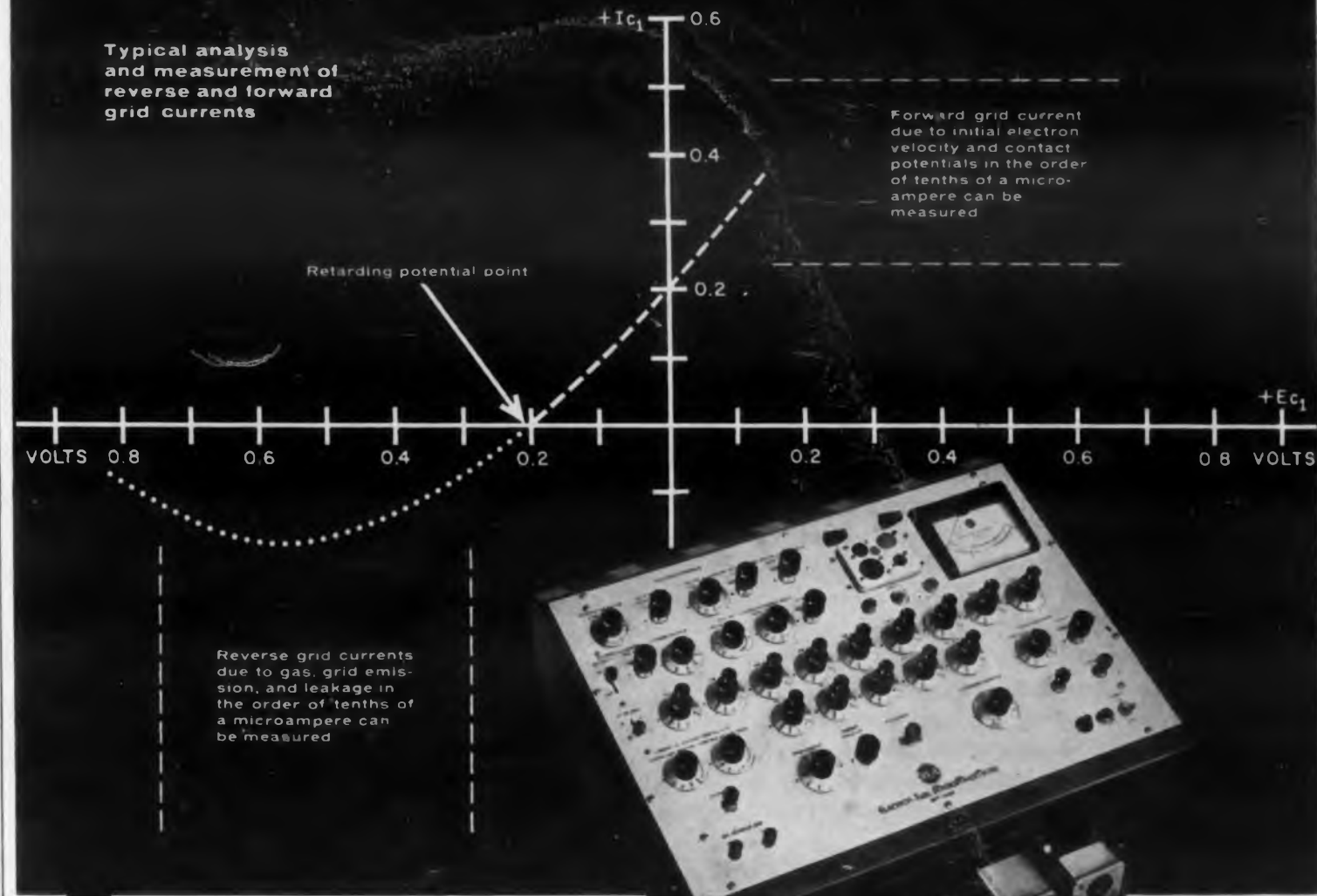
Acknowledgment is made to the many members of the Tube Research Lab, Burroughs Research Center, Paoli, Pa., who participated in the work reported.

References

1. The Magnetron Beam Switching Tube by Sin-Pih Fan *Journal of the British Institution of Radio Engineers*, Vol. XV, No. 7, July 1955.
2. Application Techniques for Use of the Switching Tubes in the ATC Transponder, M. H. Murphy, Packard-Bell Co.—Air Navigation Development Board Technical Symposium, May 1955, Washington, D. C.

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CIRCLE 18 ON READER-SERVICE CARD FOR MORE INFORMATION

THE present RETMA designations assigned to semiconductor diodes (1N-) and transistors (2N-) are little more than a "catalog" number. That is, insufficient information is given to know what the device actually is other than that it is a semiconductor and has a certain number of leads. If only the letter "N" were allowed a degree of freedom such as "N" for devices using principally electrons and "P" for units in which holes are the major carrier, a great deal more information would be conveyed by the designation. Thus a p-n-p transistor would be called out as a "2P--", and the operating voltage polarities would be known.

As other than the common junction sandwich type transistor (p-n-p or n-p-n) become standard stock items, the current type designations will mean even less. Within the next few years, other geometries such as the "field effect" and the "double-base diode" may be commonplace. In addition, a sandwich type structure designed to emphasize the "avalanche" or "delayed collector conduction" mode of operation may be a commercially-available item. Furthermore, it may be desirable to include in a single labeling system semiconductor units that are not simply rectifying or amplifying electrical devices. For example, photo diodes, thermistors, "Hall effect modulators" and solar batteries could come under the code. Thus it should be of value to expand the number of letters used in the designation of a semiconductor device in such a manner that the type of device becomes known and the designation takes on "character."

To the end that practically all semiconductor devices may fall under a single designation coding system and that such a code tells what kind of a device is involved, the following coding philosophy is suggested:



The six "boxes" illustrated above indicate alternate number, letter (s), number, etc. The boxes would indicate the following:

Box 1: A number indicating the number of pertinent electrical leads or terminals. **Box 2:** A letter or set of letters indicating the kind of semiconductor device. **Box 3:** A "serial" or "catalog" number that represents the functional specifications of the particular device type. **Box 4:** A letter or set of letters indicating the type of mechanical structure, especially the external dimensions and the location of leads. **Box 5:** A "serial" or "catalog" number that represents the mechanical specifications of the particular device type. **Box 6:** A letter (absent on "first" devices) annexed to the designation of an improved device that is functionally and mechanically interchangeable with a previous device having the same symbols in

Scheme for Designating Semiconductors

Richard B. Hurley

Senior Research Engineer, Convair

the first 5 boxes. The first improvement would be annexed with an "A," the second with a "B," etc.

The emphasis in such a coding system would be on the first three boxes, the latter two or three boxes being used primarily when labeling a drawing, tabulating a parts list, or discussing a packaging problem. Only the first three boxes would normally be referred to in ordinary electronics conversations. Such a coding system allows, say, a given transistor type, to be manufactured in several different mechanical forms without the necessity of a new "electrical" designation for each packaging change. Likewise, a given set of "housing" specifications (Boxes 4 and 5) may be used, say, with many electrically-different transistors that are packaged the same.

To show how the filling of the first three boxes may be instrumented, a suggested set of rules for these boxes is given below:

Box 1: A number, one less than the number of external, electrically-different terminals that connect internally to the functional device. That is, "floating" or dead terminals or terminals connected only to the "can" are not counted.

Box 2: This box of letters contains, in general, two parts running together. The first part indicates polarity if pertinent to the application of the device. That is, a conventional "n-p-n" sandwich type transistor should be distinguished from its "p-n-p" counterpart since each operates on opposite polarity voltages. A "p-n" diode, on the other hand, may operate principally with electrons or with holes, but this distinction is of no explicit consequence in application, and thus no polarity letter should be used.

The rule for the first letter, where pertinent, is:

"N" for devices operating principally with electrons such as "n-p-n" sandwich type transistors, point contact transistors on a "P" type chip, and field effect transistors with an "N" type body.

"P" for devices operating principally with holes.

The second part of Box 2, whether or not the first part is used or omitted, would make use of set of key letters to further describe the device, including those listed below but excluding the letters "N" "P", "I", of "O", "N" and "P" are excluded to prevent ambiguity with polarity designations, and "I" and "O" are excluded to prevent confusion with the numbers "I" and "O". The key letters include—

- | | |
|--|---|
| A. Avalanche (delayed collector conduction). | G. Generator. |
| B. Multi-base diodes as in a "double-based" diode. | H. Magnetic field. |
| C. Contact (point contact). | J. Junction. |
| D. Diode. | L. Light, including ultraviolet, gamma rays, infrared, etc. |
| E. Electrical field. | M. Mechanical. |
| F. Internal field from reverse biased diode as in a "field-effect" or analog transistor. | R. Radiation (particles only). |
| | S. Sandwich structure. |
| | T. Thermal. |
| | Z. Zener. |

Box 3: A "serial" number, starting with "1" for each different combination in Boxes 1 and 2, that are associated with a set of functional specifications.

Examples—To appreciate the use of the rules for the first three boxes and the key letters, a few examples follow. In each example, it is assumed that the

first device of a type is being designated. That is, all examples are arbitrarily assigned serial No. "1".

2FS1—A "p-n-p" or "p-n-i-p" conventional sandwich type junction transistor regardless of method of manufacture and crystal material.

3NS1—A "p-n-p" tetrode.

2NFI—A "field-effect" transistor built on an "N" type crystal.

4HI—A "Hall" effect modulator having three leads coming from the crystal and two from the electromagnet winding.

1DI—A rectifier or diode.

1ZI—A "Zener" diode.

2PCI—A point contact transistor on an "N" chip. While no distinction was made between a junction and a point contact diode, the distinction is pertinent in the case of the transistor because of instability (alpha greater than unity) in application.

2PSAI—A "p-n-p" junction transistor designed to emphasize "avalanche" effect on current gain. Such a unit is distinguished from a conventional "p-n-p" sandwich because of instability (alpha greater than unity) in application.

1LDI—A photo diode.

1LSI—A photo transistor of junction sandwich form.

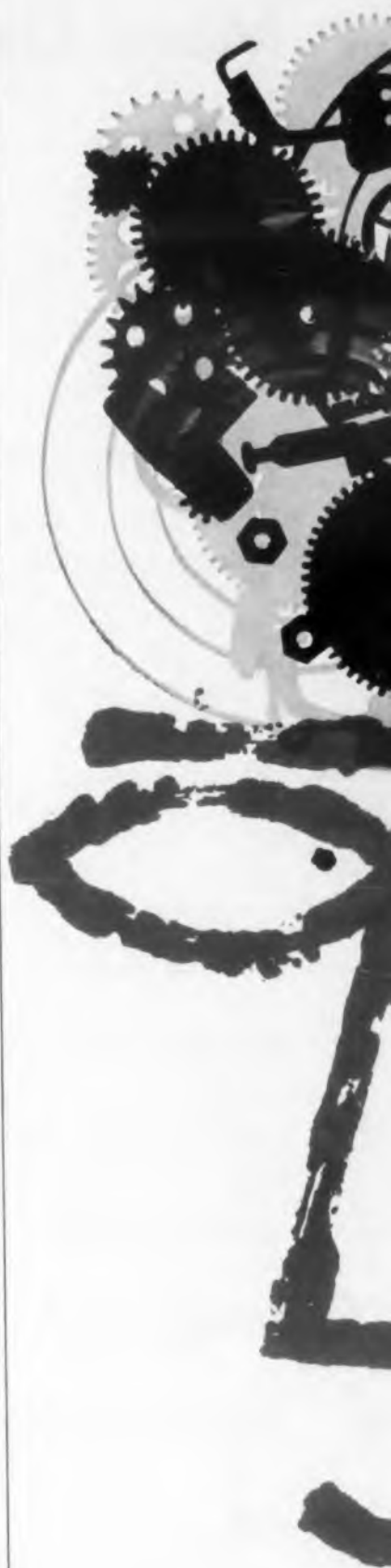
1TI—A thermistor.

1LGI—A solar battery.

It is noted that the key letters often refer to the physical form of input to the device. For example, a device used to sense beta rays would use the key letter "R", and a device with a mechanical or acoustical input would employ the letter "M". A set of pairs of key letters could also be added provided ambiguity was avoided with single letter definitions. Thus the system could grow with future needs. Obviously, a set of key letters also could be devised for describing the type of external structure, lead locations, and potting mediums, and Boxes 5 and 6 thus could be filled by a predetermined code.

Should an attempt be made to include in the coding, "ball park" information relative to such things as power ratings, maximum frequencies, operating temperatures, and voltage levels, the coding would become much too complex. Thus no distinction is made as to material (silicon, germanium, intermetallic compounds), nor is a "p-n-i-p" distinguished from a "p-n-p" junction sandwich or a "fused" (solid state fusion) from an alloyed transistor.

It is felt that the proposed method of coding would yield far more information than the current RETMA designations, would be flexible, and would add "character" to particular type devices without being excessively involved. Regardless of details, however, the purpose of this presentation is to encourage the adoption of a coding technique that yields a fair amount of pertinent information to the engineer.





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Fire Control Radar Group, which is responsible for the installation and application of the most advanced type of fire control systems in fighter-interceptor aircraft. The work covers the installation of the equipment and associated wiring; continuing liaison with equipment manufacturers; preparation of system analysis and reports; and follow-up of system performance in the field as aircraft become operational.

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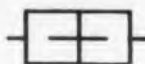
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More Definitive Symbols

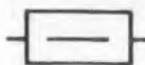
Leslie M. Balter

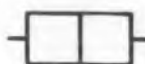
Consulting Engineer

 $\frac{1}{10}$ WATT RESISTOR

 $\frac{1}{4}$ " "

 $\frac{1}{3}$ " "

 $\frac{1}{2}$ " "

 1 " "

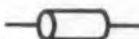
 WIRE WOUND

 TRIMMER CAPACITOR

 ADJUSTABLE COIL

 ADJUSTABLE RESISTOR
(CONTROL)

 VARIABLE CAPACITOR

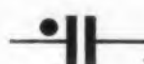
 FUSE

 TUBE HEATER

 TRANSFORMER

 ANTENNA

 125 V DC PAPER CAPACITOR

 250 " " "

 500 " " "

 500V AC " "

 125 V DC POLYSTYRENE CAPACITOR

 500 " " "

 250 VDC CERAMIC CAPACITOR

 350 " " "

 500 " " "

 CAPACITOR WITH MARKED
OUTSIDE FOIL

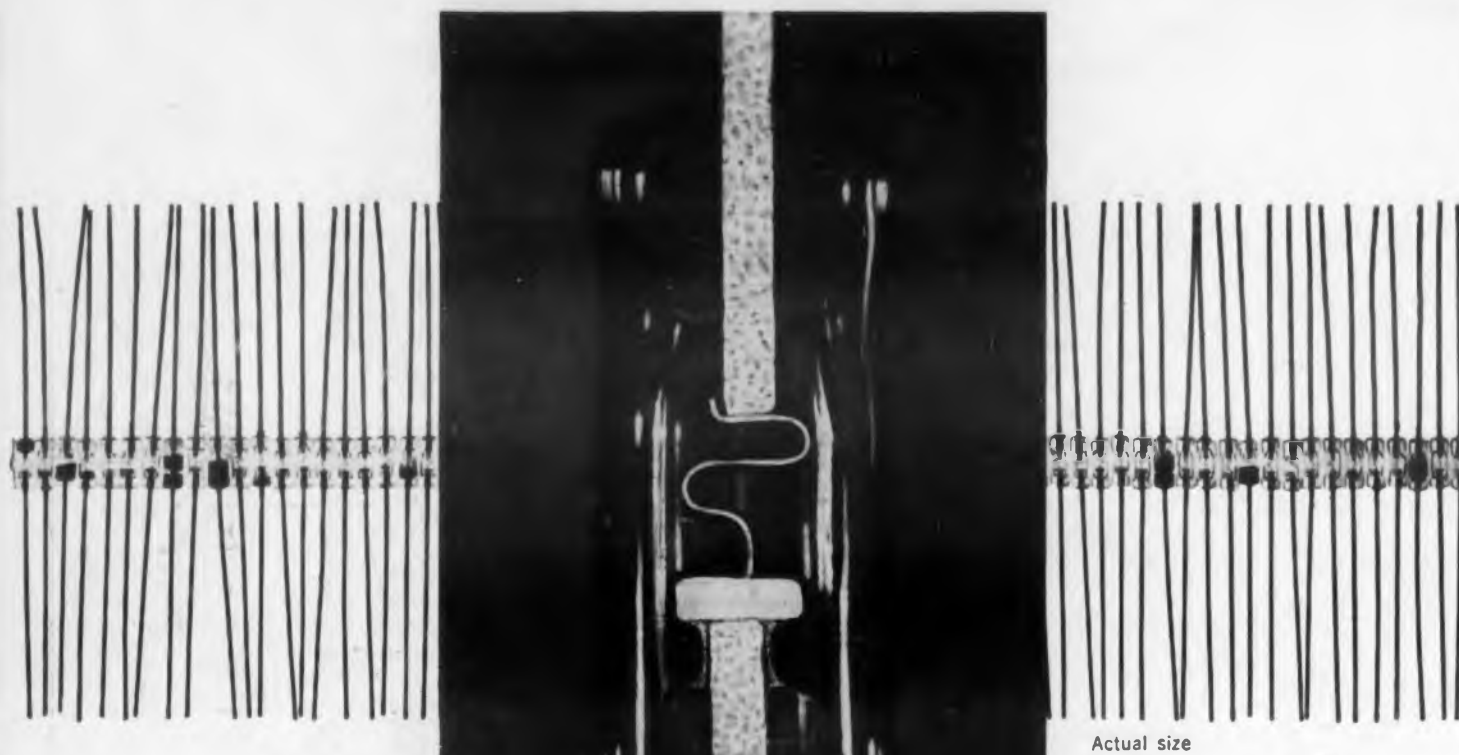
 FEED-THRU (C 77)

 DUAL ELECTROLYTIC (C 71-72)

 GROUND

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Close-up of a diode



Cross section of a Hughes germanium diode photographed at 18 diameters to show structural detail.

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Rectangular electrostatic loudspeaker of the membrane type.

Electrostatic Loudspeaker

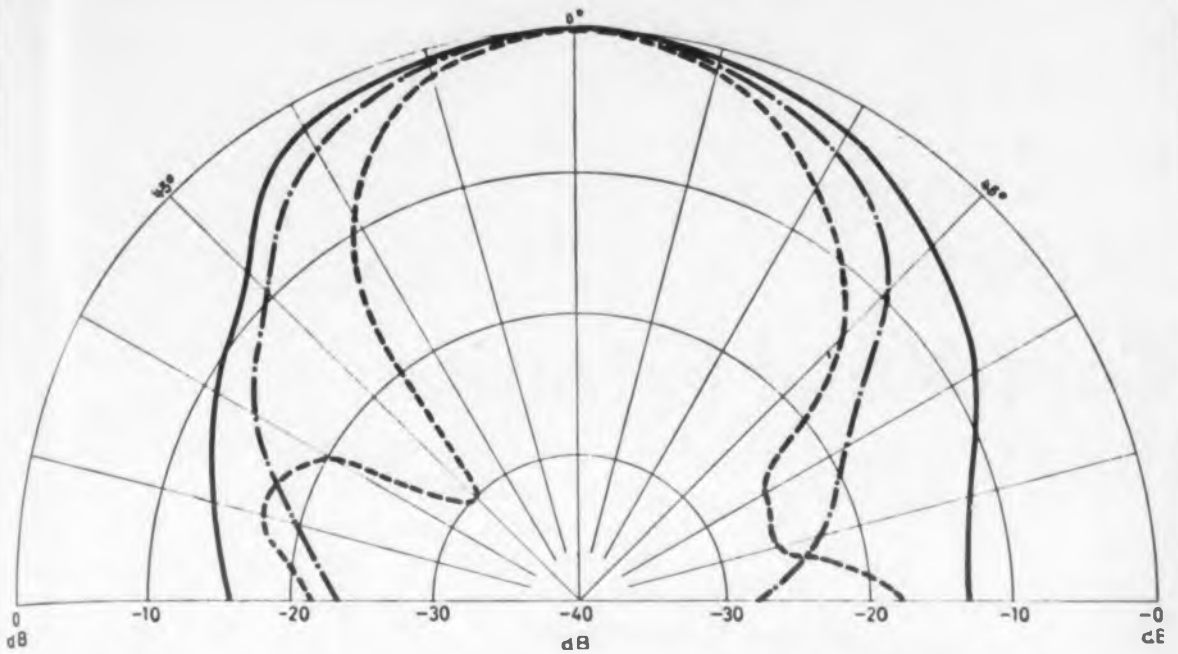
REPRODUCING extremely high audio frequencies efficiently is possible with the electrostatic-type loudspeaker. Although the principle of operation has been known for some time, commercial units have not been generally available.

Presently available in the U.S. from International Standard Trading Corp., 22 Thomas St., New York 6, N.Y., the Lorenz LSH 518 is a tweeter of rectangular shape. A German import, the tweeter may be mounted in corners or sides of cabinets where it may be difficult to mount circular units.

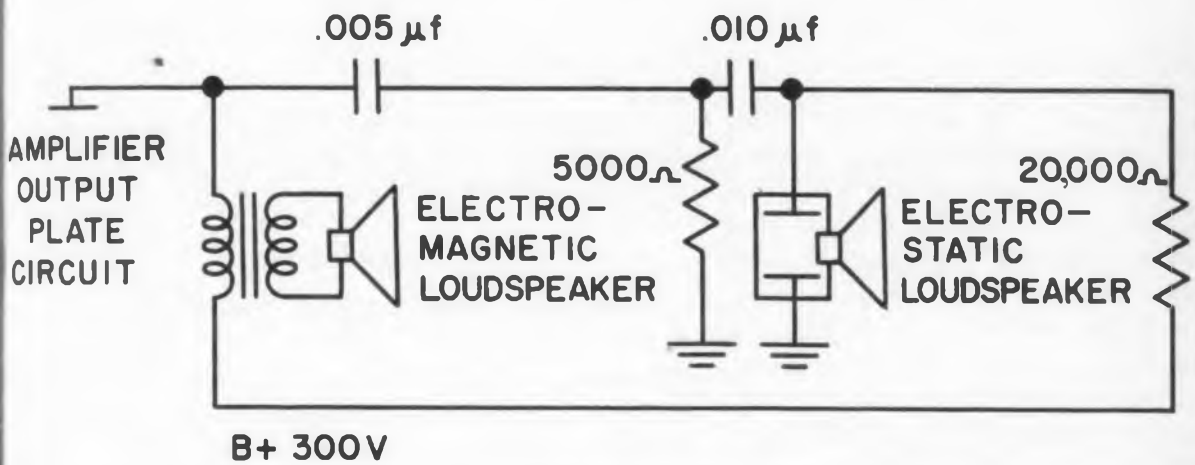
About 2-1/2 times the radiating area of conventional units is provided by this newly-introduced rectangular unit. Vertical mounting of the speaker achieves an unusually wide angle of sound radiation. Horizontal mounting will provide directivity characteristics for special applications.

To achieve an even sound distribution, the tweeter may be used as a tweeter column. Thus, the necessity of combining several small tweeters around a low-frequency speaker is eliminated.

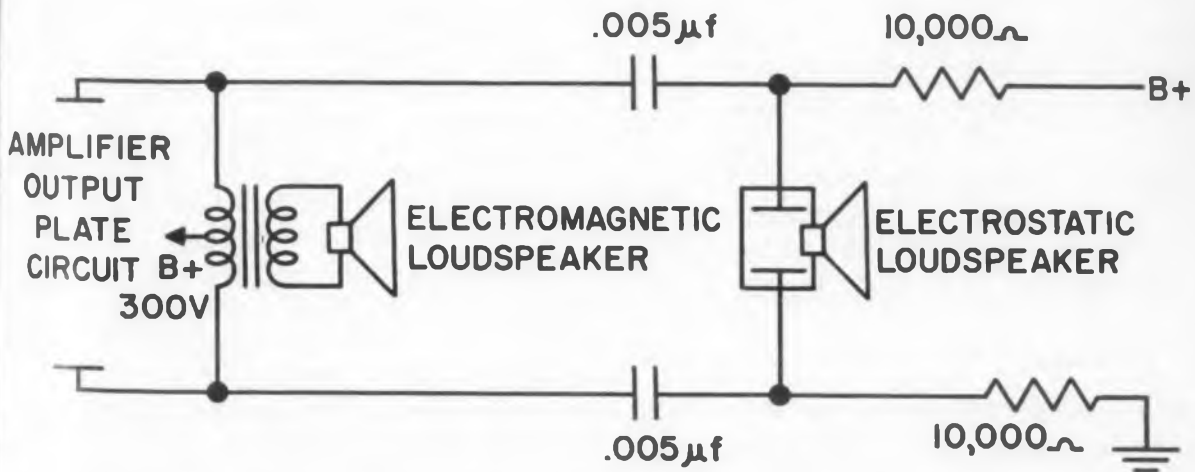
Overall dimensions of the unit are 7 x 2.5 x 0.33 in. Capacity is approximately 1200 μ f. Biasing dc voltage is 300 maximum. Maximum exciting of voltage is 60 with a maximum ambient temperature of 140 F. The membrane is self-healing after a voltage breakdown. For more information on the electrostatic loudspeaker, turn to Readers Service card and circle 22.



Directivity pattern of the Lorenz electrostatic tweeter. Solid line is at 5000 cps; dot-dash line is at 8000 cps; dash line is at 12,000 cps.



Schematic of the connections required to operate the electrostatic speaker from a single-ended output.



Schematic of the circuit for operation of the electrostatic tweeter from an amplifier having push-pull output.

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CIRCLE 23 ON READER-SERVICE CARD FOR MORE INFORMATION

Last issue we called attention to a frequently overlooked method of metal fabrication—cold extrusion. Cost savings are often possible with this process, particularly with high volume production. The metallurgical qualities of the final parts are also generally enhanced by cold working.

A good metallurgical knowledge is necessary to produce parts successfully by this method. Undoubtedly, few electronics engineers will wish to experiment with the process themselves; yet, an understanding as given here and in the earlier article should help the designer understand when cold extrusion should be considered and how much freedom for the fabricator must be allowed in drawings and materials specifications.

Also, in many instances the electronics designer may need to guide the fabricator in proper technique, materials selection, lubricant, etc. Guides are given here that should be helpful when experimenting with cold extrusion for the first time.

Mechanics of Extrusion

The pressures required to make extrusions is an aggregate of forces acting upon the material, dies, and punches. It is important to recognize the necessity for lapping the dies and punches to a high state of finish. Hard chrome over a highly burnished surface provides better punch and die life and better flow characteristics.

The type and kind of material being extruded will have a great deal to do with the amount of reduction that can be made in any single operation. Under normal circumstances, and especially with non-ferrous materials, it is advisable to make the first reduction as great as possible, in most cases at least fifty percent of cross sectional area. The ultimate desired wall thickness can usually be reached in one pass when working out the more plastic metals such as copper, aluminum, lead, etc. With such materials a cross sectional area reduction of ninety percent is possible.

The work hardening of the metal during extrusion requires, under most conditions, the use of soft drawing annealed metal. In some cases the metal should be annealed to what may be called "soft as possible." For copper this would mean a grain size of 60 to 70 mm. If the metal tears apart in the extrusion process or tends to elongate when being removed from the die or stripped from the punch, harder metal at the start will probably be required. Also, additional operations must be provided including perhaps intermediate anneals, in order to produce the finished part. However, to effect economy it is best to plan for a single operation to reach final shape of part.

Pressures Needed

Calculation of pressures required must necessarily be approximate. In no case, however, will it be less than the yield point of the metal being used. Tests

Cold Metal Extrusions—II

Edward S. Cornell, Jr.

Design Engineer
Burndy Engineering Company, Norwalk, Conn.

in a hydraulic press equipped with gage can be used to advantage. It can be assumed that higher speeds will create higher loads under impact, but this does not always follow due to the cushioning effect of the material acted upon and its ability to flow. Higher speeds are a requisite for forcing the metal to flow through restricted contours, while in other instance it will be found that slower speeds which provide a squeeze rather than high impact, will produce good results with less die and punch strain. To obtain sharp clean lines, however, impact is a requisite.

Based on the yield point and the reduction in area of the non-ferrous materials most often used in extrusions, it may be assumed that the pressures required will be the tensile strengths given by mill manufacturers in their handbooks for various anneals. Recommendations can only be approximate, however, since pressures depend on changes in die and punch characteristics and condition of the material as received from the mill (viz grain size, surface condition, etc). The true stress strain may be plotted by dividing each load by the actual area of the specimen billet and by treating strain in a like manner.

Contours

Symmetrical contour design is desirable but by no means necessary. An unbalanced design will have a tendency (as metal flows) to sweep the punch along with it. There are many ways of overcoming this, such as creating the first or other operations to provide a

congregation of metal at desirable points and by subsequent operations extruding this congregated metal into the desired unbalanced contour.

Lubrication

Lubrication is an important consideration. The extensive pressures and heat generated in extrusion have a tendency to break down the lubricating qualities of the oil or lubricant used. Sulphur base oils or other lubricants having a strong resistance to lubricant break down are supplied by oil companies to meet practically any conditions encountered. No one lubricant will prove efficient if used on different metals. Complete information is readily available from any of the well known oil companies.

Die Strength

In die manufacture and design, steels are required that have resiliency and toughness, yet with strength enough not to bend or break under the extreme pressures. Dies must be able to withstand severe shock without shattering, without undue surface wear, and without deformation. The hardness of such dies should generally be from 58 to 62 C Rockwell, depending on the steel and use. The punches likewise will as a rule stand up if hardened to around 59 to 60 C Rockwell. These steels must be carefully ground in order not to decarbonize their surfaces or have excessive grinding marks. They also should be stress relieved after grinding at a temperature below their drawing

point. Carbide dies may be used but are not recommended, as such material does not have unusually good shock resistance.

In order to minimize the cost of die replacement, inserts may be resorted to. When contained in a heavy steel supporting block, inserts will provide good service at minimum cost for replacement. In fact, it is advisable to contain a die in a block of supporting metal wherever possible in order to stop breakage or distortion of the die itself.

Extrusion Principles

For practical purposes it is best to sub-divide the process of cold extrusion and plastic deformation of metals into several categories viz: (1) *Upward extrusion* performed by impact of the punch upon a billet or formed metal piece which is held in a die with a solid bottom; the metal can only flow upward in the direction of the punch. (2) *Downward extrusion* in which the metal in the billet is caused to flow ahead of the nose of the punch into an orifice in the die and even through a hole in the bottom of the die; the punch member forms a close fit with the side walls of the die, thereby preventing upward extrusion. (3) *Downward and upward extrusion* in which the metal flows simultaneously both in the direction of the punch and downward into an orifice in the die. (4) *Horizontal extrusion* in which a billet is acted upon by end actuated punches by means of cams or other mechanical means of exerting horizontal movement to the punches; the billet is contained in a split die and the metal flows into orifices in the die or is extruded along the line of the punch.

Upward Extrusion

Upward extrusion is the most commonly practiced extrusion process in which the slug or billet is placed in a solid die and subjected to impact pressure, the metal taking the shape of the die and the punch. The shapes thus generated may be straight, as in the case of round, square and rectangular shells, or may take an irregular contour in which as the metal flows upward it widens out into enlarged diameters and can be made to generate a flange if required by a shoulder stop on the punch. The punch itself may also be contoured to provide interior configurations to the part and may consist of a series of steps or enlarged diameters. The tool engineer must, however, provide proper radius and flow characteristics at the places where metal lines are to change so that proper metal flow is permitted.

The tendency for a punch to wander or deflect may be overcome by several methods the most common of which is to include a pointed end on the punch. A small boss on the end of the punch or a combination of boss and taper will generally prove successful. Tapering the punch in order to provide draft is of considerable help under some circumstances, and a back taper of about 1 deg will not only help in prevent-

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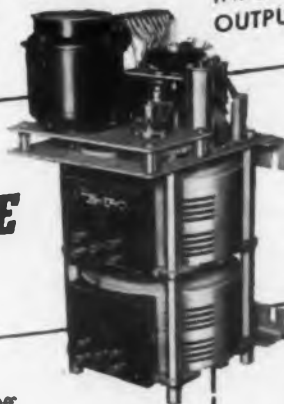
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micro-microammeter**

The 410 measures currents over 10 decades on 20 ranges—from 1×10^{-3} to 3×10^{-13} ampere full scale, accurate within $\pm 3\%$. It drives the inexpensive 1-ma and 5-ma recorders, as well as the 50-mv rebalancing types, and is available in either rack panel or cabinet mounting. Input and output connectors are furnished at both front and back.

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Other features include a very low input voltage drop of 5 mv; a 250-volt tap at the back; for polarizing ion chambers; and input noise below 1% full scale on all ranges. Modifications available include incorporation of a contact meter or sensitive relay for control work.

A new folder on this latest vacuum tube micro-microammeter is now ready with complete descriptive data. A note on your company letterhead will bring a copy by return mail.



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ing deflection but will under some circumstances help in getting metal away from the nose of the punch. This will aid in carrying the piece on the punch when there is a tendency for it to stick in the die. Shoulder elements may be included at stages on the punch to exert greater downward pressures while increased radius will generally increase flow. The billet should fit the die as nearly as possible in order to prevent it from wandering when hit by the punch and which will help to minimize punch bending or breakage.

Downward Extrusion

Downward extrusion is accomplished by enclosing a billet in a die having an orifice large enough to accept the billet and a smaller orifice into which is extruded the metal from the billet by means of the downward thrust of the punch. In this case the punch normally has a close fit with the die in order to prevent upward extrusion, which causes all the force to be exerted in making the metal flow downward into the desired form within the die.

By contouring the die and punch a piece of irregular configuration may be secured. The slug may have a simple preform operation prior to extruding it into its final form, in which case anneals between operations may be necessary to restore plastic characteristics to the metal due to work hardening.

Hollow metal parts can be extruded by the "Hooker Process" of downward extrusion or by use of a double action press or a double action built into the die viz: The punch pierces the billet and protrudes into the mouth of the die opening thereby forming a prescribed orifice between the wall of the die and the punch partially blocking the opening. The metal is then caused to flow by a sleeve member surrounding the punch being forced downward against the slug causing the metal to flow between the wall of the die and the fixed punch. A piercing operation can remove the bottom if a tube rather than a shell is desired. In the Hooker Process somewhat similar action is obtained by preforming or machining the billet.

Upward & Downward Extrusion

Upward and downward extrusion metal from the slug occurs with flowing in both directions by shaping the punch so that an orifice is left between the punch and wall of die and an orifice smaller than the blank diameter is included in the die for downward extrusion of the metal. Shoulder elements on the punch can be made to exert additional downward pressure. When the downward resistance to the punch pressure builds up owing to work hardening of the metal and resists the flow into the desired downward contour, it will overcome the resistance of the shoulder elements and flow upward until the next shoulder contour on the punch is reached when the doubled action of such shoulders will offer greater resistance again forcing the metal to flow downward. While this flow and counter flow occurs almost simultaneously, it is

never the less effective and like the duck board on a dam can cause regulation of pressure and subsequent forming of a part with varied contour.

Horizontal Extrusions

With horizontal extrusion, the billet lies in the die in a horizontal position. The punch or punches are actuated in either a horizontal or vertical plane in respect to the billet. The punch or punches may or may not be contoured in respect to the part made viz:

A flat die with mating punch can be used in which the punch member acts on the die member in a vertical plane. The die may be made by milling, hobbing, etc. and is in general a cavity mold made of impact steel with the exception that the mating punch member is generally contained within the die in order to prevent flash. There are other applications in which flash is not a deterrent or where it is undesirable due to the excessive pressure required to wholly contain the metal. The male die will then only enter the impression in the female die to the extent required to form the part. Excess metal is allowed to flow between the punch and die in the form of flash. In this application, what is accomplished is in reality cold forging in which both extrusion or plastic deformation may play a part, or where little or no extrusion is actually accomplished and cold deformation has accomplished the desired result with a minimum of cold working. The die may contain the entire contour of the piece desired and the punch member may be only a flat surface. Likewise the punch and die may both be contoured in which case the finished piece is contoured in conformity with both die and punch. In reality the last application is a mating die in which one part of the die acts as a punch member. In some sub-press applications, however, both sections of the die act on the billet simultaneously.

Horizontal extrusion will in time become more popular as its application becomes more widely known and its broad scope of application is recognized. This process not only lends itself to extrusion and deformation of a billet, square, round, hexagon, etc by endwise opposed punch pressures, but also permits the use of preformed billets to the design engineers great advantage.

The dies usually used in this process are split dies contained in a die set permitting cam or other endwise mechanical action on the punches. Air cushions can be used and in some cases hydraulic action has also been used. The general procedure is to enclose the billet in the die and exert pressure on the punches simultaneously. The die is contoured to the desired shape of the finished piece, and the punches may take the desired shape of the finished interior, or several subsequent operations may be required to contour the piece using a multiplicity of forming punches and various shaped dies. A hollow body member with desired outer and inner configuration may thus be made. A thin film of metal will have to be machined from the interior bore where the punches come to-

s on a
quent
together, the thin film of metal being permitted to re-
main between the ends of the punches to cushion them
from each other.

Solid members can be made in a similar manner by
plunging nose punches which flow the metal ahead of
them into the desired shape in the die.

It is evident that a series of dies can be made to
make preformed stages leading to the formation of a
final part. This must be resorted to when excessive
pressures or irregular contour makes it impossible to
make the piece in one operation. This procedure is
generally complicated and a thorough understanding
of press working of metal is seemingly a necessity
as such procedure follows to some extent the making
of redrawing tools. Experience with the simpler forms
of extrusion will lead to a better understanding and
later success in the several stage extrusion of parts.
Annealing procedures of various kinds of metals with
their varied metallurgical requirements requires more
than a mechanics knowledge of metal characteristics
required to successfully practice multi-stage extrusion.
The help that can be obtained from metal manufactur-
ers, however, can be of great aid to those plants
who do not have metallurgical advice available.

A Word of Caution

A word of caution must be given in the use of
extrusion processes. One must not be carried away
with enthusiasm when it is discovered that these pro-
cesses will work. There are no doubt many instances
in which stampings, drawn metal parts and screw ma-
chine parts can be converted to the extrusion process
but at little or no gain and perhaps even at a loss.
Products which should have been continued as a
stamping in spite of scrap are sometimes converted
to extrusion when a careful study would have indi-
cated that it was not a proper candidate for conver-
sion. The desire to practice something new sometimes
gives way to better judgment. However, this in no
way minimizes the field of usefulness of the cold plastic
deformation process and with due regard to the con-
ditions required for successful accomplishment in the
field of cold metal working, surprising results can be
achieved.

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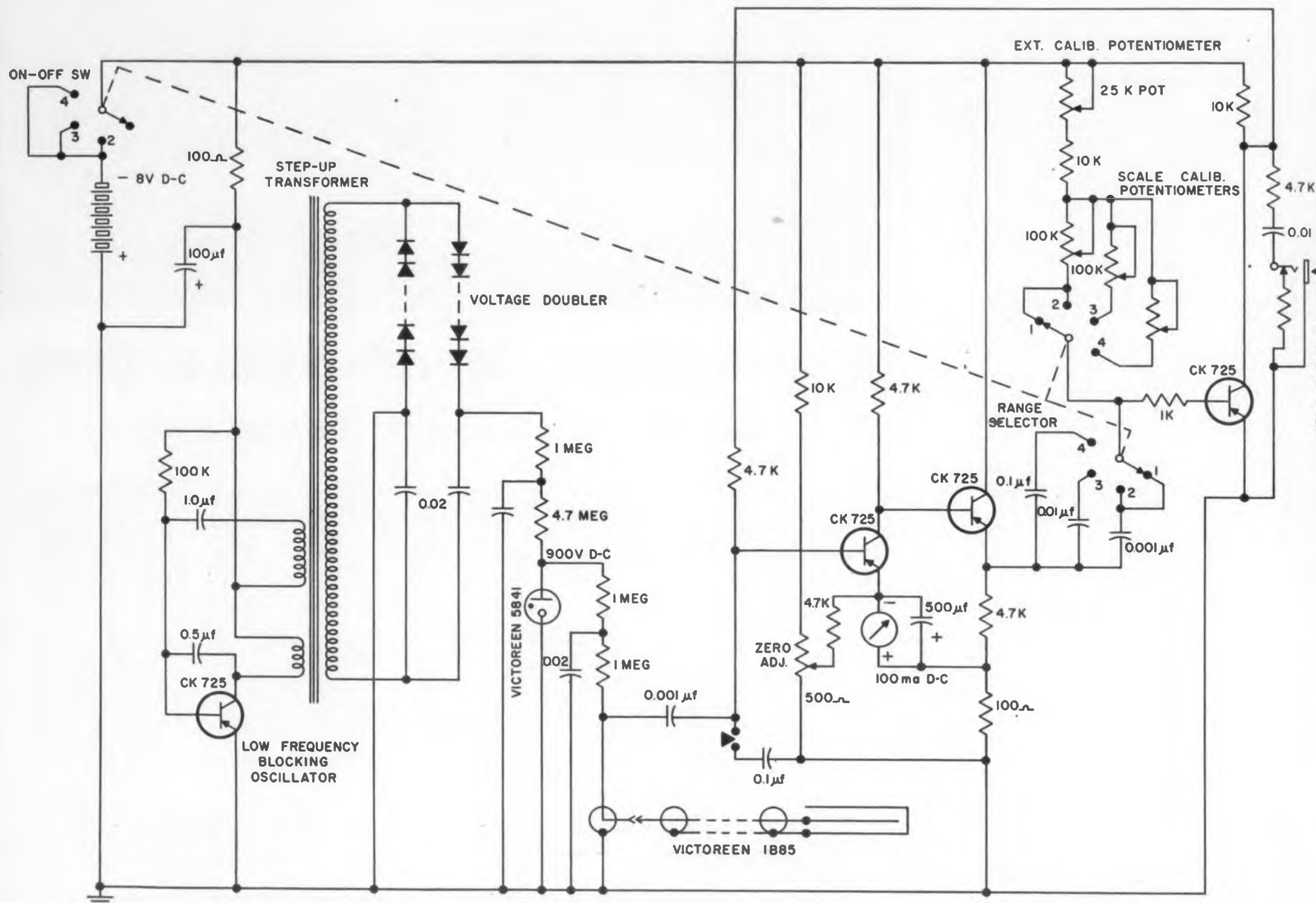
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Transistorized Geiger Counter

Miniaturized Geiger counter is powered by mercury batteries. A "Zero" button in the upper right corner permits checking of the electrical zero setting.



Schematic of the transistorized Geiger counter.

Design
Forum

MINIATURIZING a Geiger counter starts with the power supply. Because about 75 per cent of the bulk of a Geiger counter is the battery supply, reduction of this section first involves some circuit redesign to enable the unit to operate at lower voltages.

As the first step in the design, Seezak, Div. of the U.H. & F. Mfg. Corp., substituted transistors for vacuum tubes. Then, after the final circuit was developed, miniature parts were substituted for standard components.

Geiger-Mueller tubes are operated at about 900 v. A transistor blocking oscillator was developed to produce low-level voltage pulses. These low-level pulses are stepped up in a secondary winding of the oscillator transformer. The resulting high voltage ac is rectified by a full-wave voltage doubler circuit. High voltage is held constant by a Victoreen type 5841 900 v corona regulator tube.

A one-shot transistor multivibrator was designed which could be triggered by the pulses produced by the counter tube. Connecting a dc 100 microammeter, shunted by a 500- μ f capacitor, in series with the normally-off transistor, provides an integration circuit. Meter deflection is proportional to the pulse repetition rate.

Printed circuits and multi-deck construction result in maximum use of space. Mercury batteries supply 8 v to the collectors.

Weighing only 30 oz, the unit measures 4 x 5 x 2-1/2 in. Largest single item is the meter. Protection of the counter against rough handling is provided by a leather case.

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As an engineering company, we have learned to trust engineers with our top positions. Our president, vice-presidents, in fact all our management people, are experienced engineers. The business experience which equips them for management tasks has not obscured the technical considerations which dominate our activities. As in most small companies, the distance from bottom to top is short. There are no rigid echelons, no remote and unapproachable Front Office.

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Originality, imagination, and a basic physical insight into their work are the qualities we value most in our engineers. Continuous stress on these qualities since the company's inception has brought together a group of engineers who are, first of all, individuals, but who have proved, too, to have this in common: the versatility of the non-specialist and, regardless of age, the lively curiosity that led them into scientific careers in the first place. With professional interests often reflected in spare-time activities, they are free to carry on hobby projects in a company-equipped "week-end workshop". The atmosphere of mutual respect in which these men work is of their own making. We have found that, besides understanding their work, they understand one another.

How We Determine Salaries

The individual contribution of each engineer to the company's progress is the major factor that determines his salary. We believe that this is the logical "pay scale". We have no automatic increases or seniority requirements. To insure against stagnation, however, the salaries of all employees are reviewed twice a year. This policy has resulted in exceptional pay and advancement opportunities, particularly for younger men. Two out of five of our top engineers are men who have been out of school less than five years.

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We have located our company in southern Connecticut because we like to live and work in this desirable area. Most of our employees drive to work in 15 minutes on country roads, and many go home for lunch. In this area, we are close to good schools as well as fine recreational, educational and entertainment facilities.

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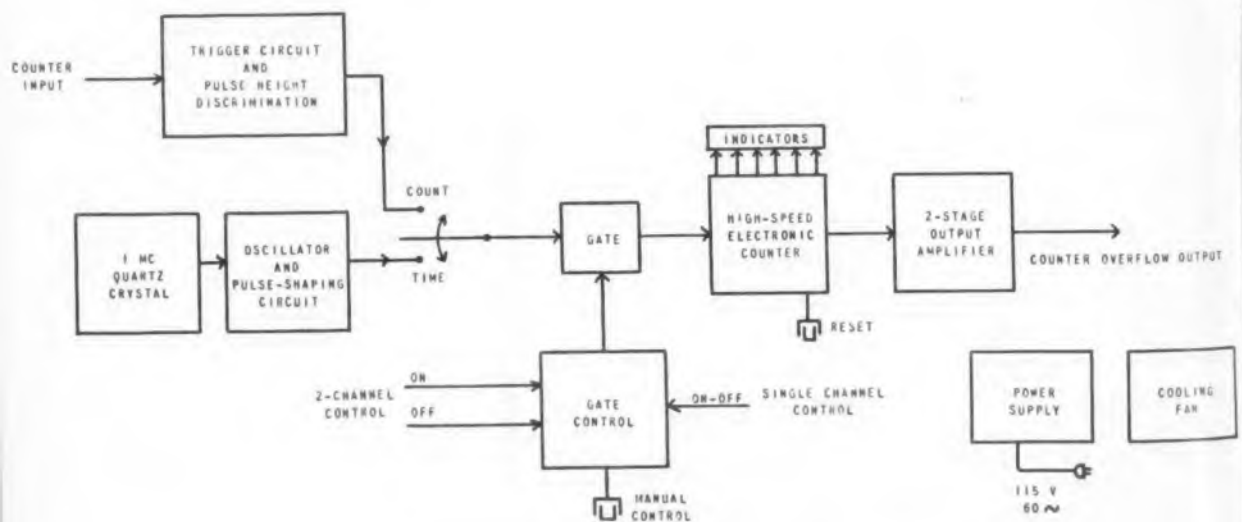


Compact Counter

Jacobs Model 401 Counter-Chronograph. Weighing only 8 lb and measuring 4-1/4 x 6-1/4 x 7 in., signal connections are made to BNC connectors on the panel (below). Presentation of information is supplied by a bank of 20 neon lamps, also on the panel.

JUST announced is an instrument which for the first time combines a high-speed, high-capacity counter with a precision chronograph that measures time intervals up to one second in steps of one microsecond. It should be of special interest for applications where compactness and portability are of prime importance. Presentation is by neon lamps on the instrument panel.

Developed and manufactured by the Jacob Instrument Company of Bethesda 14, Md., the Model 401 Counter-Chronograph is portable, measuring only 4-1/4 x 6-1/4 x 7 in. and weighing only 8-1/2 lb. Unitized construction, with plug-in units, facilitates servicing when necessary. Forced-air cooling is employed, and the unit operates from a self-contained 115 v, 60 cps



Counter-Chronograph block diagram.

Chronograph

power supply. A carrying handle is provided and a reel on which the power cord can be wound.

The chronograph has a 1 Mc quartz crystal oscillator to supply the time base. Pulses from this source pass through a gate circuit to a high speed counter (see block diagram). The chronograph can be started with a signal from one source and stopped by a signal from another. Alternatively, it can be caused to measure the time interval between two signals from a signal source.

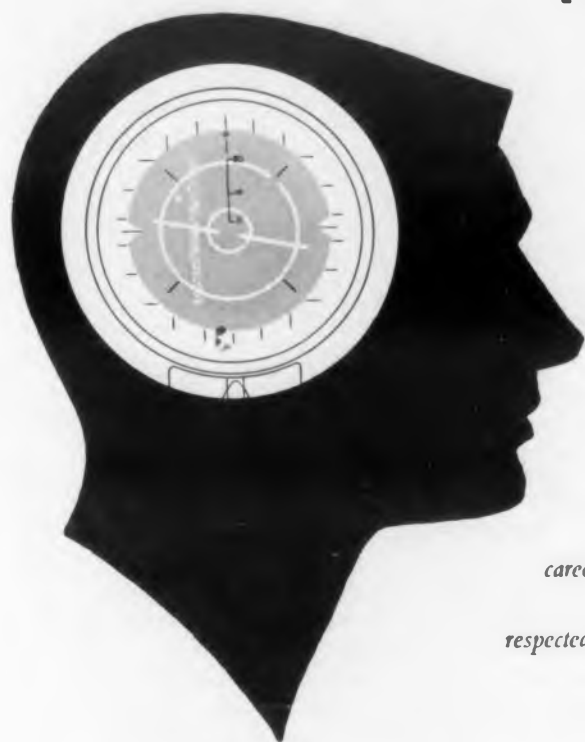
A trigger circuit precedes the counter to assure accurate counting of input signals from dc to 1 Mc, regardless of input pulse shape or rise time. It features pulse height discrimination and can be set to count only pulses whose amplitude exceeds a selected value.

Chronograph input signals required for two-channel use, are 6-v dc or pulse of 1/2 μ sec or greater. For single channel use, the input pulse required is 6-v from 1/2 to 2 μ sec duration. There is no specific rise-time requirement. The input impedance is 700 ohms in either case. Counter input required is 3-v dc or rms to 1 Mc. Sinewave signals or pulses of positive or negative polarity can be counted having amplitudes in the range from -10 to +50 v. Counter input impedance is 1/2 meg.

A representative two-channel application is measurement of bullet velocity. A typical one-channel application is measurement of time interval between two pulses in a computer or radar circuit.

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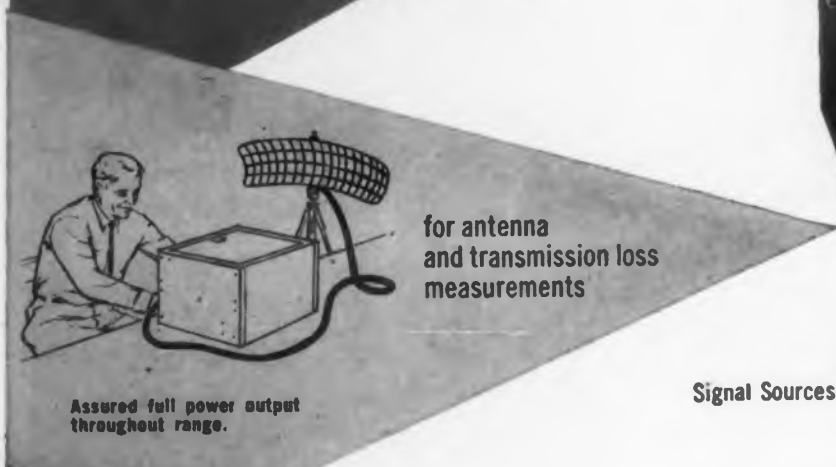
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CIRCLE 31 ON READER-SERVICE CARD FOR MORE INFORMATION

CONVERSION factors describing tube characteristics at other than published or measured values are given in the nomograph. The conversion factor holds if all electrical values are changed in the same proportion. Although these conversion factors have been available in curve form for some time, the nomograph is more convenient to use than the log-log curves.

Lines drawn from the published value, E_{pub} , to the desired plate voltage, E_{des} , establish the value of the remaining conversion factors. Conversion factors for resistance and transconductance (F_r and F_{gm}) are plotted on the scale at the extreme left of the nomograph, and conversion factors for current and power output (F_i and F_p) on the scale at the extreme right. The dashed lines on the nomograph indicate the correct procedure when going.

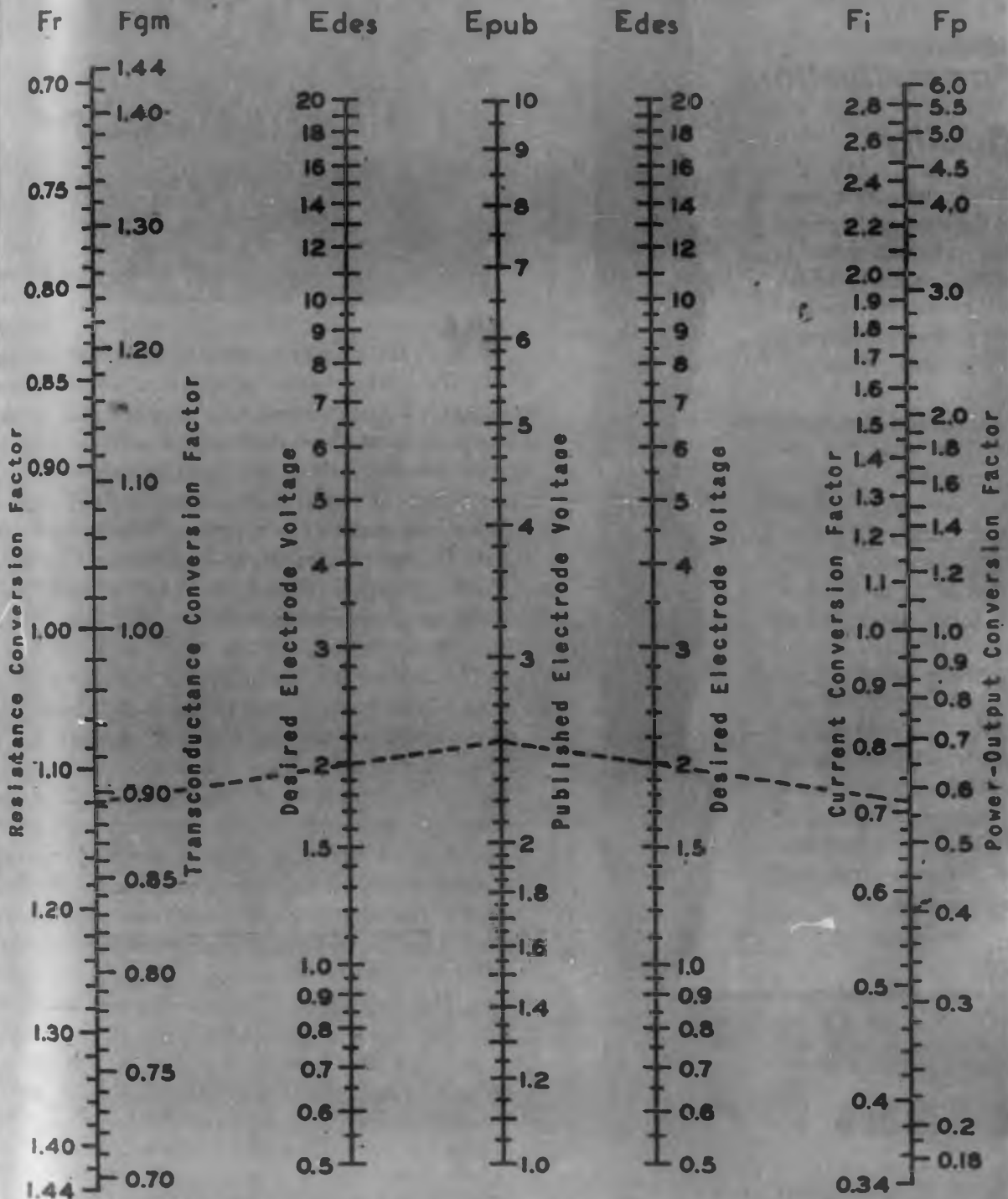
Characteristics	E_{pub}	Factor from Nomograph	E_{des}
Plate Voltage	250v	0.8	200v
Grid-No. 2 Voltage	250v	0.8	200v
Grid-No. 1 Voltage	-12v	0.8	-12v
Plate Current	30ma	$F_i=0.72$	21.6ma
Grid-No. 2 Current	6ma	$=0.72$	4.3ma
Plate Res. (Approx.)	0.13M	$F_r=1.12$	0.15M
Transductance	2000 μ mhos	$F_{gm}=0.89$	1780 μ mhos
Load Resistance	10000ohms	$F_r=1.12$	11200ohms
Harmonic Dist.	10%		no change
Maximum-Signal Power Output	2.5w	$F_p=0.57$	1.42w

Because this method for conversion of characteristics is necessarily an approximation, progressively greater errors will be introduced as the voltage conversion factor (E_{des}/E_{pub}) departs from unity. In general, it may be assumed that results obtained will be approximately correct when the ratio is between 0.7 and 1.5. Beyond these limits (down to 0.5 or up to 2.0), the results obtained can serve only as an approximation.

This method does not take into account the effects of contact potential or secondary emission in electron tubes. Contact potential, however, may safely be neglected for most applications because its effects are noticeable only at very low grid-No. 1 voltages. Secondary emission may occur in conventional tetrodes at low plate voltages. For such tubes, therefore, the use of conversion factors should be limited to regions of the plate characteristic in which the plate voltage is greater than the grid-No. 2 voltage. For beam power tubes, the regions of both low plate currents and voltages should also be avoided.

The conversion factors for tube characteristics are derived from the well-known "three-halves-power" relationship for current and voltage. Data was supplied by RCA, Tube Division, Harrison, N. J. in Application Note, AN-164.

Conversion Factors for Tube Characteristics



Nomograph for determining tube-characteristic conversion factors is applicable to triodes, tetrodes, pentodes, and beam power tubes when the plate voltage, grid-No. 1 voltage, and grid-No. 2 voltage are changed simultaneously by the same factor. They may be used for any class of tube operation (class A, AB₁, AB₂, B, or C).

NORTH AMERICAN AVIATION, INC.

at Downey, California

(North east of Long Beach)

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WRITE:

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Engineering Personnel
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CIRCUIT STANDARDS ENGINEERS—Specialists in Electronic Circuits to coordinate establishment of Standard Circuits as may be used in equipment for Guidance, Weapons Director and Flight Control systems.

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STANDARDS ANALYSTS—Analysts, Junior Designers, or Draftsmen with minimum of 3 or 4 years experience in aircraft or electronic equipment who are interested in Standards work. To assist the Design and Circuit Standards Engineers in the preparation of a design handbook and to layout Autonetics-designed Standard Detail parts drawings.

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A. S. Mittskus
Engineering Personnel
Dept. 91-9 ED
P.O. Box AN
Bellflower, California



The British Electronics Industry is making giant strides with new developments in a variety of fields. Mullard tubes are an important contribution to this progress.

Principal Ratings

Heater	6.3V, 0.2A
Max. plate dissipation	1W
Max. screen dissipation	0.2W
Max. cathode current	6mA

Characteristics

Plate voltage	250V
Screen voltage	140V
Grid voltage	-2V
Plate current	3mA
Screen current	0.6mA
Transconductance	1800 μ mhos



Base

Small button noval 9-pin

Supplies available from:—

In the U.S.A. International Electronics Corporation,
Dept. ED9, 81 Spring Street, N.Y. 12,
New York, U.S.A.

In Canada Rogers Majestic Electronics Limited,
Dept. JL, 11-19 Brentcliffe Road,
Toronto 17, Ontario, Canada.

EF86

Another Mullard contribution to high fidelity

The Mullard EF86 audio frequency pentode is one of the most widely used high fidelity tubes in Britain today. It has been adopted by the leading British manufacturers whose sound reproducing equipment is enjoying increasing popularity in the United States and Canada.

The marked success of this tube stems from its high gain, low noise and low microphony characteristics.

By careful internal screening, and by the use of a bifilar heater, hum level has been reduced to less than 1.5μ V. Over a bandwidth of 25 to 1,000c/s equivalent noise input approximates 2μ V.

When operated below 1,000c/s, internal resonances of the EF86 are virtually eliminated. Even at higher frequencies chassis and tube socket damping are usually sufficient to make vibration effects negligible.

Supplies of the EF86 are now available for replacement purposes from the companies mentioned here.

Proximity Impulse Transducer

WITHOUT any external excitation this midget impulse transducer generates an electrical signal whose frequency is proportional to the movement of ferro-magnetic materials near its sensitive end. Mechanical motion is converted to an electrical signal without mechanical contact. Where space is at a premium this midget unit may be the answer. Units can indicate speed of shafts, vibration of parts, angular or linear positions of pins, wheels, levers, cams, slots, holes, pistons, etc.

The midget $3/8$ in. diam by 1 in. long transducer, built by Minatron Corp., Belle Mead, N.J., is designed around an Alnico-V magnet. For a given distance between the source and sensitive end of the transducer, the output voltage increases over a wide linear range; the frequency increases in direct proportion to the number of times per second that the external magnetic field is cut. The change in the magnetic field can be caused by the passing of a tooth on a gear or any other ferro-magnetic object, such as a rivet or key. The passing of a hole or keyway may also serve the same purpose.

At a constant speed, the output voltage decreases exponentially with the increasing space between the sensitive end and the ferro-magnetic object.

Mullard

ELECTRONIC TUBES

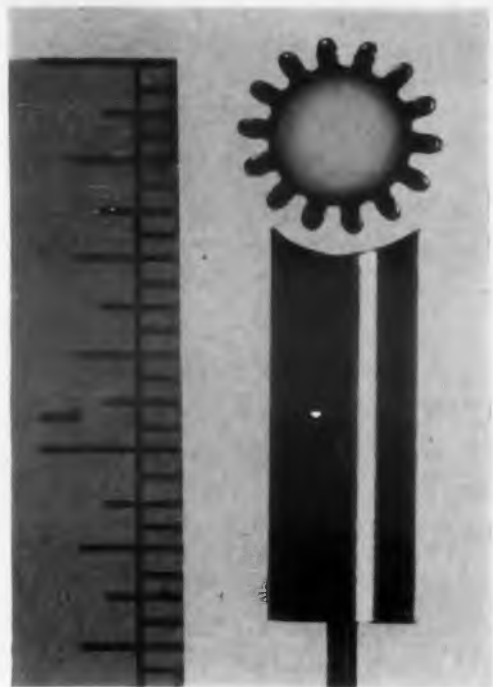
used throughout the world

MULLARD OVERSEAS LTD., CENTURY HOUSE, SHAFTESBURY AVE., LONDON, ENGLAND

Mullard is the Trade Mark of Mullard Ltd. and is registered in most of the principal countries of the world.

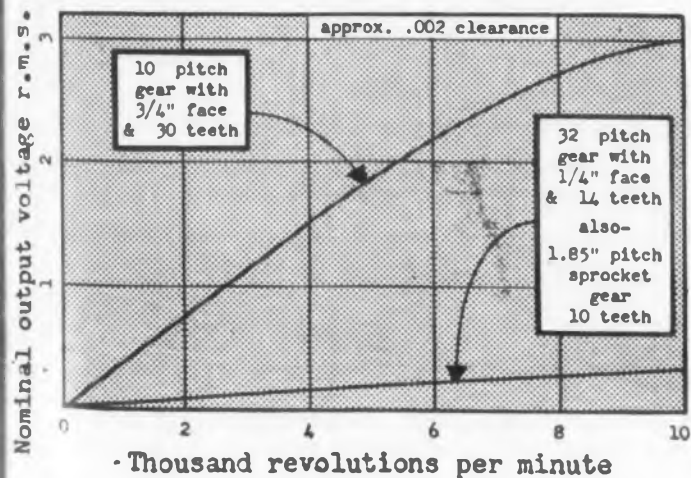


CIRCLE 33 ON READER-SERVICE CARD FOR MORE INFORMATION



Because of its very small size, the output voltage of the midget unit is necessarily much lower than standard generators. At all speeds, it is recommended that its frequency output be utilized. If the voltage output is utilized, it may be necessary to supply voltage amplification.

The device will operate at temperatures of 200 F (500 F models are available); weight is 12 grams. Impedance at 10 kc is 5500 ohms nominal; dc resistance is 1200 ohms. For more information, turn to the Readers' Service Card and circle 34.



New Grant 3400

thinslide

mounts standard 17" chassis
in standard 18" rack or cabinets

REQUIRES ONLY 19/64" SPACE PER SIDE-

YET HAS

FULL ROLLER ACTION

(fits RETMA rack hole spacing)



The Grant 3400 Thinslide requires only 19/64" space per side—installs readily in standard racks and cabinets. Allows instant access to chassis measuring from 10" to 16" deep. Tilts through 100° for under-chassis servicing. Positive lock in "out" position. Lock has finger-tip release for instant return or removal of chassis. Eight hardened steel rollers carry the rated load of 100 lbs. smoothly and easily—durability insures frictionless rolling for thousands of cycles of use.

Slide mounting not only provides for quick access—it usually eliminates need for rear access doors and rear aisles—a very important saving of space.

The Grant 3400 is a versatile slide, suited for use in your product, in plant equipment, prototype and breadboard work, and in production line or field test equipment. Very moderate cost allows a wide range of applications in original equipment.

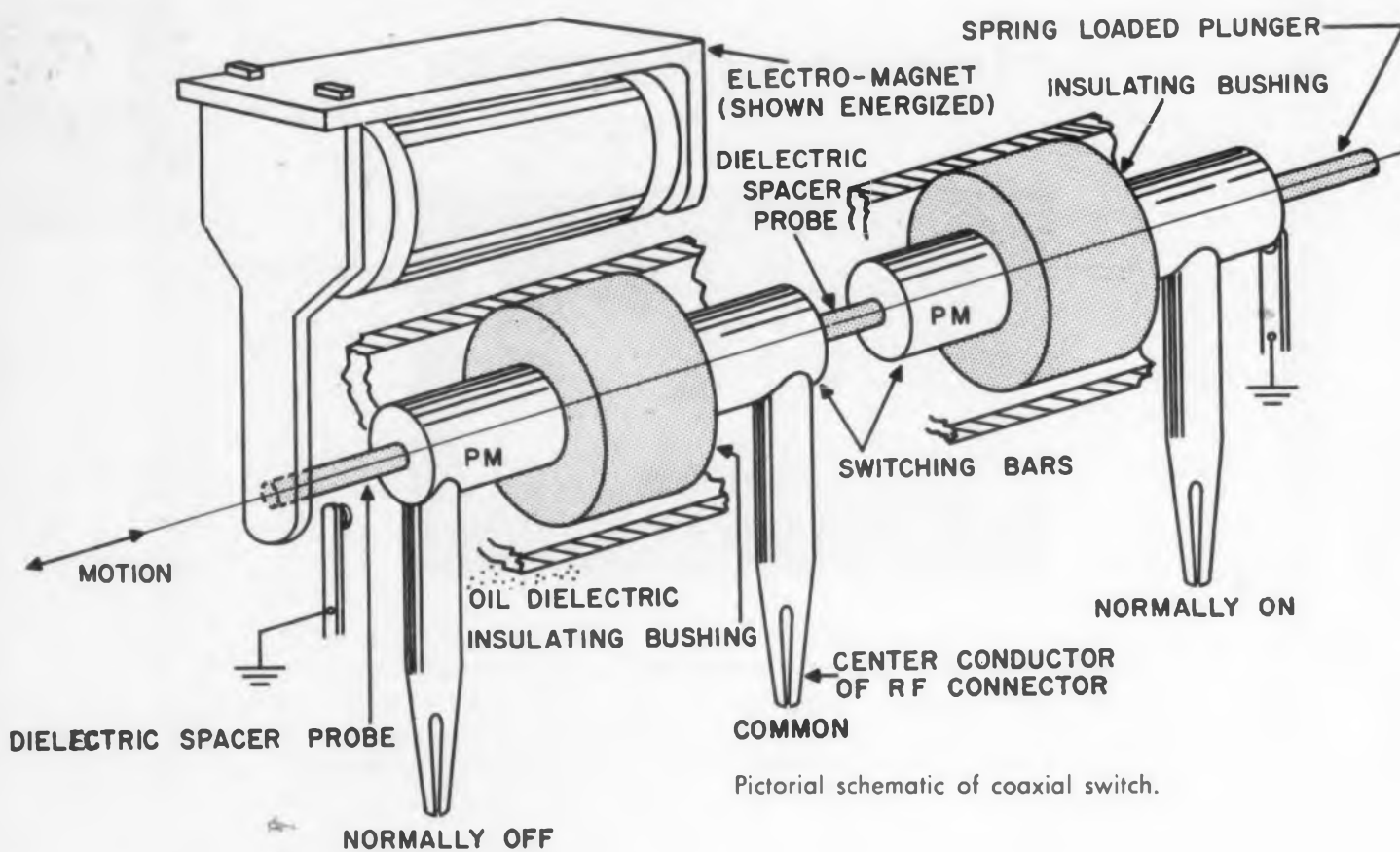
Write today for Grant 3400
Thinslide Technical Bulletin—contains
full data and specifications.

Grant INDUSTRIAL SLIDES

Grant Pulley and Hardware Corporation
factories: 31-49 Whitestone Parkway, Flushing 54, N. Y.
944 Long Beach Avenue, Los Angeles 21, Calif.

CIRCLE 35 ON READER-SERVICE CARD FOR MORE INFORMATION

Tiny Coaxial Switches



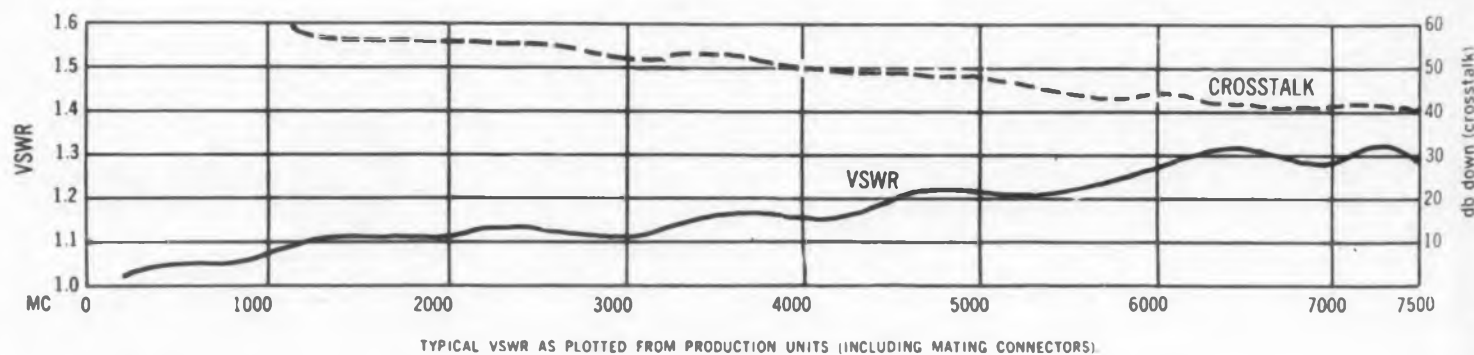
DESIGN problems associated with broadband rf coaxial switches are basically mechanical rather than electrical. The design of the switches illustrated here attempt to embody, in the simplest possible form, the obvious requisites such as reliability, high speed, mechanical simplicity, lightness, low power consumption, and repeatability in a compact sealed unit capable of performing over a wide rf frequency the power range. A series of miniature and subminiature types for all types of rf installations up to the X band frequencies are available. The new devices also feature low operating power consumption—an 0.1 amp max at 26-v dc.

The pictorial diagram reveals their simplicity. The direct approach in solving the rf transposition problem keeps the electrical length and discontinuities to a minimum. This is accomplished by using a truly concentric system where all center conductors are of the same diameter and held concentrically by a solid-dielectric material. All remaining voids which play a mechanical function are oil-dielectric filled. Both solids and liquids ("KEL-F" oil) have the same dielectric constant. The oil dielectric provides further advantages such as a heat transfer medium for cen-



Switches may be stacked for minimum space utilization.

RF DATA



CHARACTERISTIC IMPEDANCE 50-Ω OHMS.
MAX. INSERTION LOSS 0.3 DB.
OUTPUTS OPEN (NOT GROUNDED)
WHEN CONNECTED TO COMMON OUTPUT.

Graph of rf data on type "N" switch. Other type "N" units extend to 10,800 mc.



we're in Milwaukee so we ought to know!



An AC* ENGINEER TELLS HIS STORY



Working at AC, THE ELECTRONICS DIVISION OF GENERAL MOTORS is exciting . . . challenges every inch of my engineering ingenuity, currently I am working on a phase of the Inertial Guidance System Program. A month or two ago I was equally absorbed in our Jet Engine Fuel Control Program. I am certainly growing ENGINEERING "KNOW-HOW-WISE" and my salary checks reflect it. I started at a good salary . . . have had regular increases in salary and position . . . gosh, I like it here.

AND, I enjoy AC's MASTER'S DEGREE PROGRAM, University of Wisconsin—Milwaukee. I attend evening classes and AC is paying my tuition and with no strings attached.

My family enjoys Milwaukee too. Here in cool, southern Wisconsin we have endless miles of swimming beaches, parks, playgrounds that are ours for the asking. We have the cultural and shopping advantages of the big city in a community long known for its small town hospitality.

P.S. AC's Permanent Expanding Electronic Program provides openings for more Mechanical, Electrical Engineers and Engineering Technicians. Even "square pegs" are provided "square holes" at AC.

Write today in strictest confidence to my friend, Mr. J. F. Heffinger, Supervisor of Salaried Personnel.



*AC THE ELECTRONICS DIVISION
GENERAL MOTORS CORPORATION

Milwaukee 2, Wisconsin

Flint 2, Michigan

ter conductor cooling, mechanical lubrication, are quenching, and mechanical damping.

Grouping of several switches into space-conserving stacks for network use in aircraft for general rf switching is facilitated by the housing design and the placement of cable connectors.

Since the discontinuities are few and of low magnitude, reflections are minor and cancellation effect is virtually non-existent. Thus broadband rf applications are possible. (See graph).

The switching bars are displaced longitudinally (by an electromagnet) sliding on the rf output center conductors. The conductors provide wiping action as well as a large area of contact. Further, because the conductors are free to rotate at random, the periphery of the switching bars serves as a potential contact area.

Positive contact pressure is provided in a number of ways depending on the switch model and type of rf connector used. The version illustrated employs permanent magnetism in the switching bars. Magnetic attraction to the probe of the rf connectors, results in relatively high contact pressure and reliability. The ideas incorporated in the switch are credited mostly to Donald H. Lanctot, Chief Engineer of the Cado Div. of Electromation Co., 116 S. Hollywood Way, Burbank, Calif.

Maximum isolation is achieved by precise displacement and grounding of the unused switching bar. This results in a blockage of the unused cavity and serves as a matched continuation of the outer rf connector shell.

Several variations of this basic design are available such as models using two electromagnets allowing versatility in selection of rf switching arrangements such as "make" before "break" in high power applications. The switches are available in SP4T, SP3T, SP2T, DP2T, DP3T (fail safe or selective), in various types of connectors. Units are designed to meet the environmental requirements of MIL-E-5272a specification. Typical weights for the units are 1.8 oz. for SP2T type 27 and 3.8 oz for SP27 type N switches.

NEW Power Transistor



—key COMPONENT in SYLVANIA'S "power-pack"
for hybrid auto radio offers new features
for general power applications

Sylvania's new Power Transistor Type 2N242 was developed as part of the hybrid auto "power-pack" which includes the Sylvania type 12J8 driver tube. The 2N242 provides 2½ watts class A output with 5% total harmonic distortion.

For general power applications, ten watts collector dissipation is provided. Other general-purpose features of this new power transistor include a welded hermetic seal for ruggedness and a storage temperature of 85° C to eliminate heat problems under idle conditions. Thermal drop characteristic of the 2N242 is 2° C per watt.

GENERAL FEATURES OF THE 2N242 POWER TRANSISTOR—

- 10 watts max. collector dissipation
- 2 amps max. collector current
- 40 volts max. collector voltage
- New welded hermetic seal
- 30 db minimum power gain (typically 35 db)
- 85° C storage temperature
- 100° C junction temperature
- Thermal drop—3° C per watt (typically 2° per watt)

Engineering Sample Offer

Sylvania will honor all bona fide requests for engineering samples of this new power transistor. Write on your company letterhead indicating application, or call your Sylvania representative.



 **SYLVANIA**

SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway, New York 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd.
Shell Tower Bldg., Montreal

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CIRCLE 37 ON READER-SERVICE CARD FOR MORE INFORMATION

Automatic Impedance Plotter



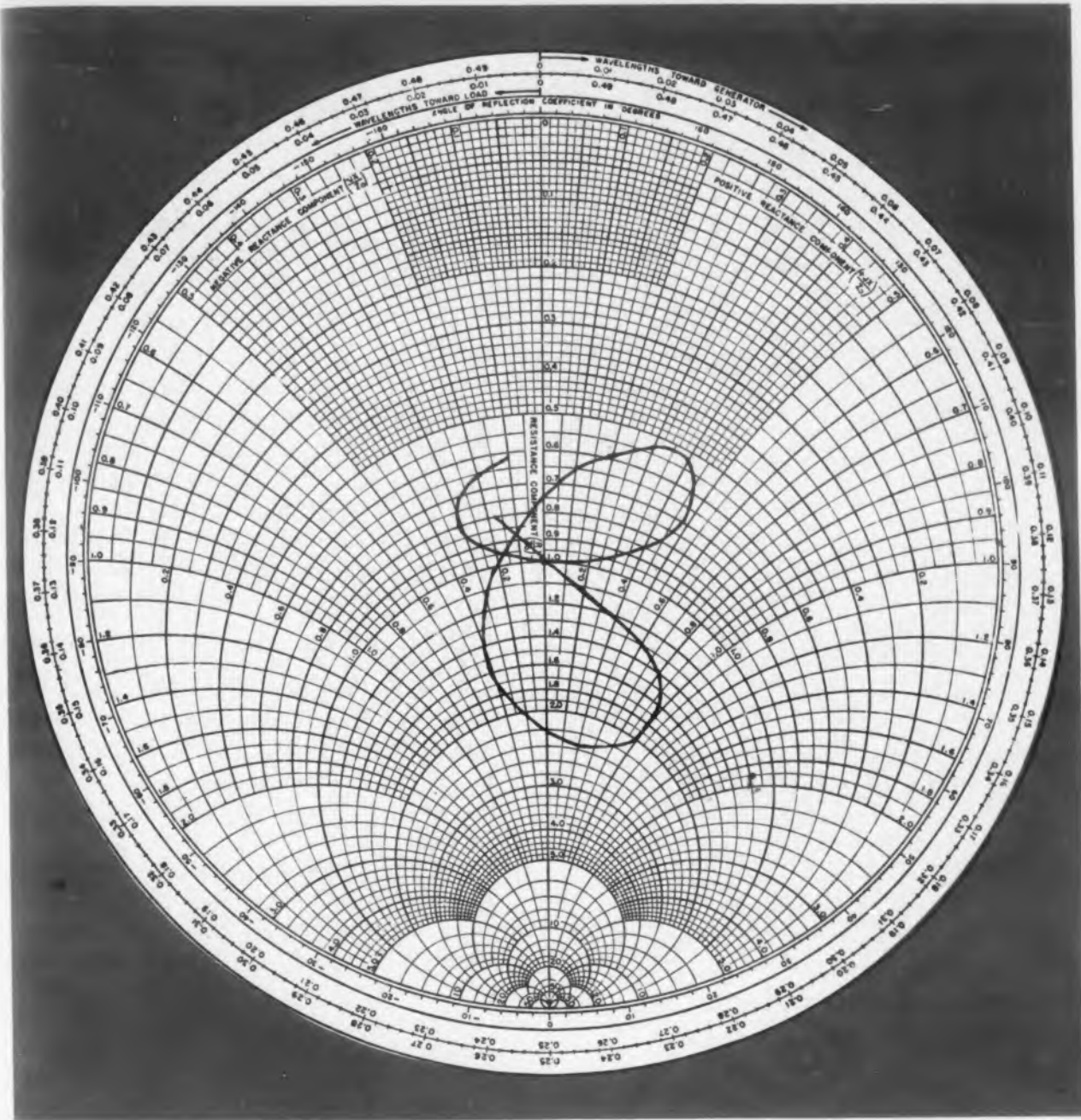
MICROWAVE impedance measurement is basically a measurement of the reflection coefficient which can be expressed in terms of resistance and reactance components of a complex impedance. This instrument, called a Z-Scope, takes samples of incoming and reflected waves and converts the resulting signal into a spot on an oscilloscope screen. The position of the spot is determined by the resistive and reactive components of the unknown impedance.

A convenient method of presentation is the Smith chart where numerical value and angle of the reflection coefficient are shown in a polar system. Impedance is read on a transparent chart placed over the face of the cathode-ray tube.

An age system built into the instrument insures that the sample of the incoming wave will have a constant level. Samples of direct and reflected waves are both taken by couplers of the multihole type in order to have good and constant sensitivity over a wide frequency range. After delay and modulation, each of the two sample signals is split in two equal parts. One part of one of the signals is given a phase change of 90 deg.

Output from the detector crystals is amplified and applied to the deflection plates of a 7 in. cathode-ray tube. Impedance is read directly in terms of resistance and reactance components from the transparent Smith chart.

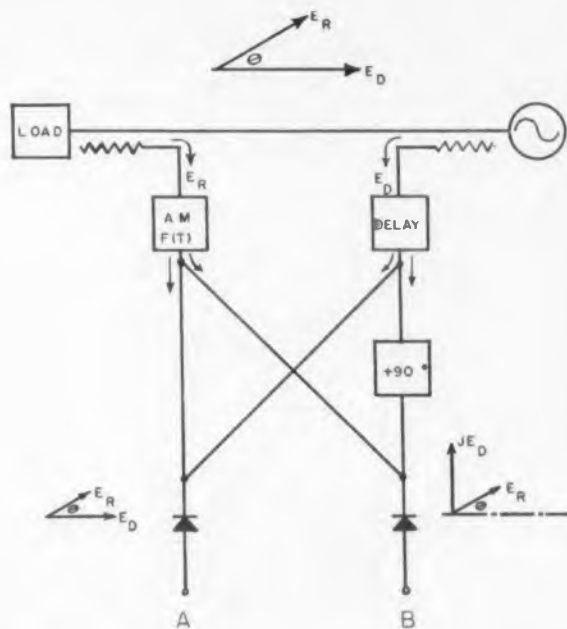
If the impedance varies or the frequency is swept, the impedance variation will be shown as a curve. To facilitate the interpretation of impedance vs frequency curves, the Z-Scope has an input for frequency marker



An example of an impedance vs frequency curve measured by the Z-Scope.

pulses which will blank out the light spot and create a break in the curves. Such marker pulses could be supplied from a tunable reference cavity with a detector or from a multiresonant cavity which would give a pulse whenever the frequency passes through one of its resonances. The normal Smith chart can be replaced by an expanded Smith chart and the amplifier gain increased correspondingly so that the 7 in. diameter tube will give a more detailed presentation.

Made by Cascade Research Corp., 53 Victory Lane, Los Gatos, Calif., the present model is designed for the X-band which is covered from 8200-12,400 mc. To make the instrument available at other bands from about 6000 mc to about 35,000 mc, it is only necessary to replace the waveguide system. Electronic circuitry would be the same. The waveguide system can be made at all frequencies where suitable directional couplers and Gyrals are available, but the bandwidth covered would probably be smaller at the higher frequencies. For more information on this automatic plotter, turn to Reader's Service Card and circle 38.



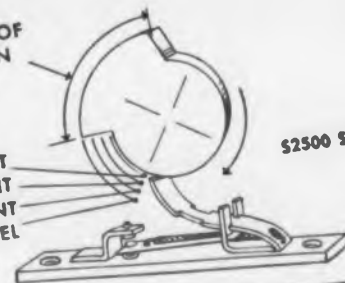
Block diagram of the operation of the Z-Scope. Signals from the detector crystals A and B may also be fed to an x-y recorder.

SNAP-ACTION SWITCHES

CHERRY offers methods for...

ANGULAR DISTANCE OF SWITCH ACTUATION

REST HEIGHT
RELEASE POINT
OPERATING POINT
OVER TRAVEL

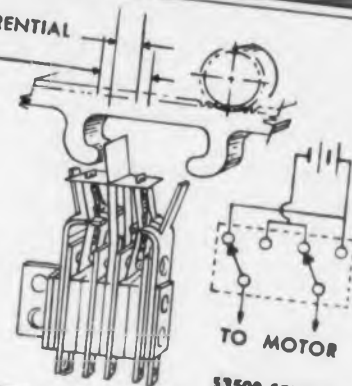


S2500 SERIES

DESIGNING A SNAP-ACTION SWITCH INTO A CAM OPERATED SWITCH SYSTEM BULLETIN C-200

MOVEMENT DIFFERENTIAL
LIMITS OF ACTUATOR TRAVEL

SLIDE EXCURSION
EQUALS SWITCH
DIFFERENTIAL PLUS
YOKE GAP



TO MOTOR

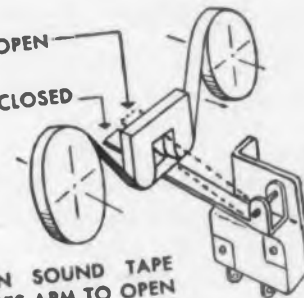
S3500 SERIES

APPLICATION OF LIMIT OR REVERSE SNAP SWITCHES INTO AUTOMATIC EQUIPMENT BULLETIN L-100

CIRCUIT OPEN

CIRCUIT CLOSED

BROKEN SOUND TAPE
RELEASES ARM TO OPEN
CIRCUIT



E1600 SERIES

SPECIFYING A SNAP SWITCH FOR INTERLOCK FUNCTION BULLETIN I-300

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C-200 L-100 I-300 On complete CHERRY line

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WE NEED YOU --

We are expanding so rapidly that we urgently need young men to join our editorial staffs of **ELECTRONIC DESIGN** and **ELECTRONIC WEEK**—our new weekly news magazine to be directed exclusively to management in the electronics field.

If you have an electrical engineering degree, some industrial experience, and an ability to write, **YOU** would have a fine opportunity to work on the closely knit staff of **ELECTRONIC DESIGN** and to meet and talk with top-flight engineers in the electronics field. Editors are needed for New York City as well as the Chicago and Los Angeles areas.

If you have a journalism education and training, experience in reporting and editing for some business magazine, and a working acquaintance with the electronic industries, **YOU** would find an excellent opportunity to grow with **ELECTRONIC WEEK**, the first management publication to the electronic industries.

If interested, please send us resume with salary requirements. Information will be treated as confidential.

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New York 21, New York

Portable

VHF Field

LIGHT-WEIGHT, dry battery-operated v-h-f field strength indicator meter covers the frequency range 47 to 225 mc. Useful for obtaining data on field strength of vhf transmitters, the device also has many other applications. Some of these include transmitter site determination, antenna adjustment, monitoring and direction finding.

Designated FT-HUZ, the instrument is available from Federal Telephone & Radio Co., 100 Kingsland Rd., Clifton, N.J. Its 9 lb weight and self-contained power supply make it especially adaptable to portable use. A telescoping dipole antenna fits into the 9-7/8" x 8-1/8" x 4-3/4" cabinet.

Interference studies can be made using a search coil. Various components of complex antenna systems may be tested by disconnecting the antenna and using the set for voltage indication. Input voltage range is 1 μ f to 100 mv. An unbalanced 70 ohm input and a balanced 300 ohm input are provided.



Vhf field strength meter consists of a superheterodyne am-fm receiver, a dial calibrating oscillator and dry battery power supply.

Strength Meter

Accuracy of the instrument is ± 6 db. Calibration of the dial is provided by a built-in 100 mc oscillator. A built-in piezoelectric loudspeaker permits aural identification of signals. Provision is also made for headphones.

For laboratory use, the batteries may be removed and an ac power supply inserted into the battery compartment. For further information turn to Reader's Service Card and circle 41.



Portable vhf field strength meter covers vhf broadcasting, TV, aircraft and police radio frequencies.

NEW 10 STAGE $\frac{3}{4}$ " multiplier phototube

Actual Size



DU MONT Type K1382

In the new Type K1382, Du Mont offers the first $\frac{3}{4}$ " multiplier phototube with the ruggedness of field equipment combined with the performance of a laboratory tube.

The average gain of the Type K1382 of 300,000 at 105 volts/stage exceeds that of many laboratory tubes, with no sacrifice in long-term stability for which Du Mont multiplier phototubes are noted.

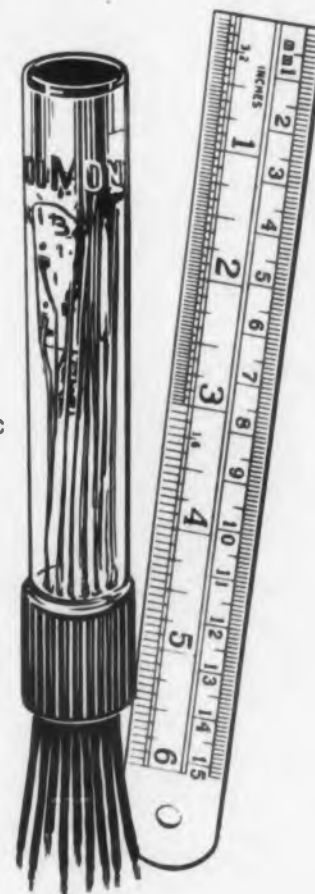
In addition to its small size and superb operating characteristics, the Type K1382 is unusually rugged. This tube has been designed for the roughest service under the worst climatic conditions. The tube base is potted and all leads jacketed to permit operation under severest humidity without leakage between leads. Laboratory performance can be obtained from this tube even when it is being dropped as a probe into a drill hole far underground.

As in other Du Mont multiplier phototubes, the linear box-type dynode structure is used. This means optimum electron collection greatly improving signal-to-noise ratio. Also, long leakage paths minimize noise and dark current. Dark current is only 0.1 ua at 105 v/stage and 25°C.

The small size and excellent performance of the new Type 1382 mean an extra bonus to users in the geological surveying field where, for example, its extra gain permits much longer signal transmission from underground locations before signal level becomes too low to be useful. It should be exceptionally useful in medical physiological probing. Batteries of these tubes may be used for speedier diagnostic procedure. In addition, the small size will help greatly in the miniature and portable designs that can function at least as well as laboratory equipment.

CONDENSED SPECIFICATIONS

Average gain:	300,000 at 105 v/stage
Maximum dark current:	0.1 ua max. at 105 v/stage and 25°C
Photocathode sensitivity:	40 ua/lumen
Average anode sensitivity:	12 a/lumen
Maximum outside diameter:	no greater than $\frac{3}{4}$ "
Physical Characteristics:	potted base, jacketed leads



DU MONT®

For complete information write to:
Industrial Tube Sales Dept.
ALLEN B. DU MONT LABORATORIES, INC.
2 Main Ave., Clifton, New Jersey

CIRCLE 42 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products

New Diode Tester

Germanium or Silicone Diodes



Battery operated, static tester, Model DT-1, is intended for rapidly determining the forward and reverse characteristics of germanium or silicone

diodes. The switch has three positions: forward, reverse, and spring return to off. The meter indicates the current flow through the diode in the desired direction. The forward scale indicates 0-2 v drop and the reverse scale indicates 0-1 ma flow. A battery test button determines the battery condition on the basis of 50 v full scale. The set is also equipped with jacks for test probes.

Pacific Industrial Electronics, Dept. ED, 252-5th St., San Francisco 3, Calif.

CIRCLE 43 ON READER-SERVICE CARD FOR MORE INFORMATION

Relay Kits

For Prototype Work



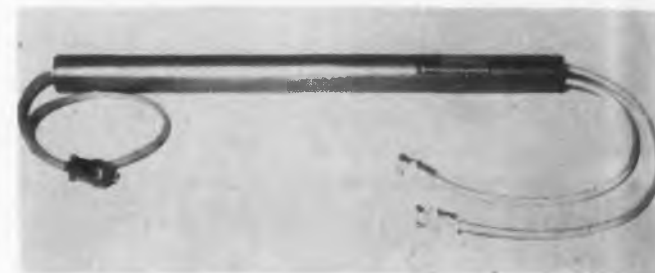
Easily assembled and with a wide range of applications, the "X" Series Relay Kits are for engineering prototype, experimental, and industrial use. They consist of standard contact assemblies and standard coils which are quickly and simply joined by a single screw at the base of the coil to form relays. The kits provide coil voltages ranging from 6 v to 115 v in both ac and dc. One coil permits the relay to be operated by vacuum tube. Kit components meet all UL requirements. All contacts are the gold-plated "fine" silver type.

Globe Electrical Mfg. Co., Dept. ED, 1729 W. 134th St., Gardena, Calif.

CIRCLE 45 ON READER-SERVICE CARD FOR MORE INFORMATION

Traveling Wave Tube Amplifiers

Medium Noise Figure



These traveling wave tubes in the X and L Band range, feature broadband medium noise figure (10-20 db) operation across their bands. Normally, these noise figures fall between the 10 and 15 db limits.

The greatest applications will be in fields where this improved noise figure is required in addition to their broadband and other typical traveling wave tube characteristics.

Other important operating characteristics include at least 25-30 db gain and 5-10 mw output. The L-Band unit is designated the HA-17 and the X-Band unit is designated the HA-15.

Huggins Laboratories, Inc., Dept. ED, 711 Hamilton Ave., Menlo Park, Calif.

CIRCLE 47 ON READER-SERVICE CARD FOR MORE INFORMATION

Rotary Actuated Switch

Hermetically Sealed



Utilizing a silastic compound sealer and offering flexibility without sacrificing the mechanical life requirements, the Model H10-7 switch offers a leak rate of less than one micron per cubic foot per hour; a temperature range from -100 F to 250 F; full water-ice-vapor-dust-and-temper proof-

ing; rotary actuation; up to 4 isolated switching actuations.

Electro Snap Switch & Mfg. Co., Dept. ED, 4218 West Lake St., Chicago 24, Ill.

CIRCLE 44 ON READER-SERVICE CARD FOR MORE INFORMATION

Potting Compound

Non-Toxic Foam-In-Place



densities from 3 to 30 lb/cu ft.

Suitable for thermal insulation, E-P-FOME requires no wasteful and tedious cutting and fitting of preformed insulation. Molds can be removed and reused after 30 minutes.

Electronic Plastics Corp., Dept. ED, 675 Barbey St., Brooklyn, N.Y.

CIRCLE 46 ON READER-SERVICE CARD FOR MORE INFORMATION

Designed to solve shock problems, E-P-FOME is light in weight, non-toxic, easy to use and safe to handle. The foaming reaction takes place at room temperature without pressure, to produce semi-rigid or rigid foams rapidly with controlled

Power Resistors

Designed for Printed Circuits



The Series KS "Standee" above-chassis-mounted power resistors are now offered with terminals featuring plug-in type installation. They are available in five sizes from 1-11/16 to

4-3/16 in. high and in 10-30 w power ratings. Values of resistance up to 21,000 ohms are available.

Clarostat Mfg. Co., Inc., Dept. ED, Dover, N.H.

CIRCLE 48 ON READER-SERVICE CARD FOR MORE INFORMATION

**Ceramic Capacitors
For Printed Circuits**



Designed especially for leadless insertion in printed board circuits, these new "Wejcap" capacitors are inserted manually or by placement machines in board slots. Dip soldering then makes permanent bond to the connection point.

"Wejcap" capacitors have several TV receiver applications in antenna coupling networks, AVC and AGC networks, screen bypass and other medium-tolerance circuits, and are already in production.

These capacitors, presently available in 150, 270, 420, 820, 1200 and 1400 μf , are 3/8 in. high, 3/8 in. across at the widest point, and 35 mils thick. They have a dense non-porous ceramic dielectric base with the silver electrode surface bonded to both sides.

Their slot-mounting in the printed wiring board does away with problems of lead placement and breakage, and minimizes problems of lead inductance. The slots to receive them can easily be punched out with the other holes in the board.

GE Specialty Electronic Components Dept., Dept. ED, West Genessee Street, Auburn, N. Y.

CIRCLE 49 ON READER-SERVICE CARD FOR MORE INFORMATION

Preset Controller Series

Counts to 1,000,000 Events



Model 310 Series Preset Controllers, to count and control to 1,000,000 events automatically, have been designed as high speed, direct reading electronic

counters of the coincident type. The new series (five models, ranging from 2 to 6 decades) will control any operation or activate an alarm after a preselected total count has been reached. Any electrical, mechanical or optical event which can be converted into electrical impulses can be counted and controlled.

Computer-Measurements Corp., Dept. ED, 5528 Vineland Ave., North Hollywood, Calif.

CIRCLE 50 ON READER-SERVICE CARD FOR MORE INFORMATION

KEPCO

with **NEW-IMPROVED FEATURES**

★ **FAST RECOVERY TIME**

★ **GOOD STABILITY**

★ **LOW OUTPUT IMPEDANCE**

KR Voltage Regulated Power Supplies are conservatively rated and are designed for continuous duty at 50°C ambient.

REGULATION: Less than 0.2 volts for line fluctuation from 105-125 volts and less than 0.2 volts for load variation from 0 to maximum current.

RIPPLE: Less than 3 mv. rms.

STABILITY: The output voltage variation is less than the regulation specification for a period of 8 hours.

RECOVERY TIME: Less than 50 microseconds. The excursion in the output voltage during the recovery period is less than the regulation specification.

OUTPUT IMPEDANCE: Less than 0.1 ohms from 20 cycles to 100KC. Less than 0.5 ohms from DC to 20 cycles. Many units have very much lower output impedance.



KR-3M

FEATURES:

- Fast Recovery Time, Suitable for Square Wave Pulsed Loading.
- Voltage Range continuously variable without Switching.
- Either Positive or Negative may be Grounded.
- Oil Filled Condensers.
- Wire Harness and Resistor Board Construction.
- Power Requirements 105-125 volts, 50-60 cycles.
- Terminations on rear of unit.
- Locking type voltage control AC, DC Switches, Fuses, and Pilot Lights.
- Color Grey Hammertone.
- Guarantee One Year.

All models available for 400 cycle operation on special order.



KEPCO LABORATORIES

131-38 SANFORD AVENUE • FLUSHING 55, N.Y. • INDEPENDENCE 1-7000

VISIT BOOTH #1516 — ISA SHOW — NEW YORK — SEPT. 17-21 • VISIT BOOTH #126-7 — NEC SHOW — CHICAGO — OCT. 1-3
CIRCLE 51 ON READER-SERVICE CARD FOR MORE INFORMATION

VOLTAGE REGULATED POWER SUPPLIES

for powering electronic equipment

SERIES

1.5 Amp. KR SERIES

Model	Volts	6.3V AC	Rack Mount			Price
			W	H	D	
KR16	0-150	Each supply	19"	12 1/4"	17"	\$825
KR17	100-200	has two	19"	12 1/4"	17"	\$825
KR18	195-325	15 Amp.	19"	12 1/4"	17"	\$895
KR19	295-450	outputs	19"	12 1/4"	17"	\$895

600 ma. KR SERIES

Model	Volts	6.3V AC	Rack Mount			Price
			W	H	D	
KR 8	0-150	Each supply	19"	10 1/2"	13"	\$330
KR 5	100-200	has two	19"	10 1/2"	13"	\$240
KR 6	195-325	10 Amp.	19"	10 1/2"	13"	\$240
KR 7	295-450	outputs	19"	10 1/2"	13"	\$250

300 ma. KR SERIES

Model	Volts	6.3V AC	Rack Mount			Price
			W	H	D	
KR 12	0-150	Each supply	19"	7"	11"	\$270
KR 3	100-200	has two	19"	7"	11"	\$180
KR 4	195-325	5 Amp.	19"	7"	11"	\$180
KR 10	295-450	outputs	19"	7"	11"	\$180


125 ma. KR SERIES

Model	Volts	6.3V AC	Rack Mount			Price
			W	H	D	
KR 11	0-150	Each supply	19"	7"	11"	\$180
KR 1	100-200	has one	19"	7"	7 1/2"	\$ 90
KR 2	195-325	3 Amp.	19"	7"	7 1/2"	\$ 90
KR 9	295-450	output	19"	7"	7 1/2"	\$ 87

To include 3" Current and Voltage Meters. Add M to Model number (e.g. KR 16-M) and Add \$30.00 to the Price.
To include Dust Cover and Handles for Table Mounting. Add C to Model number (e.g. KR16-C) and Add \$10.00 to the Price.
To include Meters, Dust Cover and Handles. Add MC to Model number (e.g. KR-16 MC) and Add \$40.00 to the Price.
PRICES F.O.B. Flushing.

A LINE OF 50 MODELS

Available from Stock - Catalog on Request



REPORTS FROM THE STRATOSPHERE

with

Vitramon[®] Capacitors

Almost from the first "whoosh," we groundlings must depend on instruments for guiding and reporting. Here, where only the best of electronic equipment is good enough, the leading manufacturers of guided missiles and fire-control systems specify "VITRAMON" capacitors — specify them because *only* "VITRAMON" capacitors are:

- STABLE
- RUGGED
- LOW LOSS
- LOW NOISE
- MINIATURE
- VAPORPROOF
- WIDE TEMPERATURE RANGE

NOW — A new design — the CY Series — adds two *additional* plus values:

- Unitized electrode/lead construction
- Complete insulation.

This new series, too, is available in values from 0.5 to 6800 μf . Catalog 55-1 tells the whole story. It's yours for the asking.

"V" and "Vitramon"[®]

are Registered Trade Marks
of Vitramon, Inc.

CY22C
500 VDC

Vitramon

INCORPORATED

P.O. Box 544D, Bridgeport 1, Conn.

CIRCLE 53 ON READER-SERVICE CARD FOR MORE INFORMATION

Self-Locking Stud Cuts Own Threads



This double-ended stud cuts its own thread when driven in an ordinary drilled hole, and locks securely in the same operation. It provides

high vibration resistance. Known as the "Schweppe" Stud, it can be located accurately from the slotted end to permit hopperizing for automatic feeding and driving.

Studs can be installed at high speed with any power stud driver. No special adapters or attachments are required. They are re-usable. They can be removed from the hole without thread damage and then re-driven in any drilled or tapped hole of the same size.

The studs can be driven in steel, cast iron, aluminum, magnesium, and plastics. They are supplied in any required length, and any diameter from No. 4 through 1 in. Any desired types of threads will be furnished at the slotted and nut ends. In most cases studs operate best with a standard fine machine screw thread on the nut end and a coarse machine screw thread on the slotted end. They are made in any alloy steel, high temperature steel, stainless steel, or non-ferrous metal. Finishes can be plain, Parkerized, or plated with cadmium, zinc, brass, bronze, nickel, chromium, etc.

Pheoll Manufacturing Co., Dept. ED, 5720 Roosevelt Rd., Chicago 50, Ill.

CIRCLE 54 ON READER-SERVICE CARD FOR MORE INFORMATION

Fixed Vacuum Capacitor Rated at 500 mfd



The Type VC500-10 Fixed Vacuum Capacitor is rated at 500-mmfd capacitance, 10-kv peak, and 42 amp rms. Dimensions are: 4 in. overall length x 3-1/4 in. diam, 3-1/2 in. mounting centers, and 7/8 in. contact diam. This unit features reversed copper-to-glass seals for maxi-

mum voltage path in minimum space. Low inductance, practically loss-free characteristics, and rugged construction are features of the unit, which is especially suited for medium and high power oscillators and transmitting equipment.

Dolinko & Wilkens, Inc., Dept. ED, 1907 Summit Ave., Union City, N.J.

CIRCLE 55 ON READER-SERVICE CARD FOR MORE INFORMATION

Solve that design or production problem...fast!

with

AUBURN

- GASKETS • PACKINGS
- WASHERS • SEALS • SHIMS
- BUSHINGS • "O" RINGS



86 YEARS OF AUBURN "KNOW-HOW"

HAS THE ANSWERS!

Yes . . . over 86 years experience in engineering, designing, fabricating and production qualifies Auburn to help you find the ideal answer to your problem. Where gaskets, washers, and other sealing devices are concerned, Auburn engineers are tops in the field. Their know-how is yours—for the asking. We are tooled to fabricate in virtually any material:

- Leather • Asbestos • Teflon • Silicone Rubber
- Neoprene • Rubber • Cork • Fibre • Compositions
- Phenolics • Cloth • Felt • Paper • Cardboard
- Plastics • Brass • Steel • Copper • Aluminum
- Kel-F • Other Special Materials

Send us your specifications or blueprints.

You'll receive

quotations, recommendations without obligation.



AUBURN

MANUFACTURING COMPANY

370 Stack St., Middletown, Conn.

Representatives: Atlanta, Ga.; Detroit, Mich.; St. Louis, Mo.; Los Angeles, Cal.; Minneapolis, Minn.; Washington, D. C.; Cincinnati, O.; Rochester, N. Y.

CIRCLE 56 ON READER-SERVICE CARD

DURANT
MFG. CO.

Specials

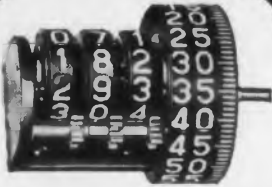
For RADAR, ELECTRONIC
and INSTRUMENT APPLICATIONS



High speed, non-reset, direct reading counter to indicate increment of measurement in radar navigation instruments.



High-speed dual bank counter for use in navigating instruments. Shutter operates to close off either bank when in the minus side.



Counter assembly component of navigating instrument to indicate increments of measurement for fast, legible, direct "read-out".



Special counter for use on Tape Recorder to indicate the position of tape passing through the recorder.



Direct reading counter for navigating and directional instruments. Unit wheel graduations permit reading of 150,000 increments per minute.

Representatives in Principal Cities

WRITE FOR LITERATURE

DURANT MANUFACTURING CO.

1993 N. Buffum St. Milwaukee 1, Wis.
93 Thurbers Ave. Providence 3, R. I.

PRODUCTIMETERS
SINCE 1879 *Count Everything*

CIRCLE 58 ON READER-SERVICE CARD

Shim Spacers

For Miniature Locking Nuts



A complete line of miniature shim spacers is offered for use with the Kaynar series of "Kaylock" miniature self-locking nuts. The minia-

ture shims and nuts offer substantial space and weight savings.

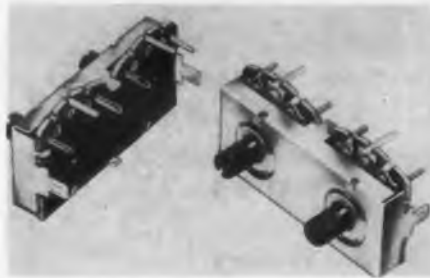
The shim spacers are available in a complete complementary line to cover all available sizes of "Kaylock" miniature nuts. They are available in 0.031 or 0.062 gage aluminum. The new TA206 and TA207 series are furnished with an anodized finish per MIL-A-8625.

Thomas Associates, Dept. ED, 4607 Alger St., Los Angeles 39, Calif.

CIRCLE 59 ON READER-SERVICE CARD FOR MORE INFORMATION

Variable Resistor

Contains Two Control Elements



The Type TV61, a twist-tab mounting variable resistor, contains two control elements and shafts mounted side-by-side on

a common base, only 7/8 by 2 in. wide. In addition to the low cost of the control itself, the unit offers savings in mounting and wiring time for TV and other electronic equipment manufacturers.

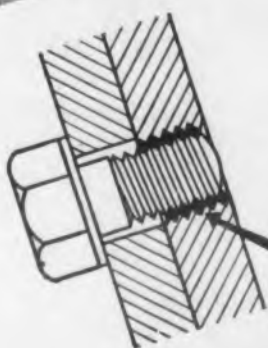
The unit has two 1/4-in. diam phenolic shafts which may be adjusted from either side of the control. The shafts on the panel side are screwdriver-slotted and cut flush with the phenolic mounting plate, making the control valuable for use in printed circuits where it is desired to adjust the control through the chassis. Shaft extensions from the rear are 3/8 in. long and are knurled for easy finger adjustment. Screwdriver slots are optional for rear extensions.

In addition to standard solder lug terminals, controls can also be equipped with horizontal or vertical printed wiring or wire-wrap type terminals. The Type TU61 is conservatively rated at 0.75 w for resistance values above 10,000 ohms, or 0.5 w for values below 10,000 ohms. Controls are fully shielded at the rear by a one-piece, nickel plated steel case.

Electronic Components Div., Stackpole Carbon Co., Dept. ED, St. Marys, Pa.

CIRCLE 60 ON READER-SERVICE CARD FOR MORE INFORMATION

New one-piece wire insert LOCKS the screw



A-A
MID-GRIP COIL



A
18-8 STAINLESS
STEEL WIRE INSERT

as it PROTECTS the tapped hole

Withstands vibration, heat, corrosion — Meets AN-N-5b lock nut specifications

Here is a ONE-PIECE stainless steel thread insert that will *lock the screw against loosening* as it permanently protects the tapped hole. The secret is in the Mid-Grip coil. Shaped like a polygon, its chords exert a spring pressure on the screw thread and prevent rotation at less-than-rated torque. No loss of torque occurs at elevated temperatures or after repeated disassemblies.

NO EXTRAS—The Heli-Coil® Screw-Lock (Mid-Grip) Insert employs no locking rings, pins, plugs, tabs or wiring. It can be installed from the front or top. Think of the money — and assembly time — you can save!

NO PROJECTIONS — Screw-Lock Inserts furnish AN-N-5b lock nut torque *right down inside the parent piece* . . . eliminate costly weight and space . . . improve design.

NO WEAR, NO CORROSION— Like regular Heli-Coil Inserts, new Screw-Lock Inserts are made from 18-8 stainless steel wire, and normally outlast the unit they protect. They permit smaller, fewer fastenings, and require minimum surrounding material. Screw-Lock Inserts are available in popular NC and NF sizes with choice of two lengths.

Mail coupon for complete data—or better still, see Yellow Pages of your phone directory — “Inserts — Screw Thread” for name of your local Heli-Coil Applications Engineer. Call him now!

Regular Heli-Coil Inserts (no locking action) put corrosion-proof, strip-proof stainless steel threads in soft materials . . . permit smaller, fewer fastenings, lighter weight, reduced cost.



SCREW-LOCK INSERTS

Products of Heli-Coil Corporation, Danbury, Conn.

*Reg. U. S. Pat. Off.



HELI-COIL CORPORATION

249 Shelter Rock Lane, Danbury, Conn.

- Send complete design data on Heli-Coil Screw-Lock Inserts.
- Send design manual on standard Heli-Coil Screw Thread Inserts.
- Put me on a list to receive “Heli-Call,” case history periodical.

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____



IN CANADA: W. R. Watkins Co., Ltd., 41 Kipling Ave. S., Toronto 18, Ont.

CIRCLE 61 ON READER-SERVICE CARD FOR MORE INFORMATION

*your move to
Accuracy
with...*



ANTENNA TESTING

① ② ③ ④

Range Systems

AUTOMATION

⑤ ⑥

COMPUTER ELEMENTS

⑦

**MEDICINE, BIOLOGY
Data Processing**

**NUCLEONICS
Special Systems**

RADAR & NAVIGATION

⑧ ⑩

MTI Evaluator

RECEIVER TESTING

⑨ ⑪ ⑫ ⑭ ⑮

STRIPLINE

⑬

Write...

*for descriptive literature
on each of the products
shown.*



**Temperature Indicating Liquids
Reduced Settling Characteristics**

This is an improved line of TEMPI-LAQ° temperature indicating liquids with greatly reduced settling characteristics. Sixty-two different Tempilaqs are available, ranging in temperature from 113 F to 2000 F. With a few exceptions (true solutions), they consist of suspensions of temperature-sensitive materials in volatile vehicles, the rate of settling out varying with the composition.

By micronizing the solid ingredients, settling has been greatly retarded, and redispersing can be accomplished by brief shaking.

Tempil° Corp., Dept. ED, 132 W. 22nd St., New York, N.Y.

CIRCLE 64 ON READER-SERVICE CARD

**Weather-Tight Cabinets
For Polypoint Controls**

This is a new "Weather-Tight" case for bearing monitors and other polypoint controls containing contact meter-relays. The upward-swinging front is gasket sealed and of aluminum construction. Two quarter-turn fasteners lock it firmly in place. Electrical connections are made with weather tight connectors or conduit.

The cabinet protects meter-relays used in moisture laden atmospheres, where steel chips and other materials might damage the instruments, where mild chemicals are present, or in outdoor locations exposed to the weather.

Assembly Products, Inc., Dept. ED, Chesterland, Ohio.

CIRCLE 65 ON READER-SERVICE CARD

Circle No. 300 RMC Associates ➤

Circle No. 301 Hewlett-Packard Co.

Circle No. 302 Beta Electric Corp.

Circle No. 303 John Fluke Mfg. Co., Inc.

Circle No. 304 Varian Associates

Circle No. 305 Pimex Inc.

Circle No. 306 Budd Stanley Co., Inc.

Circle No. 307 Sorensen and Co.

Circle No. 308 Kay Lab.

◀ CIRCLE 63 ON READER-SERVICE CARD

Airborne Instruments Laboratory

INCORPORATED

160 OLD COUNTRY ROAD • MINEOLA, N.Y.

*Quoted to meet your requirements

Wire Cutter and Stripper Pocket Sized, Easy Stripping

This is a new pocket size wire cutter and stripper featuring a wire size adjustment for easy wire stripping. Designed for electrical work, radio, TV, and electronics, the tool features 5" long blades hardened and ground to cut with a smooth shearing action severing wire cleanly and neatly.

For wire stripping, the electrical worker simply sets the adjusting stop to the wire size, closes the jaws of the tool around the wire, holds firm and strips clean to the bare wire with an easy "straight pull" motion. The tool measures 5" long and weighs just 2 oz.

Jo-El Co., Dept. ED, 14209 Leroy Ave., Cleveland, Ohio.

CIRCLE 74 ON READER-SERVICE CARD

Interlock Terminals

In Loose or Chain Form

Primarily designed for use as an a-c interlock, these terminals are equally adapted for connecting speaker leads, printed circuit panels or flybacks and also as mounting lugs on transformers for printed circuit applications.

Special design features include: (1) reinforced ribs to prevent banding or deformation of any part of the terminal during continuous use; (2) male prong is bullet shaped for easy and quick insertion into line cord female; and (3) square extruded barrel and inverted tongue assure proper alignment and accurate spacing when terminals are used in multiples.

Malco Tool and Mfg. Co., Dept. ED, 4025 W. Lake St., Chicago 24, Ill.

CIRCLE 75 ON READER-SERVICE CARD

Circle No. 300 RMC Associates

Circle No. 301 Hewlett-Packard Co.

Circle No. 302 Beta Electric Corp.

Circle No. 303 John Fluke Mfg. Co., Inc.

Circle No. 304 Varian Associates

Circle No. 305 Pimex Inc.

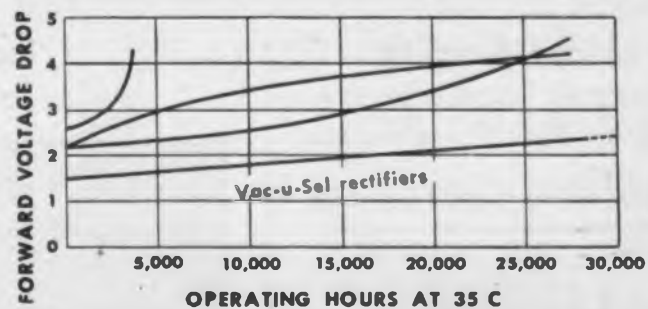
Circle No. 306 Budd Stanley Co., Inc.

Circle No. 307 Sorensen and Co.

Circle No. 308 Kay Lab.

CIRCLE 76 ON READER-SERVICE CARD

A COMPARISON GRAPH between General Electric Vac-u-Sel rectifiers and three other makes, showing the change in forward voltage with time. Note that all other makes have at least doubled their forward resistance (completely aged) in less than 30,000 hours. Vac-u-Sel rectifiers' long life makes them ideal for such applications as business machines.



WHEREVER LONG SERVICE IS ESSENTIAL . . .

G-E *Vac-u-Sel** Rectifiers Will Give 80,000 Hours of Reliable Life

When you're designing a circuit for a business machine or other essential-service type of industrial machine, two important objectives are absolute dependability and maximum life. Therefore, it will pay you to take advantage of the special characteristics of General Electric Vac-u-Sel rectifiers. This long-life rectifier has more than adequately proved its dependability in many years of outstanding service.

THE VAC-U-SEL RECTIFIER IS UNIQUE in that it is manufactured by an exclusive sphere-type, vacuum-evaporation process, which G.E. has been using for over 15 years. The ultimate benefit is 80,000 hours life expectancy at full-rated current and voltage. This is at least $\frac{1}{3}$ longer than the life expectancy of ordinary selenium rectifiers under the same conditions.

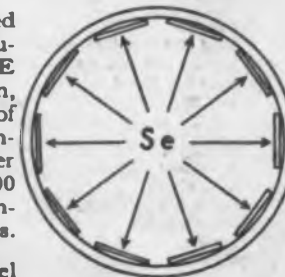
In addition, the Vac-u-Sel rectifier gives you low forward resistance, and minimum heat loss.

A full line of Vac-u-Sel rectifiers is available. Contact your nearest G-E Apparatus Sales Office, or write for Bulletin GEA-6273 to: Section 461-42, General Electric Co., Schenectady 5, N. Y.

* Vac-u-Sel is a trade-mark of the General Electric Co. It designates top-quality selenium rectifier cells manufactured by a unique sphere-type vacuum-evaporation process. Vac-u-Sel rectifiers are produced by the Rectifier Department, Lynn, Mass., headquarters for silicon, germanium, selenium and copper-oxide component rectifiers.

THE SECRET'S IN THE SPHERE

A vacuum-tight sphere is used to evaporate selenium onto aluminum plates. This unique G-E process results in a more even, natural-crystalline formation of selenium. It also eliminates contaminants, and permits better control over the more than 100 variables encountered in the manufacture of selenium rectifiers.



The end result is a Vac-u-Sel rectifier made by a precision process more closely related to a science than an art. This makes it possible to accurately predict performance, repeat the same dependability, and maintain the same high quality.

Progress Is Our Most Important Product

GENERAL  ELECTRIC

Meter-Relays, VHS Relays, Simplytrol and Versatrol Automatic Controls, Panel Meters and Indicating Pyrometers

40 PAGE ASSEMBLY PRODUCTS CATALOG 4-A

Contents include:

"Circuitry"—6 pages of diagrams and text, including response time tables and discussion on non-locking contacts.

Ordering information.

Prices and detailed specifications for:

Clear plastic, black bakelite and ruggedized-sealed styles of:

Meter-relays
Indicating meters
Indicating pyrometers

VHS Relays

Plug-in relays, power supplies

Automatic pyrometers

Automatic control packages and components

Bearing monitors

Oven pyrometers and millivoltmeters

Kiln pyrometers

Shunts

Transformers

Write for Catalog 4-A.

Assembly Products, Inc.
Chesterland 17, Ohio
Hamilton 3-4436

(West Coast: Desert Hot Springs 17,
Calif. Phone 4-3133 or 4-2453).

Booth 1614, Instrument-Automation Show, Sept. 17-21, New York Coliseum

CIRCLE 285 ON READER-SERVICE CARD FOR MORE INFORMATION



Meter-relays provide control of mechanical operations or chemical processes through alarm and automatic shut-off, or continuous on-off control. Applications include: Bearing temperature alarm and shut-off on pumps, turbines, generators. Automatic speed controls for machines and conveyors. Computer shut-off if power supply voltage varies. Warning and control in radiation measuring equipment and processes. Automatic switching of standby equipment in microwave communications. Continuous control of pH. Signal detection in radar warning systems.

Insulating Material

Available in Sheet Forms



Micaramic is a new insulating material made from flake mica and a mineral binder. Possessing the properties of heat distortion at 1700 F, complete flame resistance

and arc resistance with no carbon tracking, as well as excellent dielectric strength and workability, the material has been used in appliances, controls, and industrial heaters.

A wide range of other electrical insulation applications are considered, as the material is available in thin sheets (20 mils to 1/2"), and can be easily punched and shaped as well as extruded.

Spruce Pine Mica Co., Dept. ED, Spruce Pine, N.C.

CIRCLE 78 ON READER-SERVICE CARD FOR MORE INFORMATION

Random Generator

Speeds Generation of Random Numbers



Considerable time may be saved in obtaining truly random numbers by the utilization of the Stochastic generator. This machine eliminates the necessity of transcribing by hand from tables or drawing numbers from a bowl. The continuous generation of random numbers, 10 per second, is possible with this generator.

As an electronic computer accessory, the unit is able to feed in random numbers through a suitable converter. It is also capable of generating normal as well as rectilinear distributions.

Loyola Laboratories, Dept. ED, Box 45074, Airport Station, Los Angeles 45, Calif.

CIRCLE 79 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Connectors

Lock Very Simply

Miniature push-pull connectors that connect and automatically lock by being pushed together, and disconnect merely by being pulled back, meet applicable MIL-C-5015 AN "E" requirements. Since they operate in the direction of plug travel, without twisting or lockwiring, they are well-suited for crowded installations, and as umbilical or break-away units that can be remotely disconnected.

Deutsch Co., Dept. ED, Los Angeles, Calif.

CIRCLE 80 ON READER-SERVICE CARD FOR MORE INFORMATION

MILLIVAC



TYPE MV-22B

EXTENDED RANGE VIDEO VOLTMETER
20 cps to 10 megacycles, 300 uV full scale

CIRCLE 287 ON READER-SERVICE CARD FOR MORE INFORMATION

NEW—UNBRAKO socket set screws with Nylok*



The Nylok self-locking feature locks these screws securely in place, seated or not. They won't work loose. Use them

in holes tapped in soft materials or against hardened shafts. Can be used as self-locking adjusting screws. Can be used repeatedly. Tough, resilient nylon locking pellets permanently installed. Successfully resist temperatures ranging from -70 to 250° F. Deep, accurate hex sockets for positive, nonslip internal wrenching. Heat treated alloy steel, continuous grain flow, fully formed Class 3A threads for high strength and exact fit. All standard point types—including knurled cup point—available. Sizes #6 to 1 in. Also available in plated finishes and in stainless steel. Write for Bulletin 2193. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 12, Pa.

*TM Reg. U.S. Pat. Off., The Nylok Corporation

UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS

Unbrako Products are sold through Industrial Distributors

JENKINTOWN PENNSYLVANIA

CIRCLE 288 ON READER-SERVICE CARD FOR MORE INFORMATION

coaxial and shielded cable grounding completed in 90 seconds with

HYRINGS

STRIP shield. Slip outer Hyring over insulated conductor. Slide inner Hyring under shield.

INSERT ground lead under outer Hyring and line up over the inner Hyring.

INDENT, assembly with single ratchet controlled compression stroke.

COMPLETED assembly, with Burndy Hyring attached to free end of ground lead.

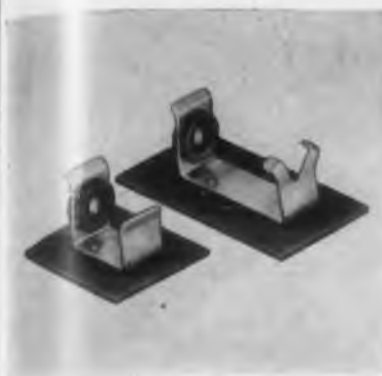
BURNDY

Hartford, Conn. - Toronto, Canada - Factories: New York, California, Toronto - Export: Phillips Export Company

CIRCLE 286 ON READER-SERVICE CARD FOR MORE INFORMATION

(Advertisement)

New Silver-plated Battery Clips Ideal for transistorized circuitry



New clips with new features! CTC's new silver-plated battery clips, type X2233 (1 cell) and X2234 (2 cell) are compact, easy to mount and are readily used in circuits, printed or otherwise.

The first of a family of CTC battery clips, these are made of phosphor bronze. The clips are designed to lock simply yet stand up and remain secure even under extremely rough handling. Featuring a positive, low resistance contact, the clips are uniquely designed and the silver plating resists corrosion even under battery leakage.

CTC's new clips take up a minimum chassis area and mount simply with only two rivets or eyelets. They are designed for use with one or two cell mercury batteries.

They may be the answer to your battery-securing problem. For complete specifications and data on price, write direct. Cambridge Thermionic Corporation, 457 Concord Ave., Cambridge 38, Mass.

CIRCLE 289 ON READER-SERVICE CARD FOR MORE INFORMATION

Analog Filters For Audio and Sub-Sonics



First of a series of analog filters for sharp band-pass performance at audio and sub-sonic frequencies, the Model BP-160 features completely independent control of high and low frequency band limits, cut-off being at the rate of 160 db per octave in each case. This type of unit produces a voltage-frequency characteristic which is an exact analog of a multi-section passive LC filter. Since the analog is achieved without inductances, no conventional low frequency design limitations apply as in the case of passive filters.

While the complete series will include units suitable for a variety of frequency ranges, the initial version covers a band of 0.83-424 cps or fractions thereof, adjustable in steps of one-half octave. The frequency intervals are based on those adopted in the American Standard for Octave Band Filters, and any segment of the specified band may be selected consistent with this system of intervals. Filters are designed to fit a standard relay rack 19 in. wide.

Spectrum Instruments, Inc., Dept. ED, 44-05 30th Ave., Long Island City, N.Y.

CIRCLE 83 ON READER-SERVICE CARD FOR MORE INFORMATION

Torque Transducer

Operates Without Brushes and Slip Rings



This new variable performance torque transducer operates without brushes and slip rings. It is designed for either static or dynamic torque measurement and features reduced length and increased sensitivity over earlier models.

Reproducibility of 0.1% and resolution of 0.02% permit one instrument to serve over a wide range of torque measurement scales. Various models are available for ambient temperatures from -145 F to 1200 F. Linearity of all models is 2%. Only corrosion resistant materials are used for all standard models.

Crescent Engineering & Research Co., Dept. ED, 11632 McBean St., El Monte, Calif.

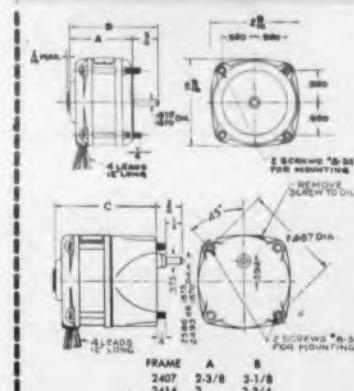
CIRCLE 84 ON READER-SERVICE CARD FOR MORE INFORMATION

For Servo Applications

HOWARD MODEL 2400



CAPACITOR OR 2 PHASE TYPE SERVO MOTOR



Dept. ED9
HOWARD INDUSTRIES, INC.
Racine, Wisconsin
Divisions: Electric Motor Corp.
Cyclohm Motor Corp.
Racine Electric Products

This four pole motor is designed for servo applications. Low inertia rotor provides quick response and high impedance stator windings can be matched to vacuum tube plate circuits. Center topped windings can be provided. As a 2 phase motor, the speed can be varied by varying the phase angle. Responds to a wide range of frequencies. Gear units are available with ratios from 2½:1 to 3600:1. For complete data, write today.

CIRCLE 291 ON READER-SERVICE CARD FOR MORE INFORMATION

CLOSURES

- Metal or Plastic Caps or Plugs to protect threads, tubes, machined parts, reamers, cutters, tools.
- Protect against thread damage, dust, dirt, and moisture.
- For inside and outside application. All sizes. Immediate delivery.

Clover closures are made in metal and tough plastic polyethylene. They are made in caps, plugs and special shapes to fit parts tightly, offering completely sealed protection during manufacture, shipping and storage. Backed by years of closure experience. Write for low prices and complete information.

Send coupon today!

Gentlemen:
Please send samples and prices of closures in
Polyethylene Aluminum

Name.....
Address.....
City.....

 CLOVER INDUSTRIES, INC. 584 Young Street
Tonawanda, N. Y.

CIRCLE 292 ON READER-SERVICE CARD FOR MORE INFORMATION

AGASTAT

Compact... Dust-Proof TIME DELAY RELAYS solenoid actuated—pneumatically timed

Introduces time delays into a-c or d-c circuits. Easily adjusted to provide delays ranging from 0.1 second to five or more minutes.

The AGASTAT is small, light, and operates in any position. Dust-proof timing chamber assures long operating life with a minimum of maintenance.

AGA
DIVISION

Elastic Stop Nut Corporation
of America

1027 Newark Avenue, Elizabeth, New Jersey
A15-924

CIRCLE 290 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC SYSTEMS SPECIALISTS

Here are some typical problems Sylvania engineers and physicists meet and solve at our Buffalo, N. Y. and Waltham, Mass. plants.

AT BUFFALO:

1. How do you design 10 similar microsecond timing circuits whose delay times can be varied over a range of 100 times by analog control voltage maintaining a tracking accuracy of $\pm 0.1\%$ in an environment of -65°C to $+125^{\circ}\text{C}$ at sea level to 100,000 feet?
2. If you know which bits of a code group are in error, can you modify the hamming code to use this data to provide maximum information capacity in a noisy channel?
3. Can you design a crystal mixer to operate with latest production type crystals and having a noise figure less than 12db above KTB operating in the "S"-band?

AT WALTHAM:

4. Under what conditions can signal fluctuations improve radar performance?
5. What are the limitations on allowable smoothing time for target tracking radars?
6. Under what conditions can random noise introduce systematic errors in radar measurements?

Continuing product diversification means long-range security and advancement... and both locations offer good housing and ample leisure-time activities, as well as unusual opportunities for advanced studies.

If you believe that you can assist us in the solving of these problems, please write:

WALTHAM LABORATORIES

Erling Mostue
100 First Ave.
Waltham, Mass.

BUFFALO LABORATORY

E. F. Culverhouse
175 Great Arrow Ave.
Buffalo 7, New York

 **SYLVANIA** 
SYLVANIA ELECTRIC PRODUCTS INC

Your inquiries will be answered within 2 weeks.

Miniature Electromagnetic Clutches

Concentric Servo Mounting



A new line of miniature electro-magnetic clutches for electronic and instrument applications, couples that input hub to the output shaft when energized. Both

the hub and output shaft are free when de-energized.

The servo mounted units are available with output shaft at either or both ends. Controlled torque output under vibration meets requirements of MIL-E-5272A. Units operate on dc voltage.

Performance specifications of the C-4 Model are 0.59 in. dia. by 0.93 in. long (excluding input and output shafts), weighs 0.8 oz and transmits transmits 4 in.-oz. of torque. The C-6 Model is 0.83 in dia. by 1.34 in. long (excluding shafts), weighs 2.3 oz and transmits 16 in.-oz of torque. The C-10 Model is 1.37 in. dia. by 1.765 in. long and transmits 60 in.-oz of torque.

A. J. Thompson, Dept. ED, Route 1, Box 812, Florissant, Mo.

CIRCLE 88 ON READER-SERVICE CARD FOR MORE INFORMATION

Coaxial Power Pad

Increases Powermeter Range



The Model 528 Coaxial Power Pad is rated 3 w, 34.8 db, dc to 600 Mc, and 50 ohm impedance. It has type "N"

connectors. The unit is used to extend the 10mw frequency sensitivity range of commercial powermeters to 30 w.

Power sensitivity (change of attenuation) is less than 0.1 db/10 w. Max input vswr under full rated power is 1.20, and max output vswr under power is 1.10. Typical frequency sensitivity (change of attenuation with frequency) is 0.3 db. Calibration supplied is: insertion loss of low power—dc, 200, 300, 400, 500, and 600 Mc; insertion loss at 30 w input—dc, 400, 600 Mc.

No forced cooling is required. The unit is a 7-section tee-pad containing carefully aged film resistors resulting in long-term stability.

Weinschel Engineering, Dept. ED, 10503 Metropolitan Ave., Kensington, Md.

CIRCLE 89 ON READER-SERVICE CARD FOR MORE INFORMATION

Have you received your copy?



VALUABLE NEW
TECHNICAL DATA
DESIGN IDEAS
MATERIEL INFORMATION

Send for

"Introduction to
Fiberglass Fabrication"
by

KOCH FIBERGLAS

FREE!

**TENTH ANNIVERSARY 20-PAGE
ILLUSTRATED MANUAL**

Every day, Koch Fiberglass is
filling new uses in your industry

Koch cases for electronic equipment will not dent, are impervious to moisture, vapor, fungus, mildew and corrosion. They are shock and vibration-proof when fitted to Koch specifications with special hair-latex shock pads. Can be self-palletized for fork lift. Can be insulated by Koch with foamed-in-place plastic. Koch cases are air-tight; require no paint or outer packaging for long-range storage or overseas shipment. Re-usable, so cost amortizes through re-use. Withstand parachute drops from any height, free falls onto water or snow from 500 feet, or submersion.

For manual, write on your business letterhead to Dept. DEB.

KOCH
PRONOUNCED "KOKÉ"
FIBERGLAS

CORTE MADERA, CALIFORNIA

One of the world's largest fabricators
of molded Fiberglass products

CIRCLE 81 ON READER-SERVICE CARD



Genisco Rate-of-Turn Tables facilitate fast, precise calibration and evaluation of rate gyros

Ball-disc integrator drive provides infinitely variable rates from 0.01° to $1200^\circ/\text{sec}$.

EXTREMELY ACCURATE... constancy of angular velocity of the turntable is within 0.1%, including wow and drift errors, at any rate.

SMOOTH, CONSTANT ROTATION... unique synchronous motor, designed specially for this application, has large diameter rotor; high polar inertia.

EASY TO OPERATE... single handwheel controls turntable speed. Inexperienced personnel can operate machine after few minutes instruction.

IDEAL FOR LARGE VOLUME TEST PROGRAMS... ruggedness, simple operation, repeatability, and versatile mounting facilities make it the ideal machine for production-line testing.

PRECISE REPEAT POSITIONING... within 0.2% in same rotational direction; 0.5% in opposite direction, under 500° per second.

LOW ELECTRICAL NOISE LEVEL... better than -55 dbm per slip ring circuit (zero dbm = 1 mw in 600Ω).

UNUSUALLY RUGGED... built to take years of continuous use; requires only minimum amount of maintenance.

TABLE CAPACITY... 100 pounds.

ACCESSORIES INCREASE ITS USEFULNESS!

SUB-RANGE ADAPTER... extends low range of Genisco Rate-of-Turn Table to 0.0001° per second.

PRECISION STROBE UNIT... for use in areas where accuracy of line frequency is questionable, or for calibration of gyros with accuracies better than line frequency.

MOUNTING STANDS... available in portable and fixed models.

Send today for complete specifications. Please direct your inquiry to Contracts Manager, Genisco, Incorporated, 2233 Federal Avenue, Los Angeles 64, California.



CIRCLE 92 ON READER-SERVICE CARD

Magnetic Amplifier

For Instrumentation and Control



Ferrac amplifier, a ferro-magnetic amplifier for analog computers, is a dc to dc amplifier powered directly from a 115 v, 400 cy line. Full linear output of ± 7.5 v is obtained with $\pm 300 \mu\text{amp}$ input. Bandwidth is at least 8 cy per each 1000 ohms in a control loop.

Two independent control windings enable the Ferrac amplifier to be used in summing and multiplying circuits. Lead and lag networks can be introduced as readily as with electronic amplifiers. Two signals can be mixed in a Ferrac amplifier even though they have no common ground. Complete analog computers, simulators, and automatic controls can be assembled using Ferrac amplifiers as basic building blocks.

Airpax Products Co., Dept. ED, Middle River, Baltimore 20, Md.

CIRCLE 93 ON READER-SERVICE CARD FOR MORE INFORMATION

Tape Recorder

Simplifies Editing and Cueing



The P-60-ACX "Editor" is a rack-mount tape recorder with advanced facilities for instantaneous editing and cueing. It is powered by three-motor direct drive with a two-speed hysteresis synchronous drive

motor and operates instantly from pushbutton controls. For editing, the operator merely opens the head cover and moves the tape for marking or cutting. Cueing is accomplished by the single operation of grasping each reel and gliding the tape over the heads with the tape lifter knob in manual cueing position.

Separate erase, record, and playback heads are completely shielded to prevent crosstalk and hum, and make it easier to monitor directly from the tape while recording. A phono jack provides monitoring input to the record head or the playback output of tape while recording, and a 4-in. VU meter enables the user to read record, playback, and bias levels at a glance.

Magnecord, Inc., Dept. ED, 1101 S. Kilbourn Ave., Chicago, Ill.

CIRCLE 94 ON READER-SERVICE CARD FOR MORE INFORMATION

SUBMINIATURE TRIMMING
POTENTIOMETERS FOR THE

HOT SPOTS

IN YOUR ASSEMBLIES



BOURNS *Model 160*

TRIMPOT

*—new high temperature,
high power design*



This instrument operates reliably in high ambient temperatures, or wherever closely massed components generate localized hot spots. The TRIMPOT will withstand temperatures up to 175° C. (347° F.) with unimpaired efficiency. Lead wires are Teflon insulated. High power dissipation— 0.6 watt at 50° C. (122° F.)



You'll find every outstanding feature of the original Model 120 TRIMPOT—standard of the industry—built into the Model 160. 25-turn adjustments are made with a screwdriver on the slotted shaft. The shaft is self-locking, to provide stable settings. Resistance element is precision wound with low temperature-coefficient resistance wire. Unit withstands severe shock, vibration and acceleration. To assure its dependable performance under extreme environmental conditions, Bourns designed the Model 160 TRIMPOT to meet or exceed rigid government specifications.

Write for new descriptive literature.



BOURNS LABORATORIES

General Offices: 6135 Magnolia Avenue Riverside, California
Plants: Riverside, California — Ames, Iowa

COPR. 61

CIRCLE 95 ON READER-SERVICE CARD FOR MORE INFORMATION

**THE WRONG POT . . .
CAN MEAN TROUBLE!**



For the *right* pot,
rely on **DAYSTROM!**

Model 300-00 is the tiniest, precision-built, wire-wound trimming potentiometer this side of "Lilliput." Despite its flyweight size, it easily handles **exacting** jobs throughout extreme temperature ranges.

For higher resistance ranges, the Model 303-00 fills the bill — using very little more space than the Model 300-00.

The **Potentiometer Division** of Daystrom Pacific Corporation is staffed with highly skilled engineers and technicians who dearly love to grit their teeth and come up with optimum solutions to all kinds of potentiometer problems.

So, rely on DAYSTROM for your right pot!

Some outstanding characteristics:

	Model 300-00	Model 303-00
Size	0.5" square by 0.187" thick	0.75" square by 0.28" thick
Weight	2 grams	7 grams
Resistance Ranges ...	10 ohms to 50K	5K to 125K

Write today for literature on these or any of the many other production or custom-made precision potentiometers available. Names of local representatives on request.

Openings exist for highly qualified engineers.

**POTENTIOMETER
DIVISION**

Daystrom **PACIFIC** CORPORATION

11150 La Grange Ave. West Los Angeles 25, Calif.

A SUBSIDIARY OF DAYSTROM, INC.

CIRCLE 97 ON READER-SERVICE CARD FOR MORE INFORMATION

Analyzer For Vector Measurements



This instrument can be used to measure vector sum or difference of two voltages; to measure phase angle between two voltages;

and to measure imaginary voltage. It also can be used as a vtvm to measure voltage across two points which are both above ac ground potential. In conjunction with an oscillator, it may be used to measure magnitude and phase angle of an unknown impedance.

There are five phase angle ranges, 0-2, 0-4, 0-20, 0-60, and 0-180 deg. A panel switch is provided for inserting 180 deg phase shift. Accuracy is: binding post, $\pm 1.5\%$ either direct or through amplifier for voltage measurement; 0.05 deg or 1.5% (whichever is larger) for phase measurement. The probe is $\pm 3\%$ below 100 Mc and increases slowly up to 8% at 500 Mc for both voltage and phase measurements. Voltage ranges are 0.04, 0.4, 4, and 40 v rms for binding post input; 0.4, 2, and 4 v full scale for probe input. The stability is better than 0.1% for 10% variation of line voltages. The frequency range for binding post is 15 cps to 2 Mc without amplifier. The upper limit decreases to 200 kc with amplifier. The frequency range for probe is 100 kc to 500 Mc.

Advance Electronics Lab., Inc., Dept. ED, 451 Highland Ave., Passaic, N.J.

CIRCLE 98 ON READER-SERVICE CARD FOR MORE INFORMATION

"L" Band Slotted Line Residual VSWR Less Than 1.05



Model SL-28 "L" band slotted line is a rugged and stable instrument for the accurate measurement of the magnitude and phase of VSWR

in standard "L" band waveguides at frequencies from 1120 Mc to 1700 Mc.

This unit, for use with any standard probe, provides a residual VSWR of less than 1.05 with probe in position and has negligible slope and leakage. A rugged waterproof transit case is available for storage and transportation.

Vectron, Inc., Dept. ED, 1583 Trapelo Rd., Waltham 54, Mass.

CIRCLE 99 ON READER-SERVICE CARD FOR MORE INFORMATION

in 1956

ELECTRONIC

DESIGN

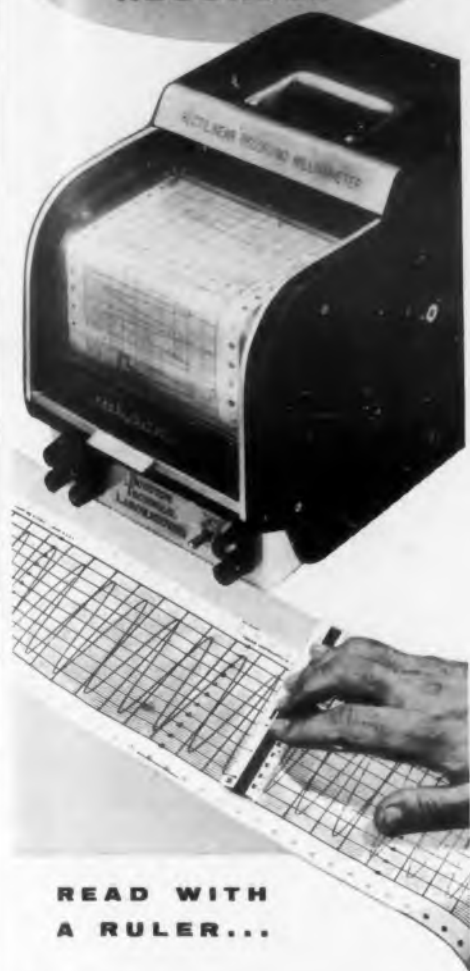
will reach

your desk

24 times

announcing the new
recti/riter

first truly
**RECTILINEAR
GALVANOMETRIC
RECORDER**



**READ WITH
A RULER...**

the exclusive *recti/rite* trigonometric linkage inscribes the true signal form on a standard rectilinear chart. You have frontal access for all controls and making chart notations . . . $\pm 1\%$ accuracy over full $4\frac{1}{2}$ -inch scale; sensitivity—0.45-inch/100 microamperes; pen speed at a quarter-second over full $4\frac{1}{2}$ -inch deflection. Use ac or dc drive, spring drive, or external drive . . . with 10 optional chart speeds.

For complete information on the modern and versatile *recti/riter* — write for Bulletin R-501.



instrumentation subsidiary of
TEXAS INSTRUMENTS INCORPORATED
CIRCLE 102 ON READER-SERVICE CARD ⁶⁴⁷⁷

Porous Tubing

In Several Degrees of Porosity



Known as "Poro-Tube" this laminated fiberglass-epoxy tubing is produced to result in controlled porosity of the tubing wall. Several degrees of porosity are achieved through variations of fiberglass weave, epoxy formula, and impregnation process. It has high temperature resistance (up to 350 F) and is available in a wide range of diameters (down to 0.062 in. ID). Wall thicknesses are available down to 0.005 in., and there is a choice of round, square, oval, and triangular cross-sections. Standard lengths are up to 9 ft, with greater lengths upon request. Weight is 0.03 lb/cu in. The material is impervious to most gases, fuels, oils, and chemicals, and it is easily machined without unraveling or shredding.

The characteristics of "Poro-Tube" make it a valuable material for: high temperature, Class H motor housings, replacing metal; internal spacers in electrolytic capacitors (allows current flow); reusable filters where corrosion resistance is critical; low cost, reinforced forms for potting and impregnating coils, resistors, and terminal boards; and for many other uses.

Lamtex Industries, Inc., Dept. ED, 51 State St., Westbury, L.I., N.Y.

CIRCLE 103 ON READER-SERVICE CARD FOR MORE INFORMATION

Tube Sockets

Permit 90 Deg Installation



These sockets permit installation of tubes in a position parallel to the printed circuit chassis, thus conserving space where height is limited. Brackets are designed to maintain rigidity and cannot be loosened from the chassis. A low center of gravity offers greater resistance to vibration and shock. All electrical and mechanical characteristics are in accordance with military specifications.

Both 9-pin and 7-pin sockets are available, with or without shield base. (Illustrated is the 9-pin type without and with shield base, and in rear view.) All sockets are rated 660 v 1 amp, with a withstanding voltage (see level) of 2000 v rms.

Elco Corp., Dept. ED, Philadelphia 24, Pa.

CIRCLE 104 ON READER-SERVICE CARD FOR MORE INFORMATION

Westmold and Westseal types resist moisture and heat

NEW WESTMOLD TRANSFORMERS—offer exclusive dimensional fidelity, flame resistance and greatest resistance to moisture penetration ever available in an open-type transformer (where MIL-T-27 grades 2 and 5 are required). This new type is molded in a plastic material which maintains its flexibility at extreme temperatures. Will withstand shock of being heated to 130°C, then plunged into -55°C alcohol-dry-ice. Ten of these cycles are passed without cracking, complying with Type C thermal shock test, MIL-C-16923. Dimensional fidelity is assured as the shape of the transformer is fixed by the mold in which it is poured.

NEW WESTSEAL TRANSFORMERS—Small, lightweight power transformers and filter chokes have been developed for radar, airborne electronics and other applications demanding good resistance to humidity and high temperatures (where MIL-T-27 grades 2 and 5 are required). They are impregnated with a newly developed solventless silicone resin and sealed with an impervious coating of silicone rubber.

The compound is firmly bonded to the transformers and to the terminals, eliminating any "wick" action. Coils are completely filled, free of voids. Result—corona-free operation in the 5000-volt range.

For further details, circle the proper number on the Reader-Service Card, see your Westinghouse Sales Engineer or write to Westinghouse Electric Corporation, Specialty Transformer Division, P. O. Box 231, Greenville, Pa. J-70772

WATCH WESTINGHOUSE!

COVER THE PRESIDENTIAL CAMPAIGN ON CBS TV AND RADIO!

WESTMOLD



WESTSEAL



CIRCLE 105 ON READER-SERVICE CARD FOR MORE INFORMATION

HUGHES PRODUCTS

proudly announces

TONOTRON

- Full circle persistence
- Displays complete spectrum of gray shades
- Controllable persistence
- Controllable rate of decay
- No hood needed, even in direct sunlight
- 5-inch screen



Weather radar with brilliant half-tone picture.



Narrow band, slow scan. Closed-circuit TV.



Freeze action until intentionally erased.



DIMENSIONS

- Over-all length: $11\frac{3}{8}$ inches, $\pm \frac{3}{8}$ inch.
- Bulb diameter: $5\frac{3}{8}$ inches, maximum.
- Neck diameter: 1 inch, $\pm \frac{1}{16}$ inch.



Single transient pulse, 20 micro-seconds wide with a one micro-second rise time, showing writing capabilities of one million inches per second. This photo was taken in full daylight without a hood.



ELECTRON TUBES

MEMOTRON

Memotron gives instant and permanent display of one or successive transients.

HUGHES PRODUCTS

A DIVISION OF THE HUGHES AIRCRAFT COMPANY

For descriptive literature write to
HUGHES PRODUCTS
ELECTRON TUBES
International Airport Station, Los Angeles 45, California

CIRCLE 107 ON READER-SERVICE CARD FOR MORE INFORMATION

Spherical Orientation Connectors Self-Aligning



A new spherical orientation (rack and panel) electrical connector, which will self-align and mate in blind connections, has three integral keys and keyslots. Compression springs make the self-aligning possible without match plates or guidance pins.

The connector, available in 19- and 37- contact models, meets applicable MIL-C-5015 AN "E" requirements. Quick-disconnecting, positive locking, moisture sealing, as well as vibration, corrosion and pressure resisting, they are operative from -67 to 250 F, have continuous dielectric separation and a visually inspected lock that automatically seals before locking. No wet process is necessary, but the connectors can be potted if required. Combed construction provides wire separation and support.

The Deutsch Co., Dept. ED, 7000 Avalon Blvd., Los Angeles 3, Calif.

CIRCLE 108 ON READER-SERVICE CARD FOR MORE INFORMATION

Vacuum Gage Has High Readability



This vacuum gage, a single meter type with a range of 0-100 microns Hg full scale, has a 4 in. indicating meter with knife edge pointer for direct reading on a logarithmic mirror meter scale. Half scale on the dial face is 15 microns, providing high read-

ability for low micron measurements. The instrument is highly accurate throughout the entire range.

The instrument operates on 115-v ac and includes an internal voltage regulator to eliminate any effects from line voltage variations. The basic circuit is the same proven type as employed in other vacuum and pressure measuring instruments made by this firm.

Hastings Instrument Co., Inc., Dept. ED, Hampton, Va.

CIRCLE 109 ON READER-SERVICE CARD FOR MORE INFORMATION

Socket Screws, Bolts

Have Self-Locking Nylon Insert

This firm has added the Nylok self-locking insert as an optional feature to its precision socket head screws and aircraft bolts. The Nylok process makes use of the resilient properties of nylon to provide self-locking action on threaded fasteners which might otherwise loosen under severe vibration.



A nylon pellet is inserted in a hole drilled part way through the threaded portion of the bolt. When the bolt is installed in a tapped hole or a standard nut, the exposed portion of the nylon pellet is compressed between the mating threads. In an attempt to regain its original shape, the nylon forces the threads together under pressure. This pressure increases the friction between the metal surfaces, thus resisting the tendency of the bolt to loosen in service in vibrating machinery, vehicles, and appliances.

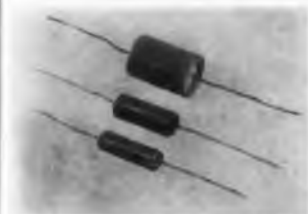
The nylon retains its resilience in the temperature range from -70 to $+300$ F, even through repeated uses.

The Standard Pressed Steel Co., Dept. ED, Jenkintown, Pa.

CIRCLE 111 ON READER-SERVICE CARD FOR MORE INFORMATION

Capacitors

Highly Stable Metal Tubulars



Built for use in various types of military computers and other electronic devices, these metal tubular polystyrene capacitors are offered from 0.001-1 mfd.

and voltage range is 100-1600-v dc. Both inserted tab and extended foil constructions are available, as well as various circuit styles and bracket arrangements in accordance with MIL-C-25A. The units also can be supplied with a vinyl sleeving. A principal advantage is that all of the elements of polystyrene as a dielectric are provided in the small sizes of CP-04 through CP-11 case styles of MIL-C-25A.

Dielectric absorption is 0.05%, and insulation resistance at 25 C is 1×10^{12} ohms. Power factor at 1 kc is a maximum of 0.05%. Stability is to 0.1% per cycle. Temperature range is -55 to $+85$ C, with a coefficient of -100 parts per million per C.

Condenser Products Co., Dept. ED, 140 Hamilton St., New Haven, Conn.

CIRCLE 112 ON READER-SERVICE CARD FOR MORE INFORMATION



At this stage, #113 is just a number. If all proceeds as planned, it will shortly acquire a name — the name of Driver-Harris's newest special-purpose alloy . . . made, as always, to meet the needs of a specific manufacturer.

When someone asks us for an alloy we do not have, we try to make it. Usually we succeed. To date we have succeeded 112 times. Many of our long line of electrical, electronic, and heat-resistant alloys — Nichrome*, Nichrome* V, Advance*, Karma*, Manganin, Nilvar*, and

the rest — are today famous names in industry the world over. And each of these was originally custom-made . . . produced exactly to the specifications of someone who needed it.

Are you in need of an alloy with special properties, not yet available? Put your specifications in our hands. You will gain the benefit of the 57 years of experience which has developed the largest variety of alloys ever made by any one company.

*T.M. Reg. U. S. Pat. Off.



Driver-Harris

COMPANY

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Louisville, Los Angeles, San Francisco • In Canada: The B. GREENING WIRE COMPANY, Ltd., Hamilton, Ontario

MAKERS OF THE MOST COMPLETE LINE OF ELECTRIC HEATING, RESISTANCE, AND ELECTRONIC ALLOYS IN THE WORLD

CIRCLE 113 ON READER-SERVICE CARD FOR MORE INFORMATION

You, too, can
have this
wonderful
**TEST-
SAMPLE
CASE**
of **SET SCREWS**
that inspired this letter!



Minneapolis-Honeywell Regulator Company
Appliance Controls Division
17200 WESTERN AVENUE • GARDENHA, CALIFORNIA

Set Screw & Mfg. Co.
Bartlett, Ill.

Gentlemen:

I received your Setko Jewel Case of Test Samples and Set Screw Ideas and was impressed in more ways than one. It has terrific appeal and impact. As a result of it, whenever I have set screw problems, I shall turn to Set Screw & Mfg. Co. for aid. In fact, Setko is now the only name that comes to my mind when I think of set screws.

Sincerely,
J. R. Ward
J. R. Ward

Find out for yourself why Mr. Ward is so enthusiastic about this Jewel Case. If you are responsible for the selection or specification of set screws you can have this Setko Jewel Case on loan, without cost or obligation. In addition to the more than 30 samples it contains of all the regular and special varieties of Setko Set Screws, we will send you in addition a generous supply of test samples of any type set screw you specify for your use in testing.

**Set
Screw
& Mfg. Co.**

For complete details of this offer, send now for Free Jewel Case Bulletin.

265 Main St., Bartlett, Ill.
(Chicago Suburb)
1273R

We specialize in Solving Puzzling Set Screw Problems

CIRCLE 115 ON READER-SERVICE CARD FOR MORE INFORMATION

Linear Bearing Adjustable Diameter



Adjustable diameter ball bushings are linear motion bearings, split longitudinally to provide line-to-line or slight preload fits when mounted in an adjustable diameter housing.

Free-running, no-play linear motion enables the tolerance on both the shaft diameter and bearing bore to be adjusted out simply and practically. In addition, the principle provides for compensation for wear that might eventually develop in severe applications.

The bearings are used in a housing that is merely split and provided with an adjusting screw.

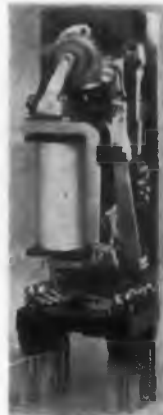
Adjustable Diameter Ball Bushings are available in standard sizes for shaft diameters ranging from one inch to four inches.

Thomson Industries, Inc., Dept. ED, Manhasset, N.Y.

CIRCLE 116 ON READER-SERVICE CARD FOR MORE INFORMATION

Stepping Relay

Has High Stepping Speed



This stepping relay, Type 7500/12, is characterized by long life and high stepping speed. It consists of a 12-point arc assembly, rotor assembly, and driving motor. Made by I. T. & T. System Co., Bell Telephone Manufacturing Co., Belgium, it has a stepping speed of 80 steps/sec with stepping pulses of a 50/50 make-break ratio.

An impulse type driving motor is used in the standard unit with a 48-v dc 244-ohm coil. Driving motors can also be supplied for 24-v, 110-v, and 120-v dc, or 110-v ac. The driving motor is fitted with a self-interrupter contact for driving the motor from a continuously applied voltage. An interrupter cam is fitted to stop the motor when the rotor is in the normal position.

The terminals of the relay are arranged so that the connection can either be soldered on or plugged into the relay tags. The relay can be mounted on a mounting plate or on a rectangular mounting bar. It has a life in excess of 10,000,000 revolutions. Overall size is 4-3/4 x 1-1/16 in., with a projection in front of the mounting plate of 3-1/8 in.

International Standard Trading Corp., Dept. ED, 22 Thames St., New York 6, N.Y.

CIRCLE 117 ON READER-SERVICE CARD FOR MORE INFORMATION

New Aircraft Controls Catalog Just Off Press

New Fenwal Publication Gives Data on Accessory Controls for Aircraft, Guided Missiles and Ground Control Apparatus



LATEST AUTHORITATIVE DATA on accessory controls comes from Fenwal, originators of famous THERMOSWITCH® unit and pioneers in many advanced ideas in aircraft, guided missiles and ground apparatus. Copies without charge.

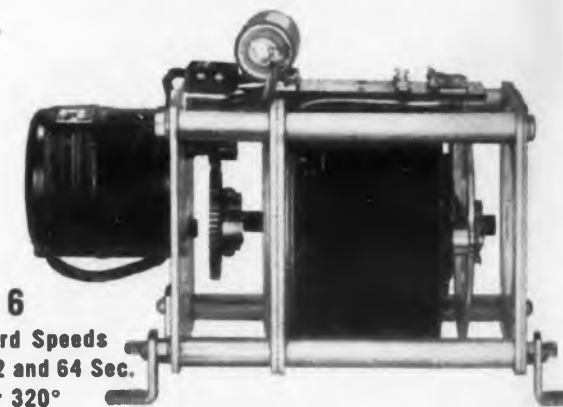
Here is new reference data everyone interested in aviation accessory equipment will want to have within reach.

It describes Fenwal Midget and Miniature THERMOSWITCH® units — logical answers to "tight-spot" temperature control problems. Gives general and specific data for standard and special applications according to government and or customer specifications.

If your problems include temperature control of liquids, solids or gases in any area, the information in this catalog should be valuable to you. Write for FREE catalog, "Accessory Controls", Aviation Products Division, Fenwal Incorporated, 99 Pleasant Street, Ashland, Massachusetts.

CIRCLE 118 ON READER-SERVICE CARD FOR MORE INFORMATION

Motor-driven Variacs® for Servo Applications and Remote Positioning Unique, Simple and Trouble-Free Designs



6
Standard Speeds
between 2 and 64 Sec.
or 320°

Gear coupling between motor and VARIAC® insures accurate alignment . . . no phase shifting . . . provides several drive speeds from one motor.

Low moment of inertia and high acceleration for servo uses . . . extra fast stopping with no overshoot for remote positioning.

Micro limit switches available for stopping at any position of the VARIAC, or for operating an auxiliary circuit when a given voltage is reached.

Moderately priced between \$75 and \$81, depending upon quantity. Complete Data in the NEW Variac 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

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CIRCLE 119 ON READER-SERVICE CARD FOR MORE INFORMATION

NOW!

Unlimited Phasing with Extreme Compactness



Phasing clamps available on three sizes of Gamewell RL-270A Blue Line Precision Potentiometers

This special Gamewell Phasing Clamp design has two important extras: Extreme compactness and High Temperature compatibility. Check these features . . .

- Only 1/4" depth per section
- Continuous service up to 150C available
- Stainless steel clamps give unlimited phasing
- Large number of taps, limited only by physical spacing
- Exclusive Gamewell high unit pressure contacts give permanent, low resistance tap connection, no

- linearity distortion
- Will withstand High "G" and operation under severe vibration
- Three styles of mounting: Servo, Bushing and 3-hole bushing
- Available in ball or sleeve bearings, shafts as specified
- Comes in models RL-270A-1 1/4", RL-270A-2 and RL-270A-3.

More information, prices and delivery available from Gamewell representatives or write:

THE GAMEWELL COMPANY
Newton Upper Falls 64, Mass.



PRECISION POTENTIOMETERS
SPECIAL!
Send for New Gamewell Catalog on complete line.

CIRCLE 121 ON READER-SERVICE CARD FOR MORE INFORMATION

A-D Converter Eight-Bit Sine-Cosine Unit



The Eight-Bit Sine-Cosine Analog-to-Digital Converter consists, basically, of two disk-type commutators with pick-off brushes. The double-brush V-scan system is used to avoid ambiguity.

The input shaft is scaled at 360 deg per revolution full-scale input. No intermediate gearing is necessary.

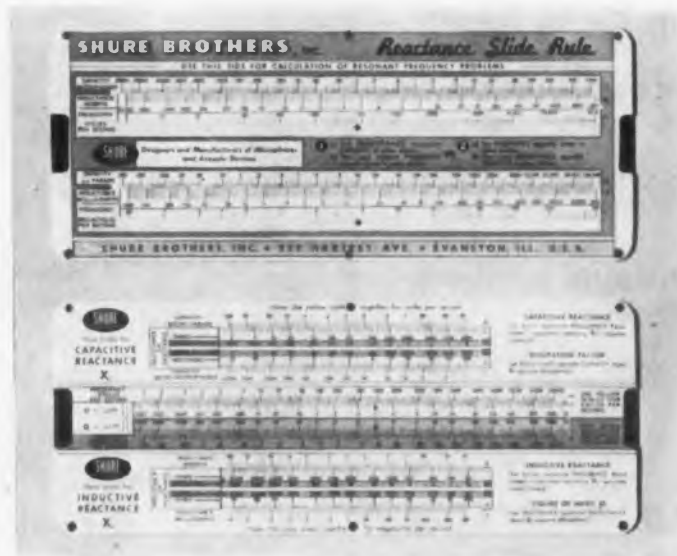
Coding is in continuous serial binary form in increments of 2-8 for values of the functions from zero to 1. A 9th bit is included to enable the encoding of the value one. The instrument is coded such that each quadrant is divided into 257 parts, each part representing equal values of the functions. Both sine and cosine values are simultaneously available.

The converter is compactly packaged in a cylindrical housing approximately 4 in. diam x 3-1/2 in. long, including the stationary portion of an electrical connector. A standard synchro-mount is provided on the input shaft end of the unit. Weight is approximately 20 oz.

Librascope, Inc., Dept. ED, Glendale 1, Calif.

CIRCLE 123 ON READER-SERVICE CARD FOR MORE INFORMATION

Reactance Slide Rule For Engineers



Reactance Slide Rule is again available. The slide rule is a time-saving means for simplifying calculations of resonant frequency range from 5 cycles per second to 10,000 megacycles.

Shure Brothers Inc., Dept. ED, 222 Hartrey Ave., Evanston, Ill.

CIRCLE 124 ON READER-SERVICE CARD FOR MORE INFORMATION



Official U. S. Air Force Photograph

Where a miss is worse than a mile

Today's new airborne weapons demand new standards of reliability.

Failure of even one part, for example, in the complex fire control computer of a modern interceptor like the F-102A (above) could nullify all the engineering skill that went into its design and construction. Even worse, such failure could cause a collision with target debris or allow the escape of a target bearing nuclear or thermonuclear weapons.

Reliability is one good reason engineers picked Bristol's® Syncroverter® high-speed polar relays for the fire control equipment.

These high-speed relays have a normal life of billions of operations in dry circuit applications. They are available in SPDT and DPDT models. They're reliable in such equipment as air-to-ground telemetering, analog and digital computers, aircraft or missile control, carrier-current switching, as well as others.

Your application may require different specs from those listed below. But chances are you'll find what you need in Bristol's broad Syncroverter line. Write for complete data. The Bristol Company, 151 Bristol Road, Waterbury 20, Conn.



Bristol Syncroverter high-speed relay. Covered by patents.

TYPICAL CHARACTERISTICS

Temperature range: -55°C to 100°C
Operating shock: 30G; 11 milliseconds duration
Vibration (10-55 cps, see below, mounting): 10G
Contact ratings: up to 35v, 45 microamperes
Stray contact capacitance: less than 15 mmfd
Pull-in time (including bounce):
as low as 200 microseconds
Drop-out time: 300 microseconds
Life: Billions of operations
Mounting: Octal tube socket; others available, including types for vibration to 2000 cps.

BRISTOL FINE PRECISION INSTRUMENTS FOR OVER 67 YEARS

CIRCLE 125 ON READER-SERVICE CARD FOR MORE INFORMATION

YOU CAN PROFIT with the BEAD CHAIN ECONOMICAL MULTI-SWAGE METHOD



this
FREE
catalog
can help
you to...

LOWER PRODUCTION COSTS on Tiny Metal Tubular Parts

Bead Chain's exclusive multi-swage method automatically swages almost any type of tiny metal tubular part from flat stock into precision forms with positive, tight seams. High-volume production can be delivered speedily and at far less cost than with conventional methods of manufacture! Parts can be beaded, grooved, shouldered and made of almost any metal. Diameters up to 1/4", lengths to 1 1/2".

WRITE
TODAY!

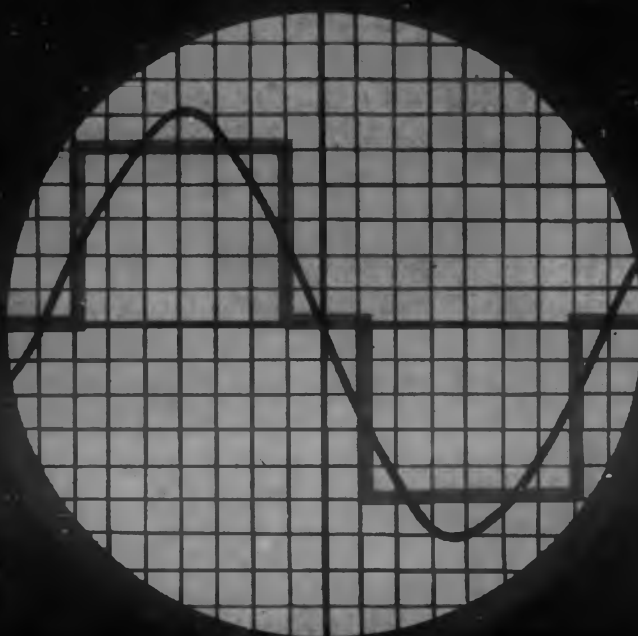
**THE BEAD CHAIN
MANUFACTURING CO.**

58 MOUNTAIN GROVE ST., BRIDGEPORT, CONN.

CIRCLE 122 ON READER-SERVICE CARD FOR MORE INFORMATION

TASKS like these...

- Reducing drift in D. C. amplifiers
- Improving the accuracy of relay amplifiers
- Extending ratio meters to D.C. applications
- Stabilizing D.C. amplifiers for zero and gain
- Reducing the size of servo amplifiers
- Automatically stabilizing high impedance in D.C. amplifiers
- Stabilizing amplifiers in analog computers
- Stabilizing wide band D.C. amplifiers and many other applications as modulators, demodulators, stabilizers and transfer devices.



require the proven performance of

OAK CHOPPERS

miniature contact modulators with tested stability

1. High temperature operation (up to 125°C).
2. High contact rating—exceptional for miniature unit.
3. No deterioration in performance due to operation or storage.
4. Contact deterioration from small or no load reduced to absolute minimum.
5. Exclusive, patented features assure unusual temperature, frequency and driving voltage stability.
6. Low voltage starting—6 volt choppers will start on as low as 3 volts.

plus OAK application-engineering

that assures correct application so vital to chopper life and performance. Send us the chopper portion of your circuits for analysis and application to your circuit requirements.

OAK NC600 series available for 15 to 600 cycle frequency operation.

Send for descriptive folder and performance graphs. Address Dept. "O"



OAK MFG. CO. • 1260 clybourn ave. • chicago 10, ill.

also manufacturers of OAK switches, tuners, vibrators and other electro-mechanical devices



ACTUAL SIZE

WEIGHT—less than one ounce.

Fits 7 pin miniature
JAN TS102P01 socket and
JAN TS102U02 shield.

New Masking Tape Has High Strength

Hi-Strength pressure sensitive flat-back masking tape, Permacel 728, has a 4 mil rope paper backing in an off-white color. The backing has been especially treated to give the tape high tear resistance coupled with thinness and high tensile strength. Recommended for the new tape are heavy-duty packaging applications.

In addition to adhesion to steel of 50 oz/in. of width, Permacel 728 has extremely high adhesive value to a wide variety of surfaces, making it suitable as a holding tape with job permanence.

Permacel Tape Corp., Dept. ED, New Brunswick, N. J.

CIRCLE 128 ON READER-SERVICE CARD

Printed Circuit Kit Speeds Circuit Layout

A complete kit for accurate and simplified production of engineering or prototype models of printed circuit parts has been developed, so that an etched electrical circuit, ready for assembly, may be had in about 30 minutes. A newly developed drawing pen is used to draw the pattern.

The kit, self-enclosed in its etching tray and cover, consists of the drawing pen and etchant resist ink, 4 bottles of etching powder, a drawing guide, 10 copper laminated Bakelite sheets (5 with copper laminate on two sides), 10 most popular tube sockets and detailed instructions for use.

Photocircuits Corp., Dept. ED, Glen Cove, N. Y.

CIRCLE 129 ON READER-SERVICE CARD

Trimmer Piston Capacitor 1 μf to 10 μf

A new precision trimmer piston capacitor, the VC11A, features a fused quartz dielectric with an invar tuning slug. The low dissipation factor remains constant, even with an ambient temperature rise of 100 C.

JFD Mfg. Co., Dept. ED, 6101 Sixteenth Ave., Brooklyn 4, N. Y.

CIRCLE 130 ON READER-SERVICE CARD

◀ CIRCLE 127 ON READER-SERVICE CARD

Receiving Tubes New Renewal Line

Thirteen tube types, including six designed for color television receivers, have been added to Sylvania's renewal line of receiving tubes.

Besides six special types for color television, the additions also include three series string types, three other television receiver types, and a miniature cathode type full-wave rectifier for special equipment use.

The type numbers are: 3A2, 3A3, 5V3, 6BJ8, 6BK4, 6CL5, 5CL8, 5CM8, 6BH8, 6BS8, 6CL8, 6CU5 and 6BW4.

Sylvania Electric Products Co., Dept. ED, 1740 Broadway, N. Y. 19, N. Y.

CIRCLE 131 ON READER-SERVICE CARD

Solar Grade Silicon For Solar Energy Use

Suitable for use in solar converters, a special grade of silicon known as "Solar cell" grade, is available for \$180 a pound.

While it must be exceptionally pure, the new grade of silicon used in so-called "solar batteries" does not require the extreme purity of semiconductor silicon.

E. I. DuPont De Nemours and Co., Inc., Wilmington 98, Del.

CIRCLE 132 ON READER-SERVICE CARD

Silicone Rubber Compounds Use Standard Molds

Three advanced silicone rubber compounds, particularly suitable for producing O-rings, comply fully to AN, MS, SAE, JIC and NAS dimensions and tolerances. They may also be used for fabrication of many other silicone rubber parts. These compounds, supplied in durometer hardness of 60, 70, and 80 and useful over a -80 F to +500 F temperature range, have the shrinkage properties of organic rubbers.

The compounds are non-toxic, making them suitable for food, ice cream and beverage processing applications, and they have zero moisture absorption, even when completely submerged in boiling water.

Goshen Rubber Co., Dept. ED, Goshen, Ind.

CIRCLE 133 ON READER-SERVICE CARD

CIRCLE 134 ON READER-SERVICE CARD >



GL-6442 tubes in quantity production by General Electric are assembled by h-f brazing in a hydrogen atmosphere.



The tubes are evacuated by rotary exhaust machine; afterwards, their metal stems are pinched off and sealed.



GL-6442 triodes are individually tested for their electrical characteristics, in order to assure tube dependability and full-rating performance at all times.

Quantity production of General Electric's GL-6442 makes this 4000-mc tube available for immediate large-scale use!

GL-6442's are being manufactured and shipped in volume by General Electric. Consequently, design engineers can specify this small, rugged lighthouse triode for immediate quantity application in microwave airborne equipment for planes and guided missiles.

Less than $2\frac{5}{8}$ " high and $\frac{5}{8}$ " in diameter, the GL-6442 puts out 2 kw of useful peak power at 3500 mc, as a Class C plate-pulsed oscillator. The tube's r-f Class C output at 2500 mc is $1\frac{1}{2}$ to 2 watts.

Dependable and long-lived! The GL-6442 will perform steadily at maximum ratings and still give full

warranted tube life. Heat-resistant . . . with safe CCS operation up to 175 C seal temperature! Shock-resistant . . . tested up to 400 G!

Advanced metal-ceramic construction; ultra-modern co-planar design! Newest and best u-h-f triode for CW and pulsed power applications that put a premium on compactness, sturdiness, and the ability to withstand high operating temperatures.

Ask . . . now . . . for complete GL-6442 ratings and characteristics! *General Electric Company, Electronic Components Division, Schenectady 5, N. Y.*

Progress Is Our Most Important Product

GENERAL  ELECTRIC

162-186

Precision Instruments . . .

backed by the

RCA reputation

for engineering

excellence



Precision Impedance Bridge
Type LB-52

Precision Impedance Bridge

Now . . . From RCA . . . One of the Most Versatile
Impedance Bridges In Its Price Class

Incorporates these important advances: A metered variable DC source of voltage and current. AC detection for all measurements including DC measurements via "magic eye" null indicator. Provisions for use of external standards. Measures resistance, capacity, inductance, dissipation factor and "Q".

Bridge may be excited: DC, 60 cps or 1000 cps internally; or from 50 to 10,000 cps externally. Such versa-

tility facilitates measurement of incremental inductance and electrolytic capacitors.

A utility impedance bridge available at a lower price.

RCA Instruments of Laboratory Precision
PULSE GENERATOR ★ RF POWER METERS ★ NULL VOLT-
METERS ★ IMPEDANCE BRIDGES ★ SIGNAL GENERATORS ★
VACUUM TUBE VOLTMETER ★ MULTIMETER ★ CRYSTAL
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*Price in U.S.A.,
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USE COUPON BELOW FOR COMPLETE INFORMATION

Radio Corporation of America
Precision Electronic Instruments
Dept. K-292, Building 15-1, Camden, N. J.

Please send me complete information on the following instruments:

Send name of nearest representative

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Colored Printed Circuits

Using Ball Point Pen

Liquid resist, in ball point dispensing tubes, for printed circuits withstands even nitric acid used in the etching operation.

The resist comes in several colors, making it possible to color code the printed circuitry to aid in checking out prototype units. Since it is a non-conductor, it can be left on as a permanent protective coating to the copper circuit against corrosion and dirt. The process is low in cost.

Techniques, Dept. ED, 178-84 Central Ave., Hackensack, N. J.

CIRCLE 136 ON READER-SERVICE CARD

Polyester Glass Mat Laminates

Have High Impact Strength

Polyester resin glass mat laminates, having properties similar to reinforced plastics, have good dimensional stability, high impact strength, and above average arc resistance.

Their chemical resistance makes them useful materials in areas of high humidity and chemical fumes of an acid nature.

National Vulcanized Fibre Co., Dept. ED, 1056 Beech St., Wilmington 99, Del.

CIRCLE 137 ON READER-SERVICE CARD

New Phenolic Laminate

Low Cold Flow

A new electrical grade laminate, Phenolite E-2040, is a paper-base sheet laminate bonded with a special phenolic resin. In addition to its cold flow properties, the new grade features low moisture absorption, good dielectric strength (both perpendicular and parallel to the laminations), and ease of hot punching and shearing.

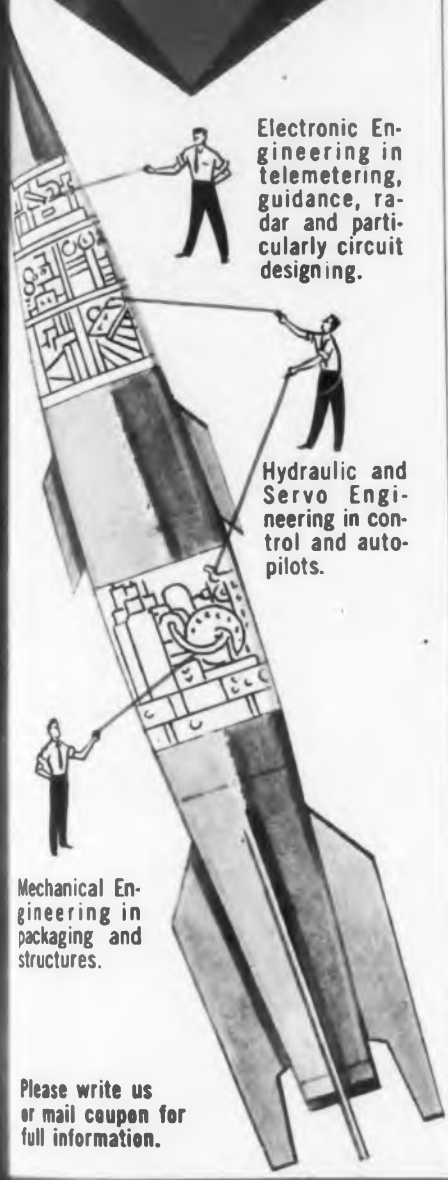
Grade E-2040 is available in sheets up to 39x47 in. and thicknesses from 0.010 to 1/4 in. Color is natural with dull finish.

National Vulcanized Fibre Co., Dept. ED, 1056 Beech St., Wilmington 99, Del.

CIRCLE 138 ON READER-SERVICE CARD

← CIRCLE 135 ON READER-SERVICE CARD

**THIS
IS THE KIND OF
ENGINEERING
HELP
WE NEED!**



Electronic Engineering in telemetering, guidance, radar and particularly circuit designing.

Hydraulic and Servo Engineering in control and auto-pilots.

Mechanical Engineering in packaging and structures.

Please write us or mail coupon for full information.

W. C. Walker, Engineering Employment Mgr.
Pacific Division, Bendix Aviation Corp.
11606 Sherman Way, North Hollywood, Calif.

I am interested in this engineering field ____
I am a graduate engineer with ____ degree.
I am not a graduate engineer but have ____ years experience.

Name _____
Address _____
City _____
Zone _____ State _____

CIRCLE 139 ON READER-SERVICE CARD

**Sealed Trimming Potentiometer
For Extreme Environmental Conditions**



A sealed trimming potentiometer, subminiature in size, offers dependable performance under extreme environmental conditions.

Designated the Trimpot Model 230, this unit is designed to meet or exceed military humidity specifications (MIL-E-5272A).

The potentiometer is furnished with wire wound or carbon resistance element. The wire wound 230 Trimpot will operate at 135°C and dissipate 0.4w at 50°C. It is screwdriver adjusted over 25 turns, with a self-locking shaft for stable settings. Ruggedly constructed, it will withstand severe conditions of shock, vibration, acceleration, sand and dust.

Bourns Laboratories, Dept. ED, 6135 Magnolia Ave., Riverside, Calif.

CIRCLE 140 ON READER-SERVICE CARD FOR MORE INFORMATION

**Binding Posts
For Instrument Applications**



Series No. 29 Binding Posts, quality units for fine instrument applications, are equipped with non-turn "D" washers and banana plug receptacles. They are available in red or black phenolic.

Model No. 29-1 shown at right) has a trim design with an OD of only 1/2 in. and is for 3/8-in. mounting holes on 3/4-in. centers. Model No. 29-3 has a 5/8" OD and is available for 1/2 in. mounting holes in existing equipment or for wider spacing. It is shown at left.

Metal parts are brass, cadmium plated 0.0003-0.0005 in. thick to withstand 50-hr minimum salt spray exposure. Thermosetting phenolic parts are of MIL-P-14, Type CFG; this material will withstand approximately 295 F without distortion. Back-of-panel studs provide for both screw and solder connections.

Grayhill, Dept. ED, 561 Hillgrove Ave., La Grange, Ill.

CIRCLE 141 ON READER-SERVICE CARD FOR MORE INFORMATION



Crosley Engineers ARE PUTTING THE EYES AND EARS IN SPACE!

Do you fit into this Engineering drama?

The daring approach . . . probing the dark recesses of the unknown. CROSLEY Electronics Engineers are taking the calculated risks which offer great discoveries as the triumphant reward.

Research and development in Communications and Radar now offer exciting possibilities. Here are areas now being explored.

- Radar—all phases
- Control Systems
- Digital Techniques
- Airborne Navigational Equipments
- Transmitters and Receivers
- Audio Circuitry
- Amplifiers
- Transistor Circuit Design

High calibre Engineers are needed to enter into these unusual programs. All benefits are available plus modern facilities. Relocation costs plus a 15 day subsistence allowance are paid by CROSLEY.

Please Send A Written Resume To:

D. B. Nason
Vice President and Director of
Engineering
Dept. No. T-9



2630 Glendale-Milford Road, Evendale, Cincinnati 15, Ohio

"Known for the NEWEST—Respected for the BEST!"

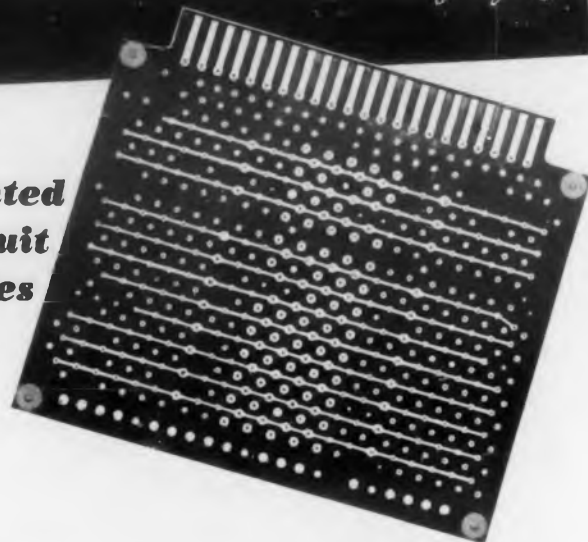
CIRCLE 142 ON READER-SERVICE CARD FOR MORE INFORMATION

TRACER-GUIDED DRILLING

100 HOLES P. M.

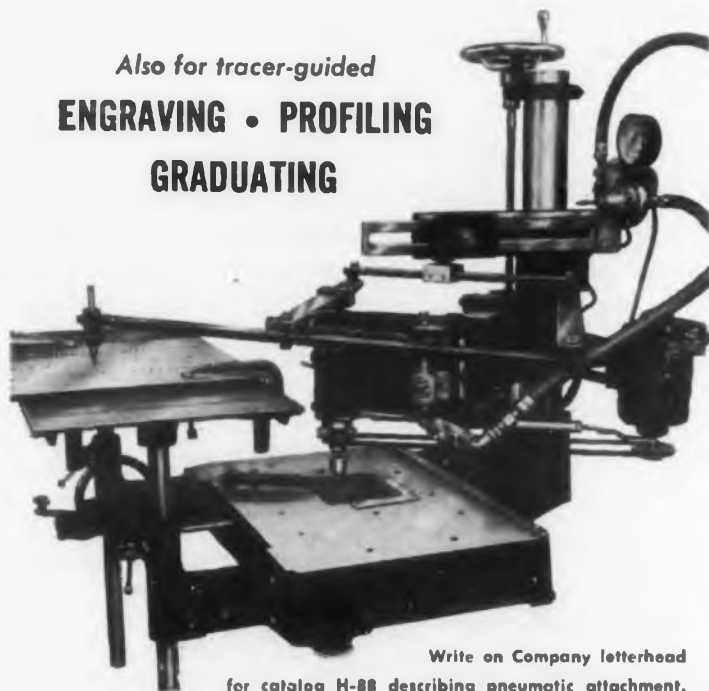
WITH NEW HERMES *Engravo* graph

for
printed
circuit
plates



- Pantograph reproduces drill pattern from template in any reduction ratio — assuring high accuracy.
- Allows drilling and routing of different size holes in one operation without changing tools.
- Pneumatic attachment with adjustable feed gives high speed production.

Also for tracer-guided
**ENGRAVING • PROFILING
GRADUATING**

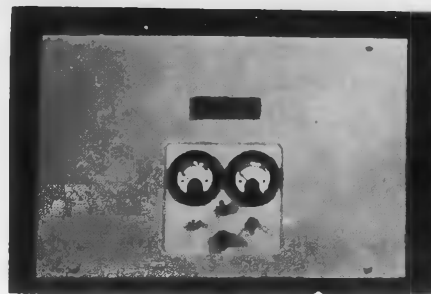


Write on Company letterhead
for catalog H-88 describing pneumatic attachment.

new hermes

ENGRAVING MACHINE CORP.
13-19 University Place, New York 3, N. Y.

DC Power Supply Regulated to $\pm 0.2\%$



The Model 910 "Reactrol" Power Supply provides an output voltage adjustable over a limited range without affecting the regulat-

ing properties of the unit. It is also characterized by rapid recovery to line and load changes, and ripple is kept at a low level. It is mounted in a cabinet complete with meters and ready for operation. A rack-mounted version is also available.

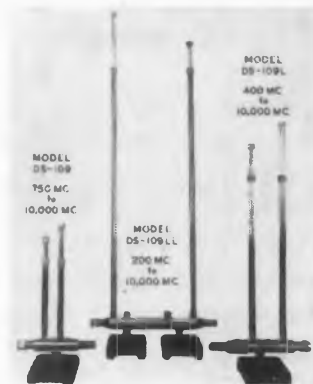
Output voltage is 28 v dc, variable $\pm 10\%$ of the nominal value with rated accuracy and down to -20% with lesser accuracy. Regulation is $\pm 0.2\%$ for line voltage variations from 100 v to 130 v and for load changes from 10% to 100% of maximum load rating. For no load, regulation will decrease to approximately $\pm 0.5\%$. Output current is 10 amp. Ripple voltage is 0.25% at 60 cps. Input frequency is 60 cps $\pm 5\%$. Ambient range is -20 to $+35$ C. Size of the cabinet unit is 14 x 21-3/4 x 15-1/4 in. deep.

Deltron, Inc., Dept. ED, P. O. Box 192, Glenside, Pa.

CIRCLE 145 ON READER-SERVICE CARD FOR MORE INFORMATION

Double Stub Tuners

Cover 200-10,000 Mc Range



Three tuners offered by this firm cover the frequency range of 200-10,000 Mc. Their sliding contacts are placed outside of the high current region and permit smooth, low-noise adjustments. Each sliding contact is machined from a solid phosphor bronze rod. Collet locks

have been added to each stub, permitting quick locking of the tuning position; the relative position of the two stubs is readily adjustable to either of three positions.

The tuners can be used to match loads such as bolometer mounts; match rf sources for maximum power transfer; make direct measurements in a 70 ohm system using a 50 ohm slotted line, matching a 70 ohm load to 50 ohms; to provide a dc return; and to suppress 2nd harmonics.

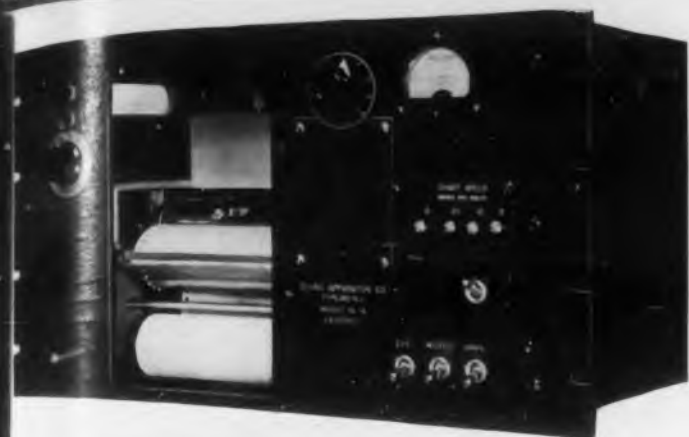
Weinschel Engineering, Dept. ED, 10503 Metropolitan Ave., Kensington, Md.

CIRCLE 146 ON READER-SERVICE CARD FOR MORE INFORMATION

in 1956

ELECTRONIC DESIGN

*will reach
your desk
24 times*



**INTRODUCING our
NEW 4" SLIDING COIL RECORDER**

**MODEL
SL-4**

**ELECTRONICALLY CONTROLLED
FAST AND SLOW PEN-SPEED
CONVENIENT SELECTION
OF CHART SPEED**

*Easily adapted
to sound, wave,
vibration and
noise analyzers.*

This compact, sturdy instrument incorporates novel, unsurpassed, patented features in its recording unit.

Primarily a frequency response recorder, this instrument is adaptable to a multitude of measuring problems in the electro-acoustical field.

Full particulars in our bulletin—sent upon request



SOUND APPARATUS COMPANY

Designers and Manufacturers of Graphic Recorders
STIRLING, NEW JERSEY

CIRCLE 150 ON READER-SERVICE CARD FOR MORE INFORMATION

P **GRIEVE-HENDRY
PORTABLE
ELECTRIC
OVENS...**

*Standard Models
For Every
Special Need!*



Model CR-1
10 cu. ft. capacity—30" wide x 25"
deep x 24" high. Removable shelves
and drip pan. **\$98.50**

f.o.b. Chicago

Portable. Costs less than 5¢ per hour to operate. Adjustable temperature control to 225° F. Fan driven forced air circulation. Uniform temperature throughout. Plugs into any 110V wall outlet—no special wiring required.

**Quick Quotations
—Reasonable
—Prompt Delivery
Prices—on Ovens
made to your specifications.**

Can be used in a group or bank. Use them on the production line—save handling—hauling.

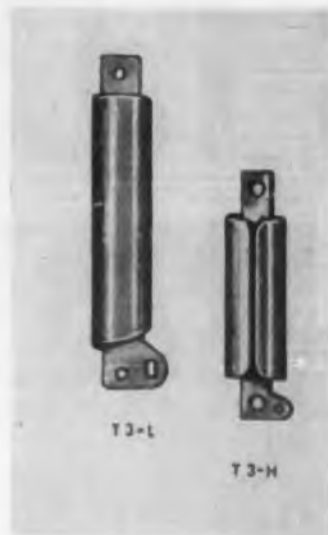
Other standard models with temperature ranges to 1000° F. available. Write for literature.

GRIEVE-HENDRY CO., INC.

1419 W. Carroll Ave., Chicago 7, Ill.
Export Dept., 10406 S. Western Ave., Chicago 43, Illinois

CIRCLE 151 ON READER-SERVICE CARD FOR MORE INFORMATION

**Shield Mounts
Two Phosphor Bronze Units**



Two new Shield-mounts have been announced by this firm. The T-3H is designed for heavy-duty use and when higher periods of vibrations are encountered. It is made of 0.015 in. thick phosphor bronze.

The T-3L is designed for use with T-3 bulb size tubes 1-3/4 in. long. The greater surface contact area provides a higher degree of clamp-

ing and more surface contact area provides a higher degree of clamping and more surface area for additional heat dissipation. It is made of 0.008 in. phosphor bronze. Both units can be provided in plain, silver-plated, or black finish.

Nems-Clarke, Inc., Dept. ED, 919 Jesup-Blair Drive, Silver Spring, Md.

CIRCLE 152 ON READER-SERVICE CARD FOR MORE INFORMATION

**Indicator Light
For Transistor Circuits**



A miniature indicator light for use with transistor flip-flop circuits, this unit incorporates a biasing-limiting resistor network within its 3/8 in. diam case. The bias voltage is adjusted to a point at which the transistor can gain control to switch the light on and off. The neon lamp is pre-aged and selected for a specified operating voltage range. The unit is used in computers and other transistor switching circuits. It may also be used in conventional vacuum tube circuits where the control signal swings over a narrow voltage range.

Overall length is 2-1/2 in., and full advantage is taken of the extremely small diameter body through the use of slotted mounting nuts of 1/2 in. diam. Extra wrenching space around the unit is not needed, as when using hex nuts. The aluminum case can be provided with a flat to prevent turning in the panel. Lenses are available in clear, red, and amber plastic.

Eldema Corp., Dept. ED, 9844 Remer St., El Monte, Calif.

CIRCLE 153 ON READER-SERVICE CARD FOR MORE INFORMATION

General Type



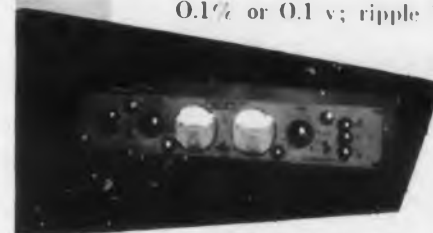
New

PROGRAMMABLE

(Remote Control)

regatron power pack

Unique circuit design of these newly developed power supply units is intended for applications requiring remote control and/or programming according to commands from an operator or control system—such as in tube-test programming, automatic production testing, and other automated processes. Also useful for general applications, all models feature main and vernier controls. Regulation applies over full range and for all load conditions; 0.1% or 0.1 v; ripple 1 M. V.



**TRANSISTOR
POWER
PACK**

- Main and Vernier Controls
- Auxiliary Bias and Filament outputs (General Type)
- Designed for Automation. Transistors, Test Consoles, Computers
- Ideal for Laboratory and Production Purposes
- Unusually low-priced, High-Quality Units

General Types:	Volts	Current
Model 231 A	0-300	0-100 MA
Model 232 A	0-300	0-200 MA
Model 233 A	0-300	0-300 MA
Transistor Types:		
Model 212 A	0-100	0-100 MA
Model 213 A	0-50	0-1000 MA
Model 214 A	0-100	0-1000 MA

Write today for Additional Information to Dept. D1



**Electronic
MEASUREMENTS COMPANY INC.**

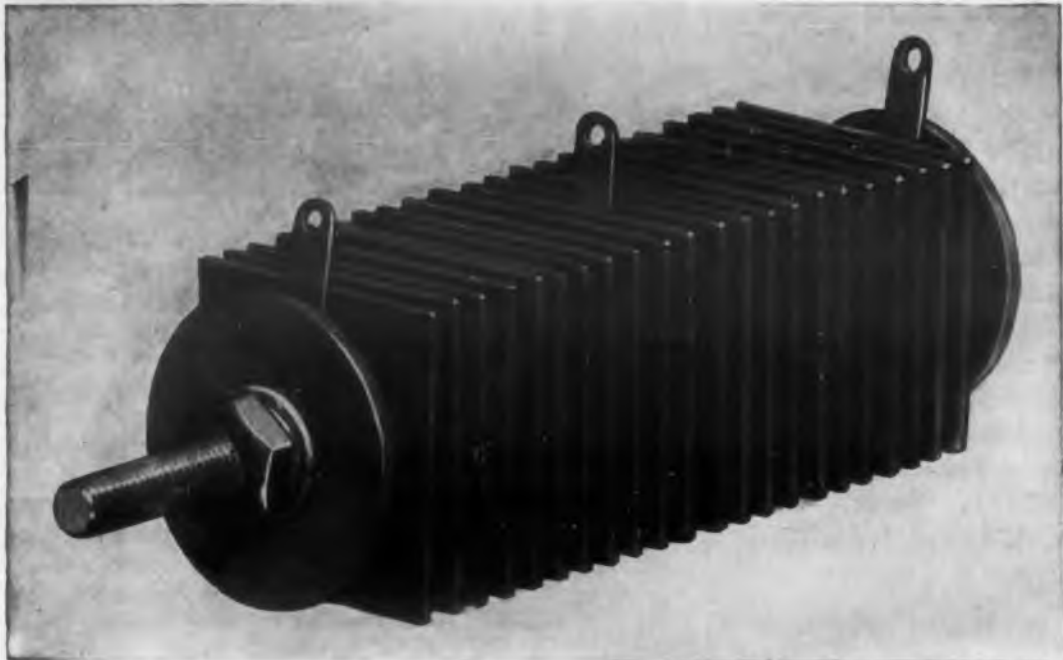
EATONTOWN, NEW JERSEY

Eatontown 3-0300

CIRCLE 154 ON READER-SERVICE CARD FOR MORE INFORMATION



DES



80,000 hours of reliable performance are possible with *Vac-u-Sel** rectifiers

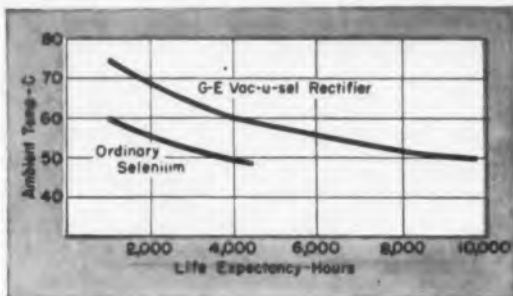
High reliability and maximum life are two prime objectives when you are designing a circuit for an essential-service type of industrial machine. General Electric's full line of Vac-u-Sel rectifiers can be expected to provide dependable service, and it will pay you to take advantage of their special characteristics and application flexibility.

These rectifiers are designed for up to 80,000 hours of life at full-rated current and voltage. This is at least 1/3 longer than the life expectancy of ordinary selenium rectifiers under the same conditions.

The high quality of Vac-u-Sel rectifiers can be translated into other benefits. By

operating the stacks above their normal rating, Vac-u-Sel rectifiers can be made up to 50% smaller than ordinary rectifiers. This is possible because of the greater current-carrying capacity and the higher voltage rating of the individual cells. The smaller size and lower cost more than offset the reduction in life. Note the accompanying graph.

Another benefit is that Vac-u-Sel rectifiers can be operated at high temperatures. Typical life span is more than 1000 hours at 130 C ambient when the cells are being operated at their normal room temperature ratings. Vac-u-Sel rectifiers are produced by a unique sphere-type vacuum-evaporation process that enables G-E design engineers to predict accurately the output and life characteristics of any model number. We are thus able to give you a stack which is better suited to your exact life requirements. By so tailoring each stack, you receive the benefit of top quality for your particular application and at the best possible cost. For further information, write for Bulletins GEA-6273 and GEA-5935.



*Trade-mark of General Electric Co.

GENERAL



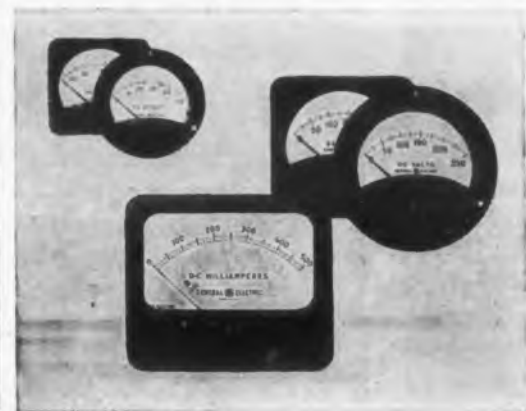
CIRCLE 156 ON READER-SERVICE

DESIGNER'S



G-E switchboard and panel instruments save you space, enable easy readability

Clear, uniform illumination of the scale is the result of General Electric's new shadow-proof covers in its line of long-scale switchboard instruments. This new design eliminates scale shadows caused by overhead lighting and enables you to read the instruments clearly regardless of the angle of illumination. Sturdy construction, good readability, and high degree of accuracy coupled with small size are features of G.E.'s line of miniature panel instruments. Panel instruments are particularly useful in radio equipment and industrial installations where space is at a premium. For complete information on these and other G-E instruments, write for Bulletins GEC-1016B, GEC-218, GEC-336.



Amplidyne† provides fast, precise electrical control

In continuous process manufacturing applications and in Ward Leonard systems, the General Electric Amplidyne provides the accuracy of performance necessary in complex electronic control systems. It will help your machine control system provide required adjustment of speed, current, voltage, or position.

Unique use of a short circuit and compensating winding in the General Electric Amplidyne creates such precise electrical balance that the smallest electrical signals release kilowatts of output capable of controlling the most powerful machinery. The amplidyne has found its greatest use in feedback control systems.

Wherever an electric signal can express the need for a change in process or operation the amplidyne can serve you. When applied on tracer control, the amplidyne's instant response cuts seconds off each pass, increases productivity.

In operations where positive control of several factors such as tension and speed in paper, printing, and textile machines, the rugged amplidyne is ideal. For further information write for Bulletin GEA-4053B.

† The Amplidyne—rotating amplifier developed by General Electric—the heart of this and many other systems requiring the maximum in reliability and precision.



ELECTRIC

SEE CARD FOR MORE INFORMATION

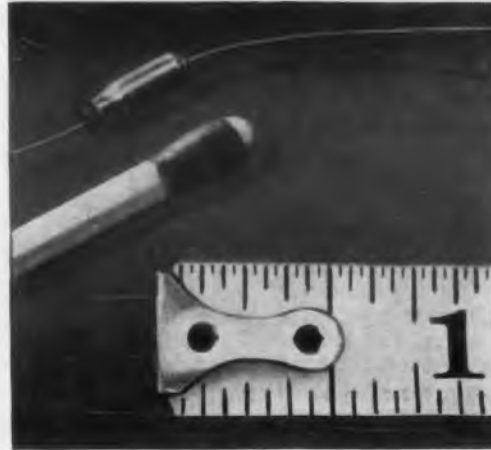
Specify Tantalytic* Capacitors to meet critical size and temperature requirements



85 C TANTALYTIC CAPACITOR



125 C TANTALYTIC CAPACITOR



MICRO-MINIATURE CAPACITOR

Small size, wide temperature range, and high reliability are features of General Electric's three separate lines of tantalum electrolytic capacitors. Designed for applications ranging from transistorized electronic equipment to guided missile electronic systems, Tantalytic capacitors can help solve your most critical design problems.

Their high quality assures longer, more dependable operation at a real savings in circuit space. High temperature General Electric capacitors in rectangular and tubular forms meet the varying requirements of modern electronic design. Available in polar or non-polar types for a-c and d-c circuits, Tantalytic capacitors operate at full rated voltage. Write for Bulletin GED-2620.

*Reg. Trade-mark of General Electric Co.

Actuator-Switchettes simplify electrical switch problems

When your application calls for a switching mechanism where space is limited and long life is required, specify General Electric's line of precision, snap-action switchettes.

General Electric switchettes can be used anywhere an electrical switch is needed, in any position, and in temperatures of -70 to 200 F. They not only resist corrosion and vibration, but are small, lightweight, consistently accurate, and extremely reliable.

Small size and light weight are shown below in the Size 1 Switchette which is approximately 1 1/4 inch by 1/2 inch by 1/2 inch and weighs only 9 grams. This compact design makes it ideal in such applications as machine tools, portable power tools, and in other machines and components where special circuit arrangements are necessary.

In addition to those units pictured, the collar-mounted limit switch is ideal for panel and door applications. These units are rugged and highly dependable, even in such severe operations as automatic reverse-action machine tools.

The snap-action, double-break construction gives the standard switchette a high current rating of 10 amperes at 115 or 230 volts a-c. Designed in a wide variety of contact arrangements, they are equipped to handle a 115-volt, 1/2-hp motor.

Whatever your electrical switch needs are, G-E switchettes will help you solve your most difficult actuator-plus-switch problems.

For further information write for Bulletins GEC-796A, 949A.

Versatile General Electric photoelectric relays assure inexpensive, dependable operation

High sensitivity and high speed for a wide variety of applications are possible with



General Electric's complete line of photoelectric relays. Seven standard combinations of relay and accessories meet many applications such as counting, controlling, and signaling operations.

Responding to light changes as small as 1/2 foot-candle, these high-speed relays are capable of up to 600 operations per minute. In most cases, the high contact rating eliminates the need for an auxiliary relay. The magnetic relay can operate a motor, motor starter, indicating lights, solenoids, electric counters, or similar devices.

Installation and adjustment are accomplished easily, and only a screwdriver is required to set the relay to operate at different levels.

To select the model best suited to your individual requirements, write for Bulletins GEA-5920A, 5921, and 3533D.



BASIC TERMINAL ARRANGEMENTS are available with any actuator for immediate shipment. Whatever your requirements are, General Electric can provide the right terminal arrangement.



LEAF-ACTION AND ROLLER TYPES simplify electrical switch problems. Leaf type operates under low force, small movement. Roller types are for fast-moving cams.

GENERAL ELECTRIC COMPANY, APPARATUS SALES DIVISION, SECTION B 667-34
SCHENECTADY 5, NEW YORK.

Please send me the following bulletins:

- | ✓ for reference only | | ✗ for planning an immediate project | |
|--------------------------|--|-------------------------------------|-------------------------------------|
| <input type="checkbox"/> | GEA-5920A Photoelectric Relays | <input type="checkbox"/> | GEA-5935 Vac-u-Sol Rectifiers |
| <input type="checkbox"/> | GEA-5921 Photoelectric Relays | <input type="checkbox"/> | GED-2620 Capacitors |
| <input type="checkbox"/> | GEA-3533D Photoelectric Relays | <input type="checkbox"/> | GEC-796A Switchettes |
| <input type="checkbox"/> | GEC-1016B Catalogue of Measuring Equipment | <input type="checkbox"/> | GEC-949A Collar-Mounted Switchettes |
| <input type="checkbox"/> | GEA-6273 Vac-u-Sol Rectifiers | <input type="checkbox"/> | GEA-4053B The Amplidyno |
| <input type="checkbox"/> | GEC-218 Long-scale Switchboard Instruments | <input type="checkbox"/> | GEC-336 Panel Instruments |

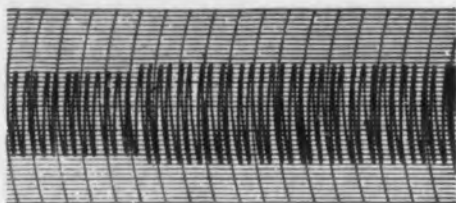
NAME

COMPANY

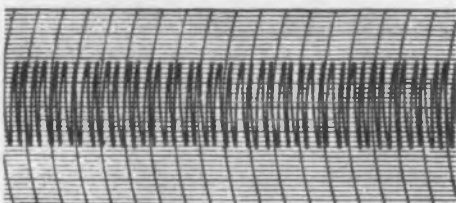
CITY STATE

CIRCLE 156 ON READER-SERVICE CARD FOR MORE INFORMATION

Regulation in less than $1/50$ th cycle . . .



Output of typical electromechanical regulator in response to step change in input voltage. Average correction rate of 6v. per sec.



Output of Curtiss-Wright Distortion Eliminating Voltage Regulator from same input. Full recovery in 330 microsec.

Simultaneous two-pen recording of 60 c.p.s. voltage

PLUS Pure Sine Wave Power

CURTISS-WRIGHT LINE REGULATOR

- Electronically regulates r.m.s. and peak voltage simultaneously to $\pm 1\%$.
- Reduces typical power line distortion to less than 0.3%.
- Furnishes 1.4 KVA of distortion-free power.
- Introduces no phase shift between input and output.
- Simultaneously provides additional 4 KVA of $\pm 1\%$ electromechanically regulated power.

Faster recovery time (less than $1/60$ th cycle, or 330 microseconds) plus the unique ability to *eliminate* line distortion — these are the reasons why the Curtiss-Wright Distortion Eliminating Voltage Regulator has been chosen by more and more laboratories and production test departments. Besides general laboratory use, this line regulator provides sim-

pler, more accurate calibration of meters . . . better design of transformers, synchros, motors . . . easier testing of such components, with fewer rejects . . . easier, more accurate measurement of magnetic properties and receiver sensitivity . . . better a.c. computer performance . . . elimination of fast line transient effects. Write for details.

Electronic Component &
Instrument Sales Department



CIRCLE 157 ON READER-SERVICE CARD FOR MORE INFORMATION

New Literature

Drafting Template 158

A new drafting template of standard self-locking anchor nuts is now available covering standard anchor nuts conforming to AN362 and AN366, in addition to single-lug, corner-type, and floating anchor nut styles. Guides for drawing recessed head screws in plan and profile views are included.

Kaynar Co., Kaylock Div., 820 E. 16th St., Los Angeles 21, Calif.

Detector Cells 159

Brochure No. TB 1300-1 has been offered describing thermistor bolometers as effective detectors of infrared radiation in the spectral region from 1 to 12 microns or more. These fast, sensitive, rugged, and long lived units are designed for use in heat detection, measurement of control systems where direct contact with the source is inadvisable or impossible. The brochure provides information on the basic nature and construction of thermistor bolometers, static characteristics, dynamic characteristics, noise, level, infrared transmitting windows, and circuit design consideration are described and amply illustrated.

Servo Corp. of America, 20-20 Jericho Turnpike, New Hyde Park, N. Y.

Bearing Chart 160

A chart has been published showing the complete chemical, mechanical, and work characteristics of a wide range of sintered bearing materials. The proper material for sintered bronze or iron bearings has always been a major problem to design engineers. The chart is easily read so that the best material for most applications can be selected by a draftsman in a matter of minutes.

Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.

Warning Signal 161

Bulletin No. 623 has been published giving information on the "Gyalite" flashing warning signal for accident prevention and other purposes. The signal maintains a maximum warning effect and lower maintenance cost and is mounted in a heavy cast aluminum housing. It flashes 96 times a minute in red, clear, and colored light. It is recommended for open manholes, emergency vehicles. The Type 15360 "Gyalite" is available for a wide range of voltages.

Pyle-National Co., 1334 N. Kostner Ave., Chicago 51, Ill.

Facilities and Operations 162

A brochure has been issued that provides a picture of present day modern plant operation. Included in this well-illustrated pamphlet are the people and machines at work. The plant manufactures a wide range of heat and moisture resistant wires and cables. In addition, insulations are made of asbestos, varnished cambric, nylon, glass, Teflon, Kel-F, polyvinyl, polyethylene and silicon rubber.

Continental Wire Corp., Wallingford, Conn.

Tabulation 163

A brochure No. R-8812 has been published describing a simplified method for typewriter tabulation. Adapted from the book *Typing Simplified*, this brochure outlines five simple steps for obtaining perfectly centered tabulation without complicated arithmetical calculations. Using the company's typewriter with a perfect positioning scale with zero center, the process is simpler, with two of the five steps eliminated.

Remington Rand, Div. of Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y.

DO YOU NEED

a really
RUGGED*
COMPACT
SENSITIVE

LIGHT-BEAM

GALVANOMETER



*Will take
25 G's!

this is it...

Here is a new series of light-beam galvanometers that were developed to withstand the extremely severe conditions of shock and vibration encountered in field servicing and testing of jet aircraft.

Through unique folding of the light beam, great compactness is achieved while retaining sensitivity to the highest degree... *equal to that of laboratory instruments!*

These Howell Galvanometers feature excellent readability. They are readily adaptable to existing instruments. They are competitively priced.

SPECIFICATIONS:

Sensitivity to .105 microamperes per millimeter. Resistances: 20, 100, 500 and 1000 ohms. Short period; high speed response. SIZE: ONLY 2.6" x 3.62" x 3.615" Sealed construction.

For full information
please write or wire



HOWELL INSTRUMENT Company

3108 Trinity St. • Fort Worth 7, Texas

CIRCLE 167 ON READER-SERVICE CARD

Potentiometers

168

A data sheet has been offered specifying the many variations of the linear travel potentiometer. The unit is designed to meet requirements of MIL-E-5272, and is currently undergoing tests to determine maximum limits of the various sections of the specification which it will successfully pass. It is satisfactory over a temperature range of -55 C to 140 C , which is the range specified for current production. It is anticipated that this range will be extended contingent to tests being run now. In addition the booklet includes rotary models that were designed and produced to particular customer specifications. One unit was for a drone auto-pilot application wherein the rotating shaft was required to withstand a 40 lb side load, and sealing against immersion was also specified.

Minco Engineering & Mfg., 801 8th St., S.E., Minneapolis 14, Minn.

Scintillation Detector

169

A data sheet has been offered describing the Model DS-3A scintillation well counter, an efficient detector for the measurement of gamma emitting radioactive samples. Some of the features covered in this booklet are a large sodium iodide "well" crystal which accommodates a test tube or centrifuge tube containing the radioactive sample. The counting geometry provided by the "well" permits rapid measurements and enables the user to obtain maximum statistical accuracy with minimum amounts of radioactivity. The counter has found wide application in medical applications. It serves as a sensitive unit for measurement of gamma ray emitting isotope in liquid or solid form.

Nuclear Instrument & Chemical Corp., 229 W. Erie St., Chicago 10, Ill.

Rectangular Shaped Motors

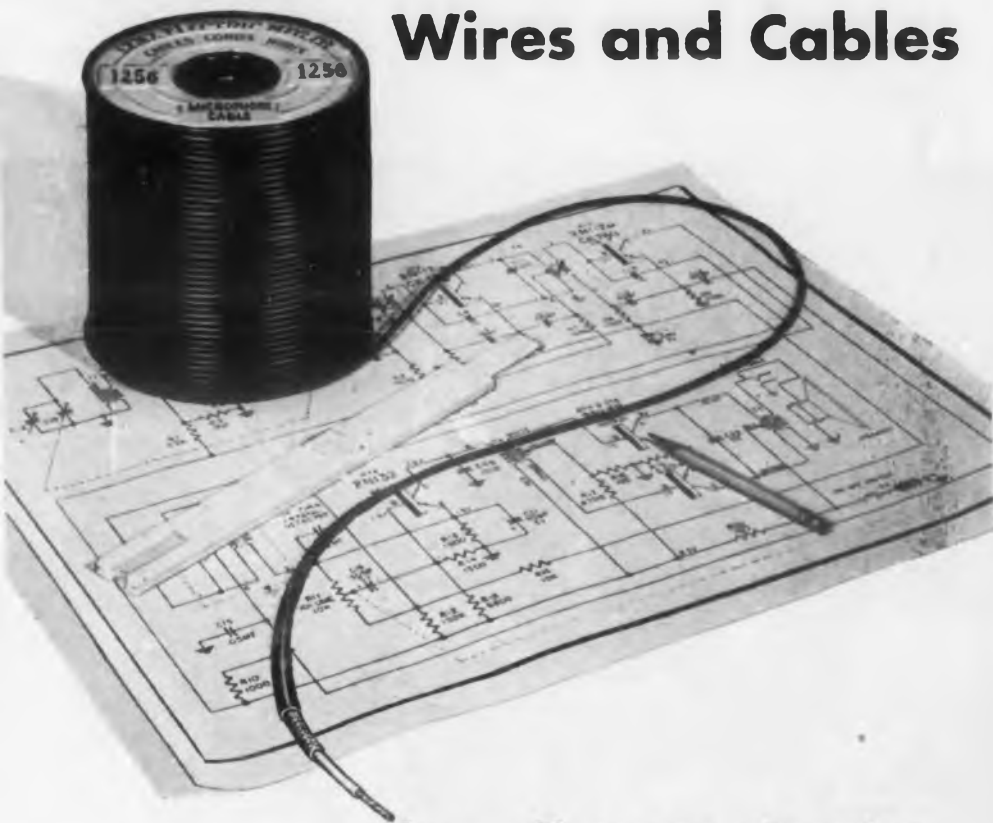
170

A 2-color catalog has been released describing the company's new line of rectangular shaped motors. The motors, which are available with a 12 v capacity and outputs up to 115 oz in., feature a special pole pattern which makes possible a flux path that is axial with the armature shaft, rather than concentric with the shaft as in conventional motors. All-welded construction, extra large bearings, welded heavy stampings which resist twisting, flexible installation, are some of the motors' principal features. Applications include window regulators, seat adjusters, air conditions, windshield wipers, defrosters, heaters and many others. The illustrated catalog contains detailed specifications, operating information, and representative performance data.

Leese-Neville Co., 1374 E. 51st St., Cleveland 3, Ohio.

LENZ

Wires and Cables



- for all your circuits

Since 1904, Lenz has been producing the wires and cables needed for communications equipment. When the Electronic Industry was born, and ever since, Lenz has devoted the major part of its engineering resources and manufacturing facilities to the production of the specialized and standard wires and cables required by Radio, TV and Electronic end use equipment and associated component parts. This long experience and the technical background Lenz has acquired in this field has proved extremely helpful to many of the leading producers of electronic equipment.

An invitation is extended to take advantage of Lenz extensive engineering and manufacturing facilities. Consult with Lenz for an economical solution to your wire and cable problems.

- Wires and Cables to Military or Commercial Specifications
- Lead Wire, UL Tested
- Hook-Up Wire, UL Tested
- Flat Multiple Conductor TV Remote Control Cable
- Microphone Cable
- Low Capacity Co-axial Cable
- PA and Inter-Com Cables
- Telephone Wires and Cables

*Circuit Courtesy Raytheon Mfg. Co.



CABLES

and

WIRES

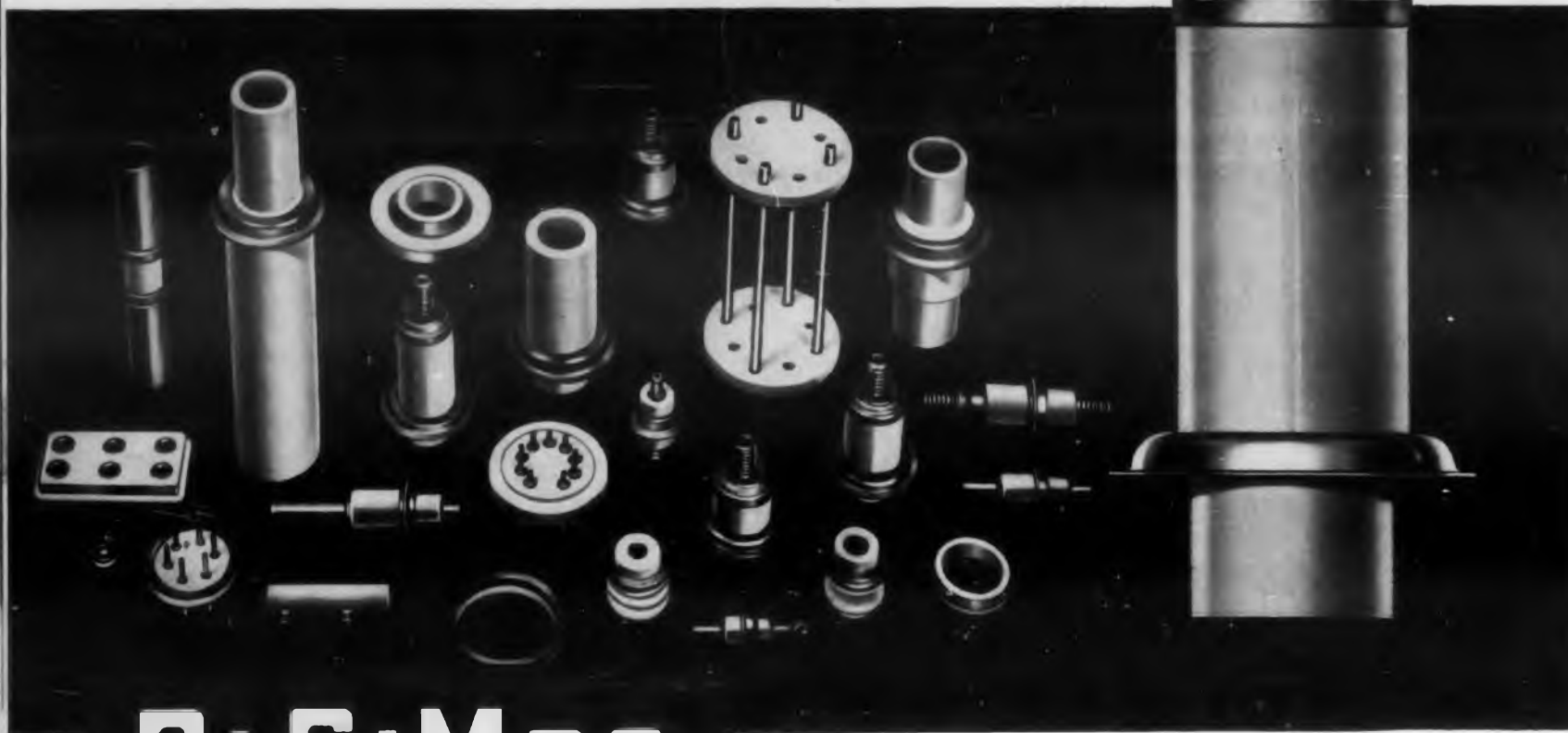
LENZ ELECTRIC MANUFACTURING CO.

1753 North Western Avenue

Chicago 47, Illinois

CIRCLE 171 ON READER-SERVICE CARD FOR MORE INFORMATION

**NOW... custom designs
available in volume!**



ALSiMAG

**HIGH TEMPERATURE
METAL-CERAMIC SEALS**

Outstanding results over wider temperature/frequency ranges. Available for silver solder brazing, hard or soft solder. Rapid, volume delivery of both custom and standard designs from greatly expanded production facilities.

Dependable, permanent bonding . . . close dimensional tolerances . . . strong Alumina

ceramics with extremely low dielectric loss . . . excellent insulation resistance . . . high softening temperature . . . outstanding mechanical and electrical characteristics over entire temperature range . . . improved glaze with superior surface resistivity . . . high tensile and impact strengths . . . greater resistance to chipping and spalling.

To assure optimum performance, American Lava engineers cooperate in establishing proper specifications and configurations on custom designs.

For complete information on ALSiMag Metal-Ceramic Seals for your application—in either high or low temperature fields—send blueprint with your planned installation and operating temperatures, electrical requirements or other pertinent data.

A Subsidiary of
Minnesota Mining and
Manufacturing Company



**AMERICAN LAVA
CORPORATION**

CHATTANOOGA 5, TENN.
55TH YEAR OF CERAMIC LEADERSHIP

For service, contact Minnesota Mining & Manufacturing Co. Offices in these cities (see your local telephone directory): Atlanta, Ga. • Boston: Newton Center, Mass. • Buffalo, N. Y. • Chicago, Ill. • Cincinnati, O. • Cleveland, O. • Dallas, Texas • Detroit, Mich. • High Point, N. C. • Los Angeles, Calif. • New York: Ridgefield, N. J. • Philadelphia, Pa. • Pittsburgh, Pa. • St. Louis, Mo. • St. Paul, Minn. • So. San Francisco, Calif. • Seattle, Wash. Canada: Minnesota Mining & Manufacturing of Canada, Ltd., P. O. Box 757, London, Ont. All other export: Minnesota Mining & Manufacturing Co., International Division, 99 Park Ave., New York, N. Y.

Flexible Shafts

178

Bulletin 570 recently issued illustrates typical installations using flexible shafting. It furnishes complete information on all sizes of shafting, from 1/8" to 1-5/8" in diameter, for either power drive or remote control applications. Rugged power drive shafts, with built-in bearings, are also illustrated. Standard fittings and ferrules available for these connections are shown in the bulletin.

Stow Mfg. Co., 79 Shear St. Binghamton, N. Y.

Parts for Heavy Wear

179

A brochure describing the supergray vulcanized fibre and thermosetting plastic has recently been issued. The supergray is of exceptional hardness and density combined with resilience.

The thermosetting plastic is used where dimensional stability, as well as wearing quality, may be required under severe operating conditions. Both materials are light in weight, highly resistant to corrosion and quiet operation.

Spaulding Fibre Co., Tonawanda, N. Y.

Transducers

180

A 4-page bulletin has been issued describing a new series of proximity transducer systems. The bulletin describes a standard and high sensitivity system. Both systems are capable of sensing operations in excess of 1000 per sec and are used with electronic counters, recording devices, batch counters, oscilloscopes, and dc volt meters. They are designed to operate under conditions of oil, moisture, vibration, and a wide variety of temperatures.

Electro Products Laboratories, 4500 N. Ravenswood Ave., Chicago 40, Ill.

Stroboscope

181

Catalog Sheet No. 18A-1 is a combined descriptive and instruction sheet on the Model 18A, and inexpensive 60-cycle stroboscope. It includes a table showing the revolutions per minute corresponding to different numbers of marks on the stroboscope disk when the stroboscope is operated on a standard 60-cycle power source. Berkshire Labs., 578 Bank Village, Greenville, N. H.

◀ CIRCLE 177 ON READER-SERVICE CARD

How to Charge HIGH-FLUX Magnets

Day-long
production
charging in
complete
safety and
comfort.



Use the MODEL 942 Magnet Charger

RECOMMENDED BY LEADING MAGNET MAKERS

This high powered condenser discharge unit will saturate large Alnico and ceramic permanent magnets of any shape, using interchangeable, plug-in pulse transformers or wire-wound fixtures. 100,000 ampere-turn output of basic unit can be increased to 200,000 ampere-turns at any time by adding 100 μ f condenser banks and appropriate pulse transformer. Adapters for multi-pole rotors, rod, bar, ring and various other shapes are available.

Operates from regular 115 volt, 60-cycle line with only intermittent 10-ampere drain (the few seconds when condensers are charging). Mounted on casters for convenient mobility. Price of basic unit with pulse transformer is less than \$2,000.



WE CAN HELP YOU
Our 12 years of magnet charging
experience is yours for the asking
— send a sample magnet or sketch
for free charging analysis.

Write for Technical and Application Data.

Radio Frequency

LABORATORIES, INC.

Boonton, New Jersey, U. S. A.

CIRCLE 187 ON READER-SERVICE CARD

Plastic Containers

188

A pamphlet has been released entitled "Plastics Weldor and Fabricator." The illustrated pamphlet describes various types of plastic, their advantages and applications. Of particular interest is a chart which covers the relative chemical resistance of several container materials. One article in particular illustrates and describes the company's newly introduced polyethylene pillows which are used to retard evaporation in open tanks and vessels as much as 70%. Also included are tips on the hot gas method of gas welding.

American Agile Corp., P.O. Box 168, Bedford, Ohio.

Load Cycle Counter

189

A pamphlet has been issued describing a telemetering load cycle counter that will accurately count only work or operations actually performed. It differentiates between idling, dry run and load cycle and counts only the load cycle. The unit is adaptable for accurate proximity or impact counting. It can also be used as a warning and/or counting instrument for material change of characteristics, dull tools, etc. Included in the pamphlet are specifications describing the load cycle counter which eliminates the inaccuracies of mechanical "no load" counts and the necessity for physical counting. The mechanism is sealed in a dust-proof, tamper-proof and locked box. Available with resettable 6-digit counter—speed up to 1000 counts per minute—power consumption 25 w—no heavy wiring required. Sensing and telemetering uses low voltage—long life components—cabinet 14-gage—supplied standard, JIC or NEMA 12-8" x 10" x 4-1/2".

Ram Meter Inc., 1100 Hilton Rd., Ferndale, Detroit 20, Mich.

Tubing

190

A pamphlet, Data Memorandum No. 4, has been published describing tubing in sizes with outer diameters from 5/8 to 2-1/2 in. and with wall thicknesses of 0.035 in. and less. The large diameter thin-wall tubing is produced in seamless and Weldrawn grades for application to a wide variety of products. The data memorandum gives useful information on bending, beading, flaring and welding the thin-wall tubing. A table on standard production limits lists sizes and wall thickness for more than 20 analyses in which this type of tubing is produced. Types include stainless, nickel and nickel alloy, carbon and alloy, beryllium, copper, and titanium. Other tables give the standard tolerances for size, ovality, straightness, and length.

Superior Tube Co., 1521 Germantown Ave. Norristown, Pa.

UNION

SPACESAVER "Selenium Slim" Rectifiers

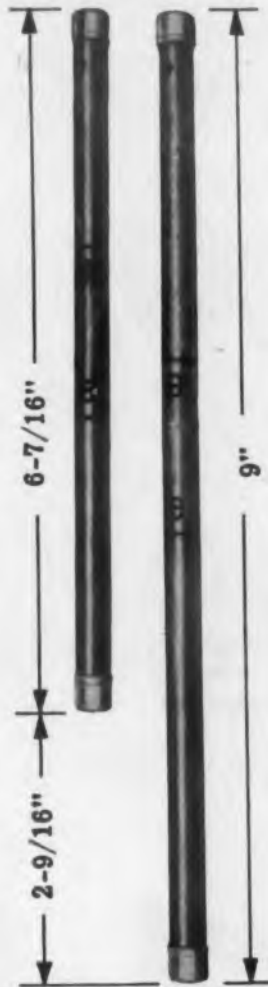
A COMPLETE line of UNION "Selenium Slim" Rectifiers is now made with a new cell which has a reverse voltage rating of 33 volts rms and is approximately 20% thinner than the previous cell.

These Spacesaver rectifiers offer more compact, efficient rectifier units and permit rigid space and performance requirements to be met. What's more, UNION's radically different manufacturing method for these miniature cells results in lower prices.

UNION Selenium Tubular Rectifiers, especially developed for high-voltage, low-current applications, are available in physical cell sizes from $\frac{1}{8}$ to $\frac{1}{2}$ inch in diameter and are rated 1.25, 2.5, 5, 10 and 20 milliamperes, D. C. per cell, in a half-wave circuit supplying a capacitive load. They are made for fuse-clip type mounting or with axial end leads. Available in both phenolic or hermetically sealed glass tubes.

A new, 33-volt, UNION selenium power rectifier cell is also available. Cells range in physical size from 1" x 1" to 5" x 6" and are designed for stud, bolt or bracket mounting. Ratings range from .180 to 10.0 amperes per cell on a single-phase, full-wave bridge basis in accordance with the latest NEMA approved specifications.

Write for complete information.



New Spacesaver "Selenium Slim" Rectifier using 33-volt cells is $2\frac{5}{16}$ " shorter than regular 9" rectifier using the original 26-volt cells. Voltage and current ratings are the same.

75 Years

1881



1956

OF EQUIPMENT AND SYSTEMS ENGINEERING

UNION SWITCH & SIGNAL

UNION OF WESTINGHOUSE AIR BRAKE COMPANY
PITTSBURGH 12, PENNSYLVANIA

CIRCLE 191 ON READER-SERVICE CARD FOR MORE INFORMATION

Performance through Precision

AIR MARINE MOTORS . . . leading manufacturers of high specification rotating equipment . . . is your outstanding source for fans, motors and blowers to meet most sub-fractional power requirements.

Adaptability through Variety



A158D-8
115 Volt 60 cycle double blower. 46 CFM at .28" static pressure.



B20B-7
115 Volt 60 cycle (or 400 cycle) blower. 50 CFM at 1.5" static pressure.



A15AD3
115 Volt 60 cycle axial blower. 35 CFM at .2" static pressure.



60-4
115 Volt 60 cycle blower. 100 CFM at 2.5" water gauge.



60-6
115 Volt (or 220 Volt) 60 cycle blower, 1 or 3 phase. 250 CFM at 2.5" water gauge.



A11A-4 115 Volt 400 cycle single phase propeller type blower using 4" 4-blade fan. Delivers 250 CFM at 0" static pressure.

years-ahead engineering...

Air Marine Motors equipment features stainless steel thru-bolts . . . die-cast aluminum housings . . . riveted stators . . . positive bearing alignment . . . uniform air gap . . . ball bearings . . . shock and vibration resistance . . . humidity and fungus resistance . . . omni-position mountings . . . temperature lubrication.

Write for specific information and brochure about any of these units . . . and use the Air Marine advisory services without obligation.



air-marine motors, inc.

369 Bayview Avenue

West Coast Factory 2055 Pontius Avenue

Amityville, N. Y.

Los Angeles 25, Calif.

CIRCLE 197 ON READER-SERVICE CARD FOR MORE INFORMATION

Transformers

198

A 24-page catalog with new design format and readable type face has been released describing transformers. Selection is simplified through a cross index of part numbers and by type of application. The catalog lists transformers for TV, radio, communication, industrial, and other electronic applications. A separate section discusses TV replacement transformers. It includes a quick preference listing of exact replacement flybacks arranged by original manufacturer and original part number. All the transformers are listed with detailed specifications, dimensions, and illustrated mounting styles.

Chicago Standard Transformer Corp., 3501 W. Addison St., Chicago 18, Ill.

Instruments

199

This 4-page brochure recently issued describes airmeters, vacuum gages, manometer-flowmeters, and electronic standard cells. Illustrated are various models with specifications. Included also are other instruments of interest.

Hastings-Raydist, Inc., Newcomb Ave., Hampton, Va.

Relays

200

A 4-page catalog sheet, R-29, has been published giving complete information on relay models—DOS, DOSY, DO and CRU, which are available in 65 different types. Models DO and DOS fill many industrial needs for a compact, lightweight relay that handles power loads usually requiring much larger, heavier units. Electrical and physical characteristics for the various units are given.

Ohmite Mfg. Co., 3637 Howard St., Skokie, Ill.

Silver Plating Process

201

An 8-page brochure has been offered describing the company's Silvrex Bright silver plating process. The booklet covers in detail such vital topics as bath make-up and maintenance; anodes, tanks, temperature; current densities; agitation; plating procedure; and simplified removal of solution impurities. The process gives a mirror bright finish directly from the bath through a complete range from flash to extra heavy deposits, and produces hard, and highly ductile deposits.

Sel-Rex Precious Metals, Inc., 229 Main St., Belleville, N. J.

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ENGELHARD INDUSTRIES

CIRCLE 202 ON READER-SERVICE CARD FOR MORE INFORMATION

Resistors

207

A catalog No. P-2b has been published describing types PW-5, PW-7 and PW-10 resistors. Three high temperature resistors, rated at 5 w, 7 w, and 10 w, are the latest additions to the company's expanding line of power resistors. The resistors have a high degree of automatic assembly and offer practical possibilities of cost savings. The maximum temperature coefficient is between -55 C and +110 C. Comprehensive data on construction, design, applications, ranges, ratings, tolerance, identification, dimensions, and charts and graphs.

International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa.

Resistor Engineering Guide 208

A data sheet is now available on resistors and special products. Data includes JAN or MIL equivalent, rated wattage, standard tolerances, temperature rise, temperature coefficient, maximum operating temperature, ohmic values available, dimensions, and appropriate prices.

International Resistance Co., 401 N. Broad St., Philadelphia, Pa.

Shaft-position Encoder

209

A bulletin has been published describing Type 309-13 shaft-position encoder. The unit is a precision photoelectric analog to digital converter for direct readings of shaft positions to an accuracy of one part in 8192. It is used in mechanical testing, missile guidance, radar, optical tracking and other applications in which the angular position of a rotating shaft expressed as digital information is required. The bulletin describes and illustrates the principle of operation, and gives full specifications as to accuracy, readout rate, size and mounting. Also described are other shaft-position encoders with non-linear readouts and accuracies up to one part in 65,536.

Electronics Corp. of America, Dept. 500, 77 Broadway, Cambridge 42, Mass.

Glassware

210

Two data sheets have been released in a continuing series on laboratory glassware. Featured in the first data sheet is a logical "two-way" test formula designed to facilitate laboratory glassware purchases. Data Sheet No. 2 features centrifuge tubes.

Doerr Glass Co., Vineland, N. J.

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Radio Corporation of America
Camden 2, New Jersey**



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Copper-Base Alloys

218

A 36-page booklet has been issued giving complete descriptions of the refractory copper-base alloys. Included in this booklet are specification information and applications for phosphor, bronze, nickel silver, beryllium copper, and cupro nickel. In addition the book contains weight tables for sheet, strip, rod, and wire; gage and decimal equivalents; definitions of trade terms; and a discussion of temper. The many industrial applications which are included make this booklet of interest to design engineers and metallurgists.

H. K. Porter Co., Riverside Metal Div.,
Riverside, N. J.

Telesync

219

A data sheet describing the Type TS-1 telesync equipment has been issued describing the requirements for a high quality unit for generating RETMA sync signals when used in conjunction with a high fidelity TV receiver. Also included are descriptions, block diagrams, and specifications.

Nems Clarke, Inc., 919 Jesup-Blair Dr.,
Silver Spring, Md.

Regulator

A 4-page brochure has been published describing the NUMAR Model C-1 magnetic field control system, a precision regulator for the stabilization and control of electromagnetic fields. The C-1 system is designed to be an electromagnet controller for mass spectrometers either singly or in tandem, high-energy particle accelerator cyclotrons, beta-ray spectrometers, microwave spectroscopy magnets, and other laboratory instruments utilizing magnetic fields. The brochure describes the operation of the C-1 and lists its specifications. Nuclear Magnetics Corp., 154 Boylston St., Boston, Mass.

Opportunities

A brochure has been issued describing current opportunities in the fields of physics, electrical engineering, mathematics and psychology. Doctors and graduate engineers interested in the possibility of working on classified projects may secure a copy of the bulletin by writing to the address below.

M.I.T. Lincoln Laboratory, Box 24, Lexington, Mass.

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- ★ High accuracy
- ★ Negligible drift
- ★ Guard terminal for high-resistance measurements

Description:

Shasta model 605 provides a rapid, easy and highly-accurate means of measuring unknown resistances. Seven full-scale resistance value ranges are selectable by pushbuttons. Values are read directly on the linear scale of a precision multi-turn Helipot after "nulling" the unknown resistance on the 4" zero center galvanometer.



BRIEF SPECIFICATIONS:

Ranges: 100, 1k, 10k and 100k ohms, 1, 10 and 100 megohms
Lowest Meas: 5 ohms
Accuracy: \pm (0.15% of res. meas., + .05% full scale)
Drift: Negligible after 30 min. warmup
Dimensions, weight: 9 $\frac{3}{4}$ " H x 8" W x 9" D;
8 lbs.
Price (f.o.b. factory): \$170.00

Write today for Technical Bulletin 605;
please address Dept. SE9

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Expanded Scale Frequency Meters and Voltmeters
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Telephone LAndscape 6-7730

S-17

CIRCLE 222 ON READER-SERVICE CARD FOR MORE INFORMATION

Plastics

227

A complete catalog and price list has been issued describing plexiglas, cadco, acetate, nylon, teflon, styrene, vinylite, polyethylene, kel-f, fiberglass, and phenolic. This catalog has a thumb index and is broken into categories of sheets, rods, tubes, etc. for convenience. Included also is a table of properties.

Cadillac Plastic Co., 2111 Olive St., St. Louis, Mo.

Potting Shells

228

A data sheet has been published illustrating various shapes and sizes of potting shells. Potting electrical connectors provides complete protection of solder cups and wires by means of a sealing compound applied in a molded plastic potting shell when the connectors are wired. It seals the connector against moisture and prevents cable strain under extreme vibration and periodic connect and disconnect of plug and receptacle. The sheet contains specifications and dimensions.

DeJUR-Amsco Corp., Electronic Sales Div., 45-01 Northern Blvd., Long Island City 1, N. Y.

Thermostats

229

A 4-page, 2-color catalog has been prepared for miniaturized thermostats and surface mounted thermostats. It describes the physical, electrical and performance data required for specifying types of Thermo-switch controls. In addition to engineering and performance specifications, catalog MC-124A presents a useful summary of design and installation factors.

Fenwal Inc., Ashland, Mass.

Stationary Batteries

230

A catalog has been published describing improvements in stationary batteries which are expected to extend the service life up to 10 per cent and reduce maintenance requirements. The catalog describes flat plate batteries which are intended for use in the electric utility field, signaling, telephone service, emergency lighting, and other industrial operations. A recently developed battery grid alloy, Silvium, has a high resistance to corrosion and ability to withstand overcharging, increases efficiency, and lengthens service life of the battery.

Electric Storage Battery Co., Exide Industrial Div., Dept. TC, Box 8109, Philadelphia 1, Pa.

FERRITE DUPLEXER

PROVEN THROUGH WIDE ACCEPTANCE
BY LEADING SYSTEMS MANUFACTURERS

by
CANOGA

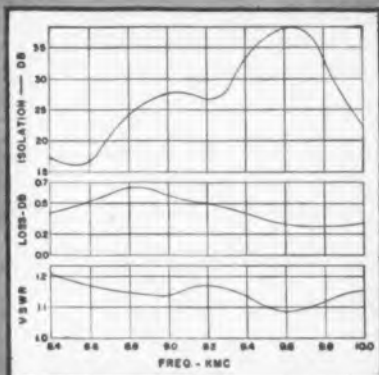


CIRCULATOR Model 35607

The Canoga Circulator Duplexer, because of built-in isolation, requires less volume, weighs less and has less round trip insertion loss than conventional duplexers. Since the single TR tube is fired by reflected power, tube life is increased and high efficiency is maintained. The TR tube arc loss is eliminated and minimum radar range and local oscillator radiation are reduced.

- Frequency: 8300-10,000 mc
- Isolation: 13 db min.
- Insertion Loss: 0.7 db max.
- Power Avg: 300 W
- Peak: 250 KW
- VSWR: 1.25 max.

Detailed Specifications
available on request.



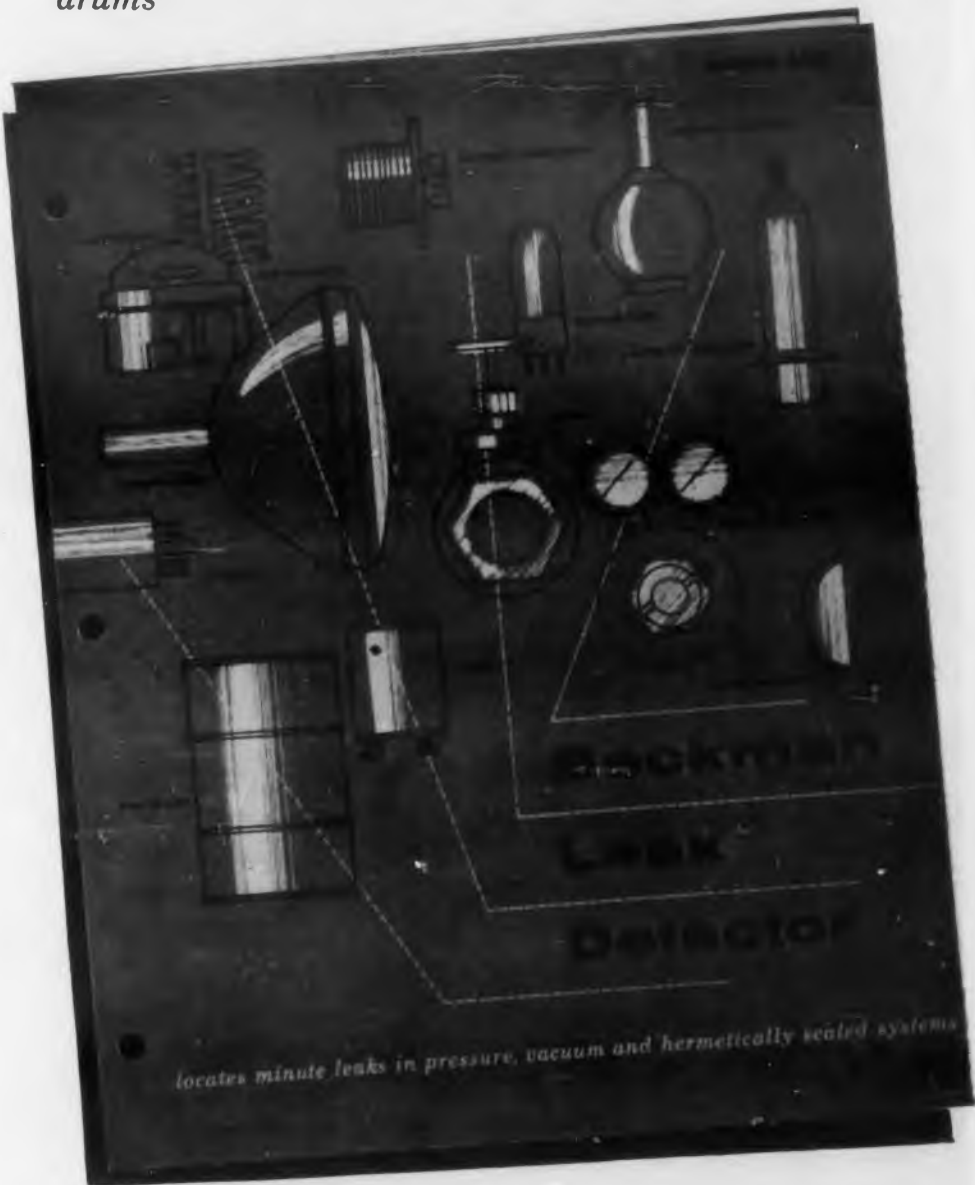
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CIRCLE 231 ON READER-SERVICE CARD FOR MORE INFORMATION

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Scientific Instruments Division, Beckman Instruments, Inc., Fullerton, California

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Pat. Pending

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Patents

Sweep Circuit

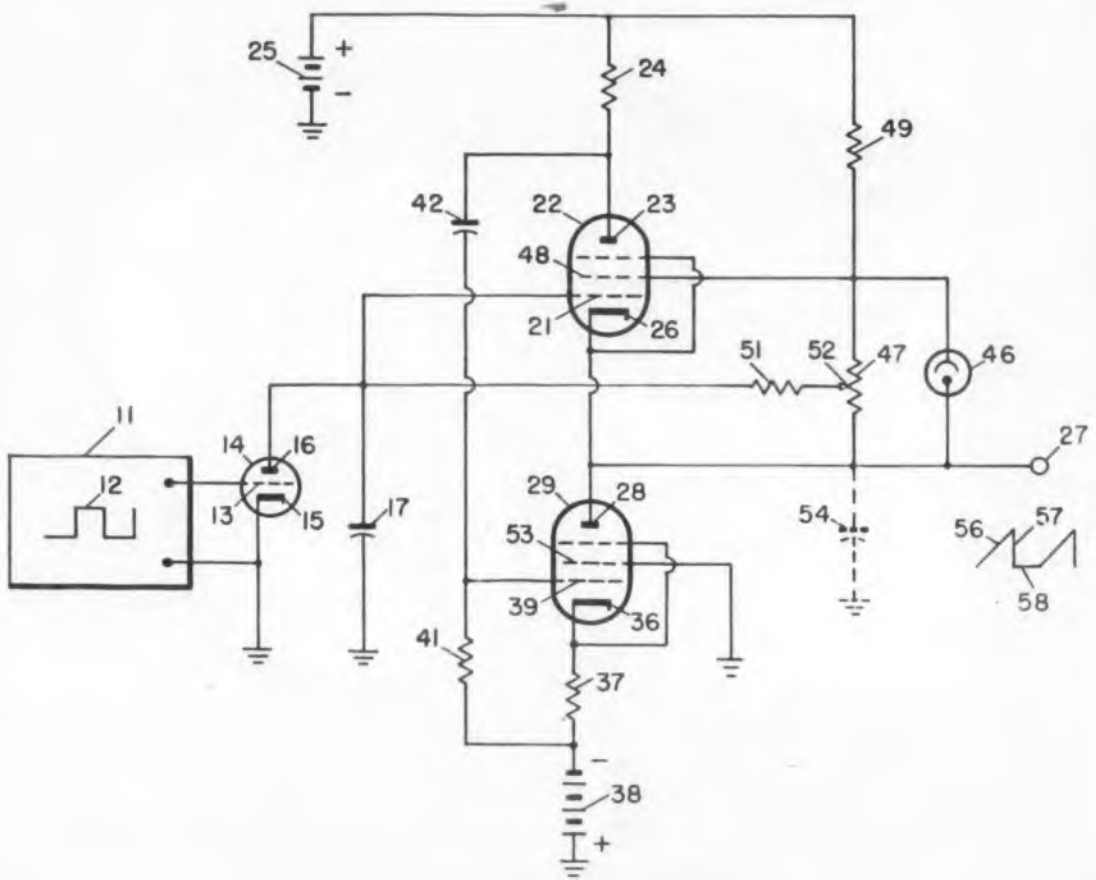
Patent No. 2,748,271. R. F. Casey. (Assigned to Allen B. duMont Laboratories, Inc., Clifton, N. J.)

Sawtooth wave generators at high frequencies have stray capacitance which lowers the impedance to these higher frequencies. Such devices usually employ a pentode tube as a constant current device and because of the reduced impedance caused by the stray capacitance, the tube will not operate at a constant current. This causes variations in the output signals for different frequencies.

The circuit shown in the figure compensates for the effect of stray capacitance 54 so that a substantially constant current passes through a cathode follower tube 22, shown particularly as a pentode. Changing frequencies, therefore, do not effect the constant current through the tube. The circuit uses a charging condenser 17 which is charged from the dc source 25 through re-

sistors 49, 47 and 51. The condenser is periodically discharged through a tube 14 under the control of a pulse source 11. The cathode follower tube 22 has its anode connected to the power source 25 through a resistor 24. A load tube 29 is in series with the cathode 26 of the tube 22.

If the current flow through the cathode follower tube 22 should increase because of stray capacitance 54, the potential on the anode 23 will drop. With the anode of tube 22 coupled through a capacitor 43 to the control grid of the load tube 29, this potential variation is applied to the grid of tube 29. The current through the load tube is reduced thereby, maintaining the current constant through the cathode follower tube so that it operates at the desired current. With this circuit, the sawtooth generator can be used at much higher frequencies than is customary in such circuits. The adjustment is accomplished automatically.



Electrical Resistance Elements

Patent No. 2,734,978. D. Bulgin. (Assigned to Dunlop Tire and Rubber Corp.)

Electrical resistance elements are commonly used in structures which are sensitive to strain in the forming of so-called strain gages. In such gages bending or elongation of the resistance element changes its resistance sufficiently so that a volt meter reading will provide an indication of the strain exerted. Metal resistance elements change their electrical resistance by about 2% for a maximum of 1% strain, and their range is limited. It has been proposed to make the resistance element of rubber which is rendered electrically conducting by inclusion of carbon black. Such resistance elements have shown variation in resistance due to changes in temperature and strain.

The patent discloses a resistance element which is made up of sponge rubber of the cellular type in which the internal cells are interconnected. The rubber is impregnated with conductive material such as pulverulent graphite or a metal. The impregnation of the sponge rubber with the conducting material may be accomplished in several ways. With such a resistance element an elongation of less than 4% results in a resistance increase of 10% or more. The relationship is logarithmic. For an elongation of about 150%, the increase in resistance will be in the neighborhood of a million times. Such a resistance element for use in a strain gage provides a substantial improvement in the gage.

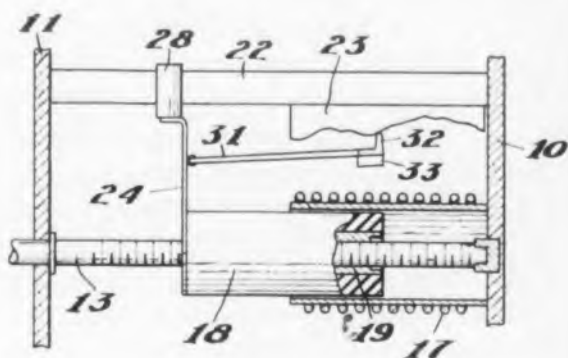
Semiconductor Devices

Patent No. 2,734,154. J. I. Pankove. (Assigned to Radio Corp. of America)

A transistor uses emitter and collector electrodes in contact with the semiconductor. These electrodes are fine wires in order to secure a small area of contact with the surface of the semiconductor. With electrodes of about one mil in diameter, it is difficult to avoid distorting them when pressure is applied. Also, the dissipation of heat from such small wires presents difficulties. The patent describes a transistor which does not use wires for these electrodes.

The improved transistor mounts the semiconductor in a capsule having a flange for engaging the semiconductor to form a base electrode. The surface or surfaces of the semiconductor and capsule are then

coated with an insulating material. The coating is perforated for a point contact, or scratched with a line for line contact, with the crystal. The capsule is then filled with a conducting material, such as mercury, which provides an electrode for the semiconductor. If both electrodes are to be a fluid conductor, then the semiconductor may be centrally located in the capsule providing a chamber on each side for the conducting fluid and electrode. A transistor so constructed avoids the difficulties enumerated.



Inductance Corrector

Patent No. 2,731,608. L. V. Miffin. (Assigned to Collins Radio Co., Cedar Rapids, Iowa)

Tunable inductances are provided with a core 18 which is adjustable longitudinally within the winding in order to vary the tuning of the inductance. To secure the desired variable control, it has been common practice to use a variable pitch for the winding of the coil, or to use a lead screw 13 with a variable pitch. These methods many times do not provide the precise variation desired and also make production manufacture difficult.

In the variable inductance means shown in the figure, a magnetic mass 33 is attached to an arm 31 so that it is movable with the core 18. The mass is located exterior of and adjacent to the winding. A cam 23 is provided adjacent to the mass so that when the core is adjusted, the mass is moved towards and away from the winding in any desired pattern depending upon the form of the cam. This mass varies the external reluctance path for the inductance means and hence the inductance. With this construction the screw and winding of the inductance may be made standard thereby effecting manufacturing economies. It is a simple matter to vary the contour of the cam 23 to secure the precise correction desired in inductance.



Size 22

Size 15

Size 11

Size 10

Size 8

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Electrical Connections: Flexible leads, terminal board, external slip rings.

Shaft Types: Single ended, double ended, straight, tapered, hollow, threaded.

Specifications: Military, Commercial, High Temperature, Corrosion Resistant.

West Coast Offices: 117 E. Providencia Ave., Burbank, Calif.,
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D I O D E S

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- Temperature sensitive

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- Can be used to make highly sensitive and accurate voltmeters out of low cost instruments.
- Available in T9 and T5½ sizes.

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CIRCLE 258 ON READER-SERVICE CARD FOR MORE INFORMATION

Grounded Grid U-H-F Amplifier with Gain Control and Constant Input Impedance
 Patent No. 2,739,189. Winfield Rudolph Koch. (Assigned to Radio Corp. of America.)

An amplifier circuit employing two grounded grid triodes with the input applied to both cathodes. The first tube has a gain control bias applied to the grid and delivers an output at the anode. The second tube does not produce any useful output but serves to maintain an essentially constant input impedance regardless of the gain control bias on the first tube.

Pulse-Operated Timing Circuit
 Patent No. 2,729,742. F. N. Brauer. (Assigned to Philco Corp.)

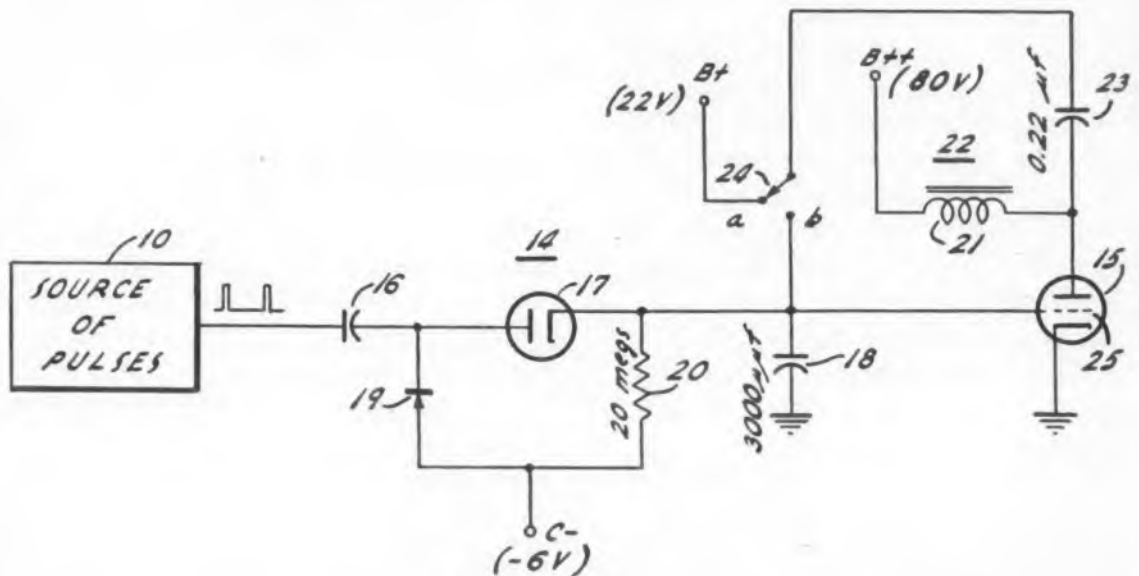
In the operation of a sonobouy or other device which is operable without personal attendance, there is need for a simple circuit which is normally inoperative. A circuit of this type will conserve the battery charge which is the source of power supply for such device. The circuit is triggered by and continues in operation from a series of impulses of very short duration. When the pulses cease, the circuit continues in operation for a relatively long period of time.

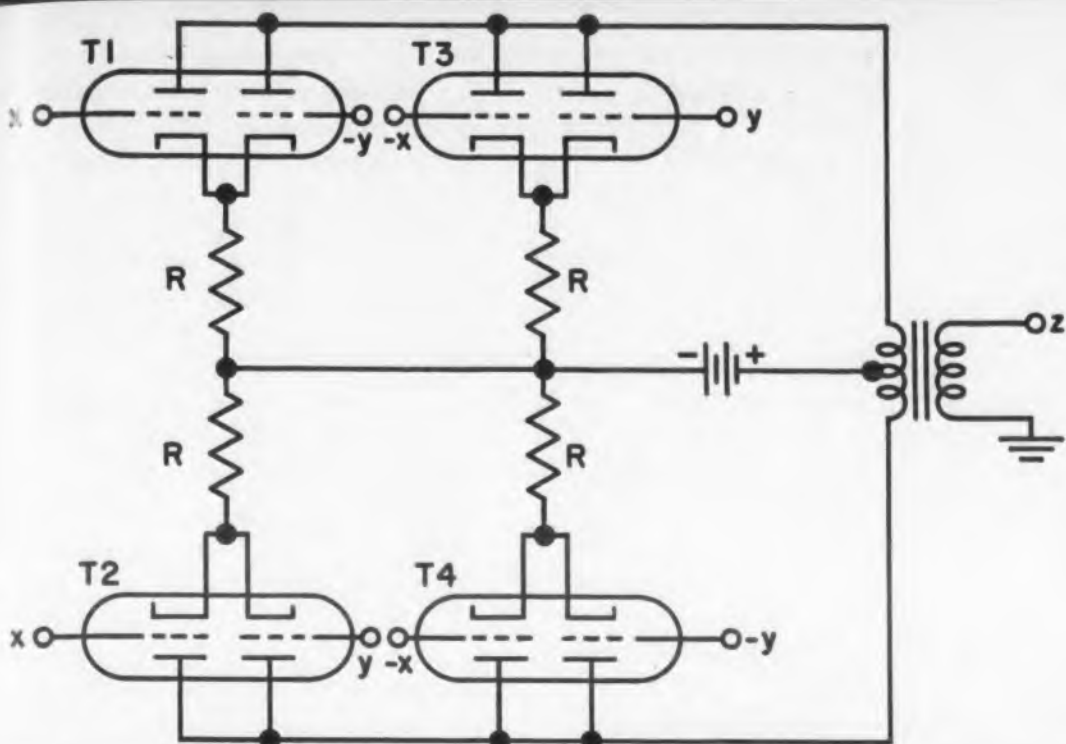
The circuit illustrated includes a source of pulses 10 which charge storage capacitor 18 through integrating circuit 14. This latter circuit includes diode 17, rectifier 19 and resistor 20. The storage capacitor is connected with the grid of tube 15. Potential source C biases the control grid of tube 15 below cut-off. Upon application of the short pulses, a charge is built up on storage capacitor 18 to a point which carries the grid

bias of the tube above cut-off. Current passes through the tube and energizes coil 21, which operates switch 24 to contact b, to connect capacitor 23 between the anode of the tube and the grid. In position a of switch 24, a 22 v battery supply charges capacitor 23, so that upon operation of switch 24 to contact b this additional voltage is applied to the grid. The potential of capacitor 23 therefore boosts the grid bias positive by a substantial amount. However, at this high bias, grid current flows to immediately restore the potential on the grid to zero bias, which is above the cut-off potential of the tube. The continuance of the pulses, however, maintains the grid on about zero potential and, therefore, current continues to flow through the tube and coil 21 to hold the relay switch on contact b.

Upon termination of the pulses, the charge on capacitor 18 leaks off slowly for a considerable period of time. A point is reached where the current through tube 15 is insufficient to hold the switch on contact b, after which the decay of the charge on capacitor 18 leaks off more rapidly. When the grid bias reaches cut-off point, the current drops off at a greater rate to restore the circuit to its initial condition.

With this circuit, capacitor 18 may be made small, so that the pulses build up its potential rapidly above the cut-off potential of the tube grid. A circuit such as the one described has biased the grid above cut-off potential on the fourth pulse. With the pulses being of 2.5 μ sec duration and spaced apart at intervals of 2500 μ sec, it can be seen that the circuit is triggered very quickly after initiation of the triggering pulses.





Electronic Analog Multiplier Circuit
 Patent No. 2,735,615.

Electronic Multiplier Circuit
 Patent No. 2,735,616. Harvey O. Hoadley.
 (Assigned to Eastman Kodak Co., Rochester, N. Y.)

A symmetrical electronic analog multiplier for obtaining the product of two applied voltages. A simplified diagram of the circuit of Patent 2,735,616 is shown in

Figure 3. By driving opposite grids in phase and connecting the plates out of phase multiplication is effected because of the nonlinear characteristics of the tubes. In operation this circuit is similar to the balanced diode modulator except that amplification is achieved, and a common ground is possible. Patent 2,735,615 is similar except that a diode bridge is used to replace tubes 3 and 4 in Figure 3.

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HIGH ACCURACY
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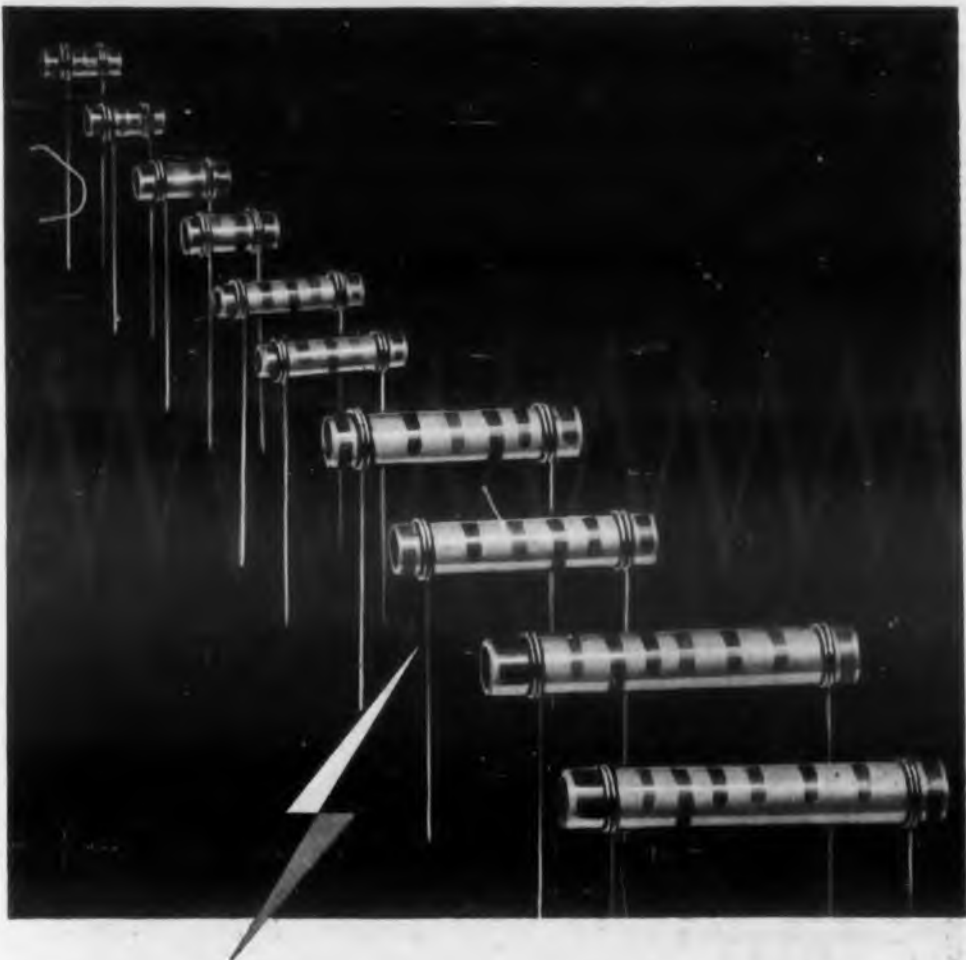


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of values.

Closer tolerances.

Greater physical
strength.

Highest
lead strength.

Faster response
to temperature
change.

⚡ A complete range of TC characteristics from NPO thru N5250.

⚡ 500 V.D.C.W., 1000 V.D.C. test.

⚡ Capacities from .5 mmf. to 750 mmf. Operate over full temperature range of -55°C to $+85^{\circ}\text{C}$.

⚡ Non-insulated tubular style reduces time-lag between temperature change and corrective capacity change. (Can also be obtained with Durez insulation.)

⚡ Meet JAN-C-20A and MIL-11015 specifications for military use. Color-coded in compliance with RETMA and JAN specs.

Technical Bulletin 42-228 gives complete engineering data. Write for it.

Centralab

A DIVISION OF GLOBE-UNION INC.

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D-3256



VARIABLE RESISTORS

ENGINEERED CERAMICS

SWITCHES

PACKAGED ELECTRONIC CIRCUITS

CERAMIC CAPACITORS

CIRCLE 260 ON READER-SERVICE CARD FOR MORE INFORMATION

For AUTOMATION

- TELEMETERING
- REMOTE CONTROL

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- Switches may have up to 24 contacts
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- Contact Material: Silver plated brass or silver alloy
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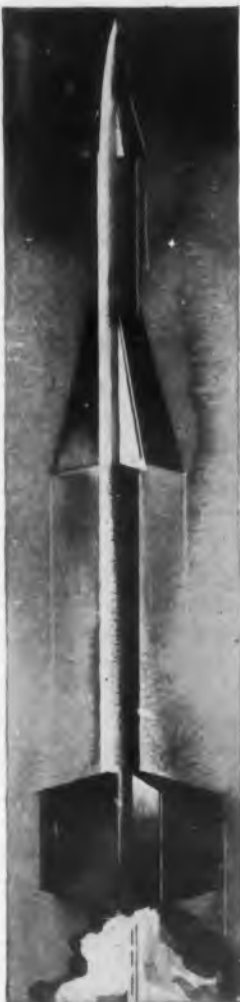


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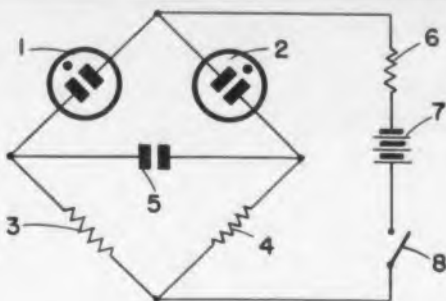


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Frequency Divider Apparatus

Patent No. 2,728,030. R. G. Green. (Assigned to North American Aviation, Inc.)

A circuit is described and illustrated which generates an oscillation or pulse by successive firing of two or more glow discharge tubes. The tubes fire in succession and at a constant frequency so that a frequency division or a pulse of predetermined frequency may be secured.

The circuit in its simplest form is shown in the figure. The circuit parameters are selected so that the discharge tubes will not fire from the current supplied by power source 7 alone. When switch 8 is closed, the full potential of the power source is applied to the discharge tubes. One tube only fires because of a lack of equal characteristics of each tube and its circuit.

Assume that tube 1 fires, whereupon the

current is supplied from the power source through resistor 3 and also from capacitor 5. The current supplied from the capacitor passes through resistor 4, which reduces the potential across discharge tube 2 and assures that it does not fire. The current supplied to the discharge tube from the capacitor decreases exponentially so that a point is reached where the current is insufficient to support the discharge. Tube 1 then becomes extinguished. When this occurs the potential across discharge tube 2 becomes such that it fires and transmits current until the decrease in current is insufficient to support conduction. When this occurs, discharge tube 1 again fires and the cycle repeats.

Seismic Depth Gauging System

Patent No. 2,735,303. Richard J. Haase. (Assigned to Shell Development Co., Emeryville, Calif.)

A fluid pressure indicator which measures pressure by comparison with the force in a calibrated magnetic plunger. In operation, current in the magnetic plunger is increased until the electromagnetic force exceeds the fluid force at which time the plunger moves and causes an indicator



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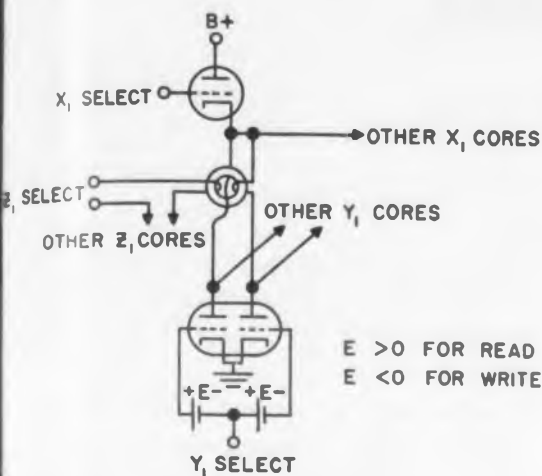
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light to flash. The current flowing in the coil when the light flashes is a measure of the fluid pressure.



Magnetic Element Memory Matrix
 Patent No. 2,739,300. *Munro King Haynes.*
 (Assigned to *International Business Machines Corp., New York, N.Y.*)

Apparatus for storing binary information electrically by magnetization of cores in a magnetic memory matrix. A simplified schematic diagram is shown. If a positive voltage is applied to "X, select" and a positive

voltage applied to "Y, select" with E greater than zero, then a current will flow through the core as shown and produce a Z_1 output if a one had been stored and no output if a zero had been stored. To write a one into the core, it is necessary only to reverse the polarity of E so that the core can be remagnetized to the one state. Any number of X , Y , and Z planes can be used according to the amount of information it is desired to store. A system with x triodes in the X selection, y double triodes in the Y selection, and z planes in the Z selection can thus store xy words with z binary digits in each word.

Multifrequency Keyed Oscillator Circuit
 Patent No. 2,735,940. *Harold A. Norby.*
 (Assigned to *Hughes Aircraft Co.*)

An oscillator circuit which can be made to oscillate at any of several predetermined frequencies. Under normal conditions all of the tuned circuits are disconnected from the oscillator tube by diode circuits. The application of a keying pulse to one of the diodes activates one of the tuned circuits, thereby causing the circuit to oscillate at the resonant frequency of the selected tuned circuit.

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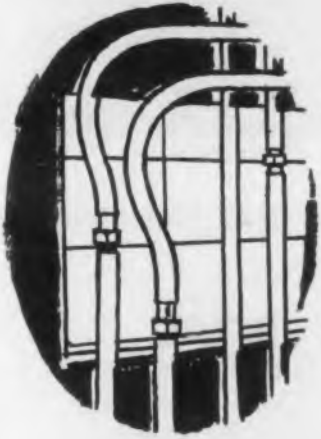
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Books

Superheterodyne Converters and I-F Amplifiers

Alexander Schure. John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y. 56 pages.

This book is volume 12 in the Rider Electronic Technology Series, suitable for all who are studying the operating principles of superheterodyne receivers. It provides a clear explanation of the theory underlying the operation of mixers and converters, and the theory of the i-f amplifier. The various facets of performance and design relating to these portions of the superheterodyne receiver are presented in a very lucid style, making both the function and design factors clearly understandable.

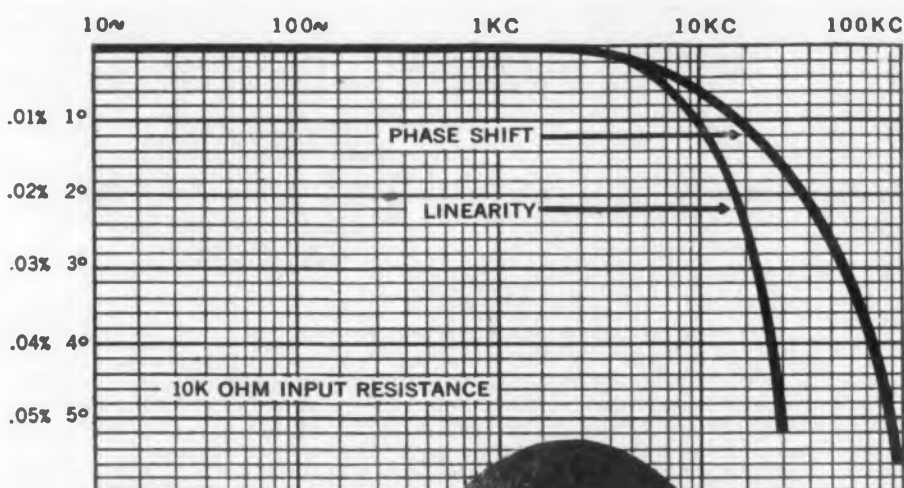
Scattering and Diffraction of Radio Waves

J. R. Mentzer, Pergamon Press, Ltd., 122 E. 56th St., New York, N. Y. 134 pages price \$4.50.

This book is intended to bring researchers and instructors up to date in the methods of determining the scattering and diffraction behavior of obstacles at radio wavelengths.

As a result of this, the material presents the latest mathematical methods for the calculation of scattering, especially back-scattering cross sections, with a brief review of the well-known classical methods of solution included for continuity and self-consistency.

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methods of the determination of the scattered (or diffracted) electro-magnetic field around an obstacle in a prescribed incident field.

RCA Transmitting Tubes

Tube Division, Radio Corp. of America, Harrison, N. J. 256 pages. Price \$1.00.

The new manual RCA Transmitting Tubes, is a book containing technical data on 112 types of power tubes having plate-current ratings up to four kilowatts and on 13 types of associated rectifier tubes.

Covering basic theory of power tubes and their application in an easy-to-understand style, it contains information on generic tube types; tube installation and application; rectifier circuits and filters; and the step-by-step design of af power amplifiers and modulators, rf power amplifiers, frequency multipliers, and oscillators. Simple calculations are given for determining operating conditions for Class C telegraphy service, Plate-Modulated Class C Telephony Service, Frequency Multipliers, and Class AB and Class B af Amplifiers.

Rapid selection of a power tube or rectifier tube for a specific application is facilitated by reference to a series of five classifica-

tion charts immediately preceding the tube-data section.

This manual contains 16 circuit diagrams showing the use of RCA tubes in representative transmitting and industrial applications.

Engineering In History

R. S. Kirby, S. Withington, A. B. Darling, and F. G. Kilgour, McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y. 530 pages. Price: \$8.50.

This book contains a historical discussion of the interaction of engineering with society. It presents the history of engineering as one of many human activities and shows various factors in the physical and cultural environment conditioned engineering advance and how, in turn, engineering has had its impact on the rest of society.

Information is given about developments in the United States. Original sources have been located and used, and whenever possible, original rather than secondary sources are employed. Included also are special branches for military and chemical engineering.

A short bibliography is at the end of the book and selected bibliographies following most chapters.

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Russian Translations

What the Russians Are Writing

J. George Adashko

Akusticheskii Zhurnal Vol. 2, No. 1,
Jan.-Mar. 1956

High-Intensity Ultrasonic Installation for Irradiation of Micro-organisms, I. V. Skarde (9 pp, 12 figs)

The claims made for this equipment (Fig. 1) are: (1) cooling system to maintain constant irradiation temperature; (2) stable intensity of irradiation; (3) special degree to adjust the degree of cavitation produced in the irradiated substratum. The resultant equipment produces a maximum intensity of 100 w/cm² and a maximum temperature differential of 5°C between the irradiated liquid and the cooling liquid. Reference is made to several articles in *Jl. of Appl. Phys. and J. Acoust. Soc. of Am.*

Acoustic Properties of a Finely Laminated Medium, S. M. Rytov (13 pp, 1 fig)

Theoretical investigation, using classical methods. Refers to article "Elastic Wave Velocities in Laminated Media" by J. E. White and F. A. Angona, *J. Acoust. Soc. Am.*, 1955, 27, 311-317.

Integration of a System of Self-Modelling Equations in the Problem of Short-Time Shock in Cold Gas, V. B. Adamskii (7 pp, 5 figs)

Advanced Hydrodynamics.

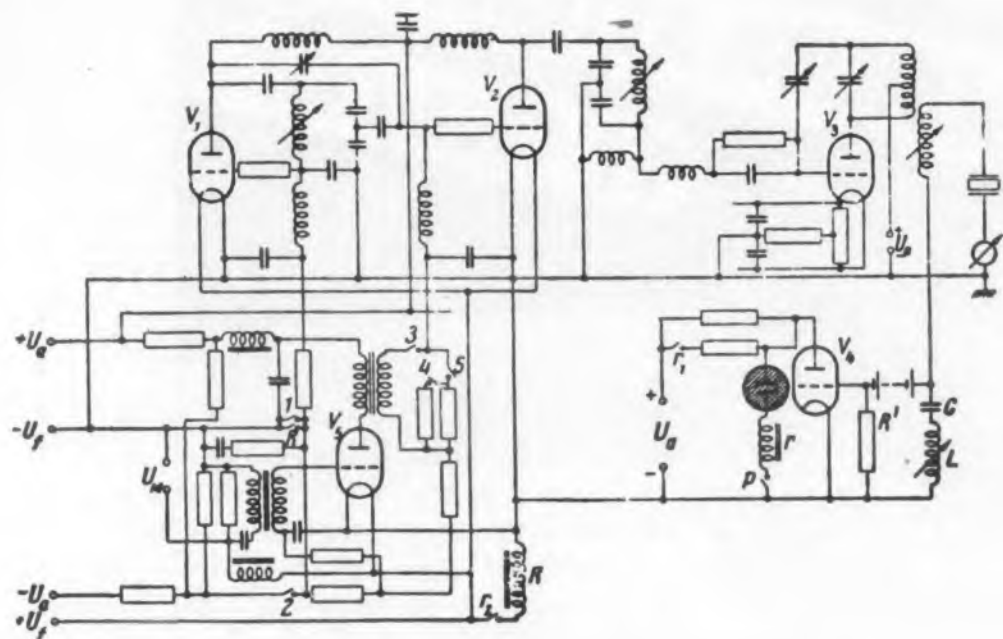


Fig. 1. Principal diagram of ultrasonic oscillator. V_1 —oscillator, V_2 —buffer stage, V_3 —driver stage, V_4 —automatic regulator, V_5 —modulator, K —radiator, 1, 2, 3, 4, 5—contacts (contacts 3, r_2 , and R are closed for modulated oscillations; contacts 5, 2, r_2 , and R are closed for unmodulated oscillations).

Calculation of Audibility of Non-Linear Distortion Produced in an Electro-Acoustic Channel, A. V. Rimskii-Korsakov, (11 pp, 3 figs, 2 tables)

Statistical methods are used to determine the audibility of non-linear distortion by calculating the probability that, under conditions peculiar to a given auditorium, the non-linear distortion products will exceed the masking threshold produced by the basic signal transmitted by the channel and the audibility threshold.

An approximate theoretical calculation is made for this probability for the very simple case when the input signal has an equal-amplitude frequency spectrum and the non-linearity is quadratic in character. In this case the real "audibility threshold" for the distortion corresponds to a harmonic distortion of 2-3%.

Velocity of Sound in Various Pure and Mixed Liquids, B. B. Kudriavtsev (12 pp, 16 figs, 3 tables)
Theoretical and experimental study.

Non-Directional Ceramic Sound Receivers (Microphones), A. A. Anan'eva (18 pp, 20 figs, 3 tables)

Discussion of piezo-electric microphones with spherical and cylindrical directivity patterns, consisting of thin shells of barium-titanate ceramics. The concept of the coefficient of transformation of mechanical stresses is introduced, and it is shown that if the character of the transformation is properly chosen and the electrodes are properly placed, the usually low sensitivity of such microphones can be raised and the directional properties improved. Many patterns are given for various types of shells (spherical, cylindrical). Reference is made to an article by R. A. Langevin, "The Electro-Acoustic Sensitivity of Cylindrical Ceramic," *J. Acoust. Soc. Am.*, 1954, 3, 421-427.

Dielectric and Piezoelectric Properties of the Solid Solutions (Ba,Sr)TiO₃, Ba(Ti,Sn)O₃, and Ba(Ti,Zr)O₃, N. A. Roi (9 pp, 11 figs)

Experimental investigation. Reference is made to article by W. P. Mason in *Bell Labs Record* entitled "Barium-Titanate Ceramic as an Electromechanical Transducer."

Radiation of Sound by Rotating Dipole, L. N. Sreten-skii, (6 pp, 1 fig)

Mathematical study of the acoustic field produced by a dipole, the axis of which either rotates in space, or carries out harmonic oscillations about a fixed direction in space. Mathematical discussion.

Motion of Gas under the Influence of Short-Time Pressure (Shock) Ia. V. Zel'dovich, (11 pp; 3 figs)

Mathematical approach, with reference to Courant-Friedrichs.

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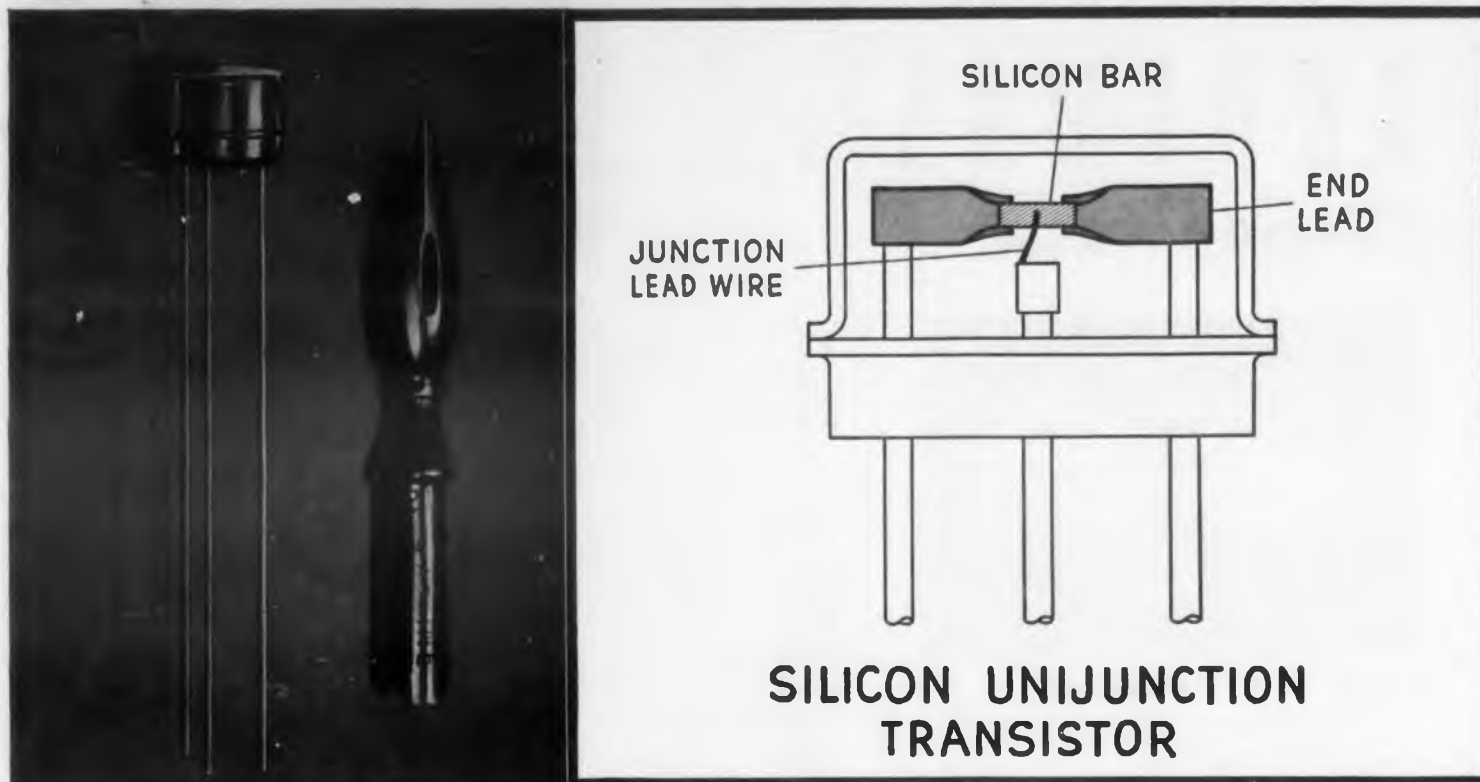
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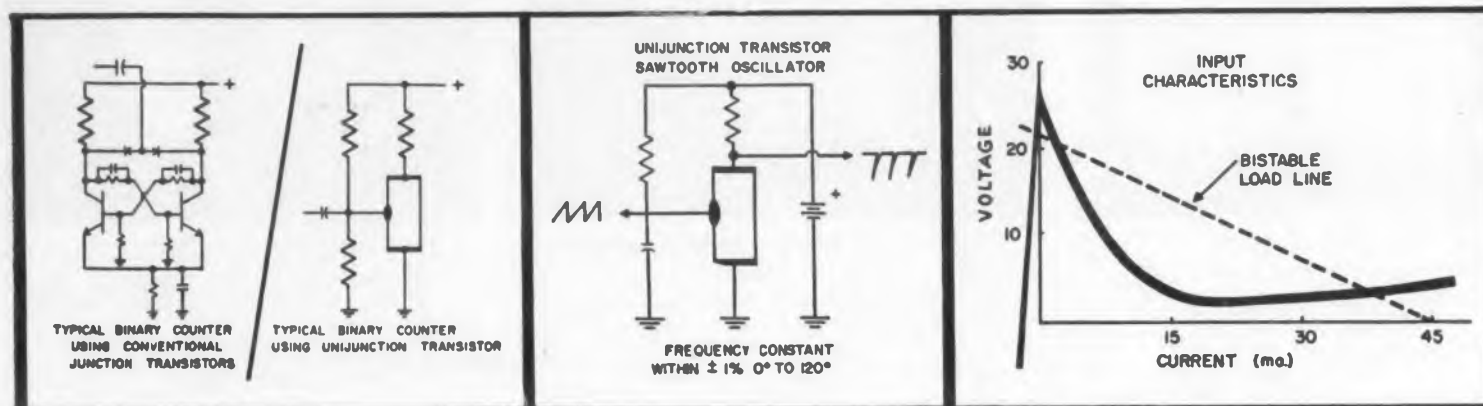
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THE July 15 issue of *ELECTRONIC DESIGN* contains an abstract of an article on the Russian EMU-5 analog computer, which employs diode elements as function generators. A brief description of these diode elements was contained in that article. The following abstract of an article by one of the co-authors of the previous article discusses in greater detail the properties of diode circuits.

The general block diagram of a diode function generator is shown in Fig. 1. The linear dc amplifier with amplification factor K , the input block f_x , and the feedback block f_y , all serve to convert the voltages E_x and E_y into currents I_x and I_y , subject to the following equations:

$$I_x = f_x(E_x, E_o) \quad (1)$$

$$I_y = f_y(E_y, E_o) \quad (2)$$

$$I_o = I_x + I_y \quad (3)$$

$$E_o = RI_o \quad (4)$$

$$E_y = KE_o \quad (5)$$

Reference to (5) shows that if K is large and E_y is to be kept within a certain limit, E_o must be small and the point Σ should be virtually grounded.

In all such circuits, the generated function is approximated by a series of tangents to the desired function, and the function generator consists of individual diode elements, one for each tangent. The diode element produces in effect an elementary increment in the slope of the function, starting at a certain value of the argument. Fig. 2a shows such a basic element, with Fig. 2b representing the corresponding current-voltage characteristic (i vs. E_x ; E_c is the voltage at which the diode starts conducting). Such a circuit is impractical because it contains an ungrounded voltage source.

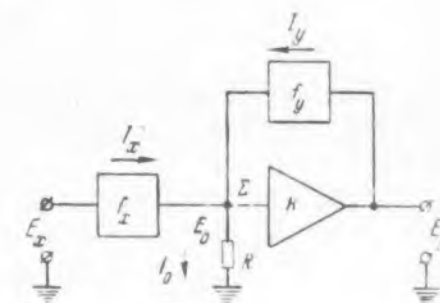


Fig. 1

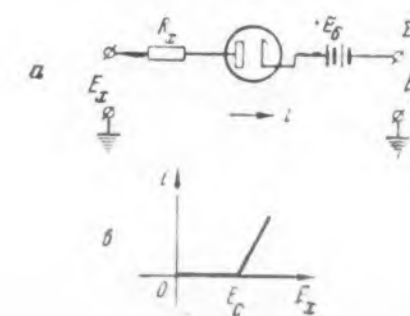


Fig. 2

Diode Function Generator Design

J. George Adashko

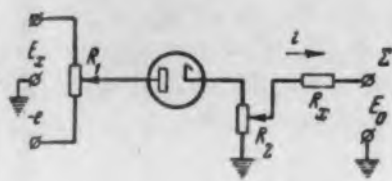


Fig. 3a

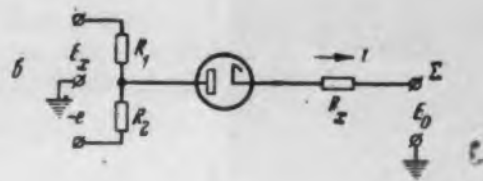


Fig. 3b

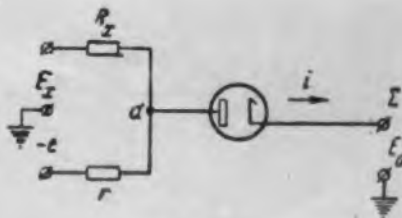


Fig. 4

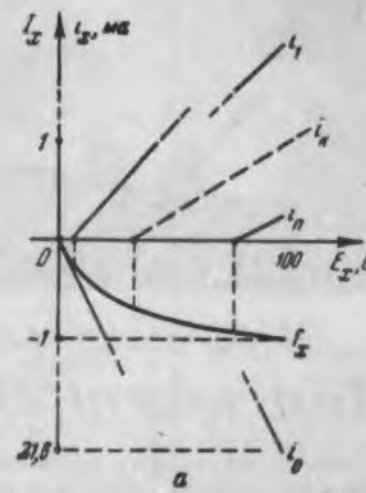
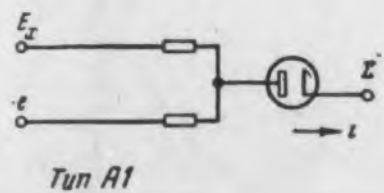
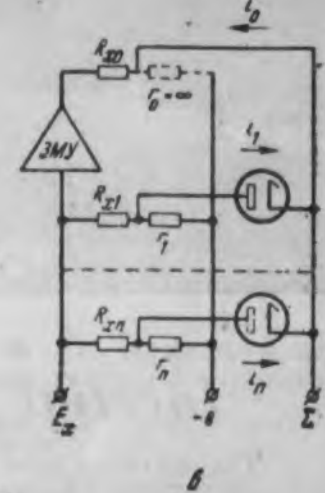
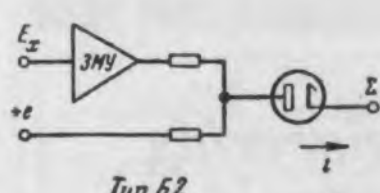


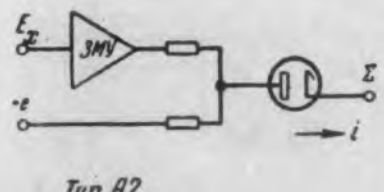
Fig. 6



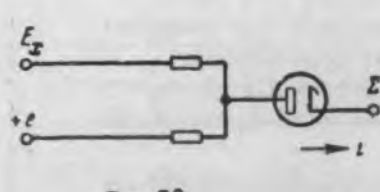
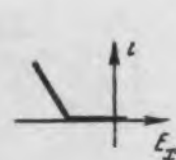
Tun A1



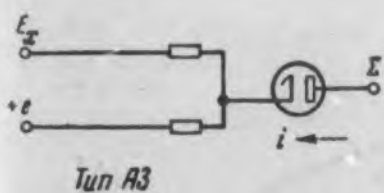
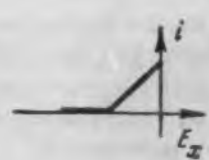
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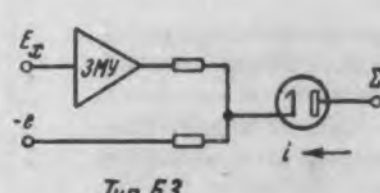
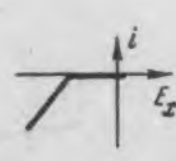
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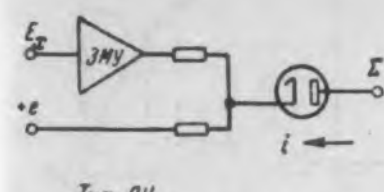
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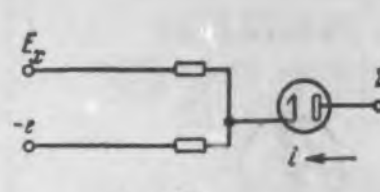
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Tun B4



Tun A4



Tun B4



Fig. 5

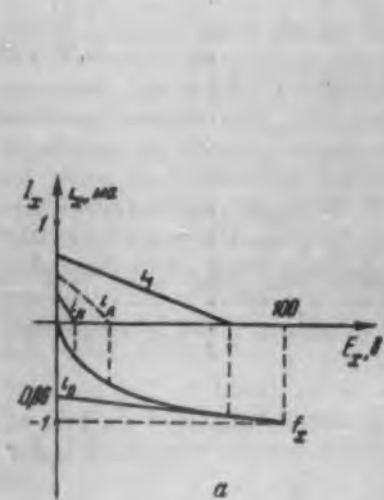
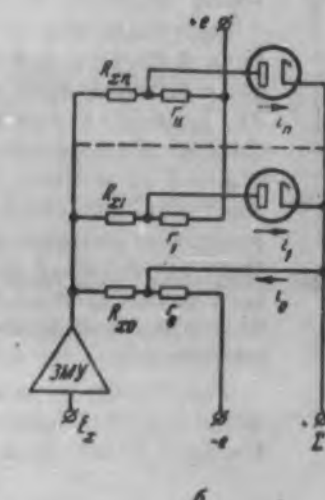


Fig. 7





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A more practical circuit is shown in Fig 3a where potentiometer R_1 adjusts the bias voltage, and potentiometer R_2 sets the slope of the current-voltage characteristics. Obviously, for fixed values of bias and slope the two potentiometers can be replaced by three resistors, as shown in Fig. 3b.

A further improvement is the "potentially grounded" diode element shown in Fig. 4, for a single voltage divider sets both the slope of the current-voltage characteristic and the value of the required bias voltage. That this is so can be seen by simply calculating the dependence of i on E_x in Fig. 4. Neglecting the resistance of the conducting diode as compared with R_x and r we get

$$i = E_x/R_x - e/r, E_x \geq E_c \quad (13)$$

$$i = 0, E_x \leq E_c$$

But if $E_x = E_c$ we have

$$e/r = E_c/R_x \quad (14)$$

and therefore

$$i = E_x - E_c/R_x, E_x \geq E_c \quad (15)$$

$$i = 0, E_x \leq E_c$$

from which it follows that for $E_x > E_c$

$$dE_x di/dE_x = 1/R_x$$

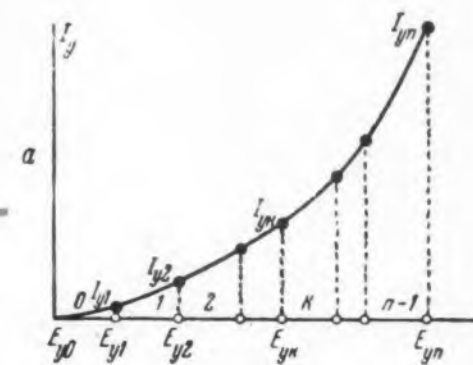


Fig. 8a

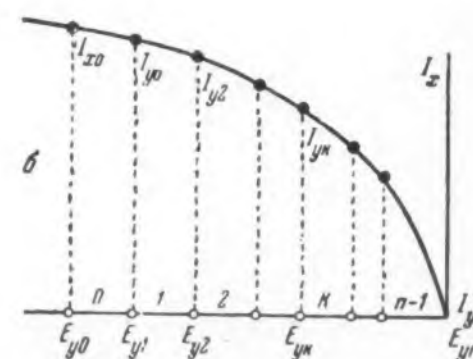


Fig. 8b

the slope of the characteristic depends only on E_x . The value of the bias voltage is given by Eq. (14). Fig. 8 shows several types of diode elements and the resulting current-voltage characteristics. Note that the group to the left consist of off-on operation elements, and that to the right consist of on-off elements. Figs. 6 and 7 show the same function, namely $E_y = 21.6 \sqrt[3]{E_x}$, can be generated with elements of both types. Calculations show, however, that the current drain is much less in the case of Fig. 7 than in the case of Fig. 6. The reverse holds for other equations, say $E_y = 1/1000 E_x^3$, where off-on elements are preferred. A function generator for the cubic equation $E_y = 1/10,000 E_x^3$ is shown in Fig. 9.

Fig. 10 shows a procedure for checking and adjusting such a diode element. The current i_x is measured with a low-resistance meter, and its value is adjusted with precision-resistance box MC.

The article contains also many practical hints concerning the practical choice of reference voltages (marked +e and -e on the diagrams) and resistance values. Translated and condensed from an article "Design of Diode Function Generators" by A. D. Talantsev, Avtomatika i Telemekhanika, No. 2, 1956.

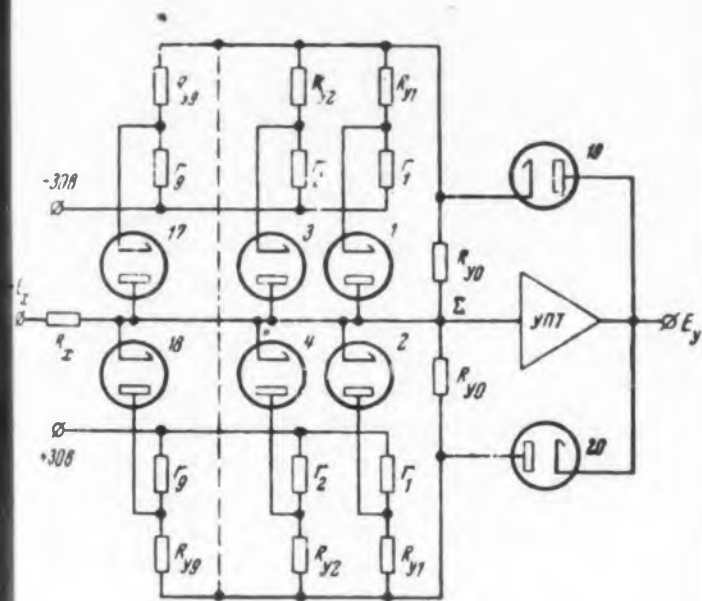


Fig. 9

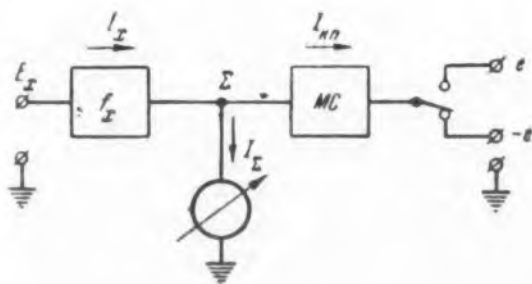


Fig. 10



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6	327	460	35 ohms @ 600 ma	1900	12.6
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6	432	100000 @ 10 volts	0.25	
6	432	200000 @ 10 volts	0.25	
Quantity	Type F Cat. No.	R @ 25°C	B Constant	Load Watts
6	763	15	1500	0.50
6	763	120	1750	0.50
6	763	330000	2150	0.50

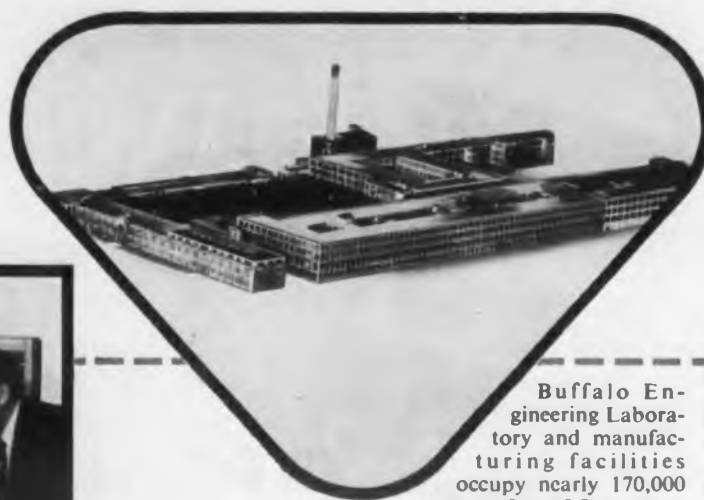
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IN THE modular concept of electronics a single, unitized electronic component part called a module—performs all the resistive, capacitive and inductive functions of a vacuum tube circuit. The module is the equivalent to the 6 to 28 components that must normally be carefully positioned, wired, and soldered to form a vacuum tube circuit. Often a small terminal strip also must be provided in the conventional circuit on which common leads and common circuit voltages are connected. Rivets and lugs, too, must be inserted somewhere on the chassis to accommodate some lead or component part. The module eliminates all of these circuit “accessories.”

Resistive, capacitive and inductive elements contained in a module are all mounted on ceramic wafers having very desirable thermal, electrical, and physical properties. The wafers are then stacked skyscraper fashion to form the module—a completely functioning component part when placed in a circuit in association with a vacuum tube or transistor.

The three dimensional approach made possible by the modular design concept requires a slight modification in the thinking about product design. Coupled with printed circuitry, the cake-pan approach for the design of typical electronic equipment is eliminated. But of particular importance, when designing the modules, the engineer goes directly from the circuit diagram to the final form factor of the product. Thus, the final chassis design is less a compromise between electronics and packaging.

In the case of the manufacture of the module mechanized techniques are also used. Every

ics module is fully tested for its electrical and physical characteristics.

The module is composed of a stack of ceramic wafers, each of which is a uniform size and thickness. The machines are designed so that they will accept only wafers within very narrow physical tolerances. All of the component elements that are mounted on the surfaces on the wafer also fall into narrow size limits.

Each component element is electrically tested for value and tolerance before it is placed on the ceramic wafer. The assembly of component element and wafer—resistor, capacitor, or inductor—is again electrically inspected after the mounting operations are complete. Finally, the whole module—wafer mounted component and tube socket—is inspected for its physical and electrical characteristics.

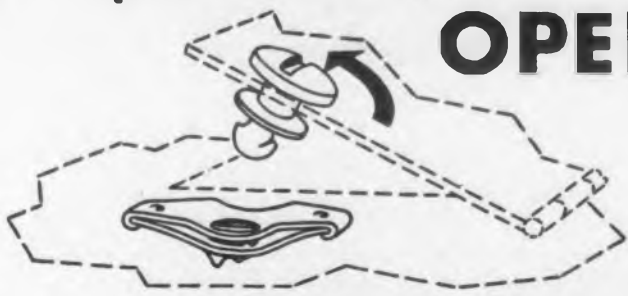
A full range of RETMA values of resistors has been developed for modular use. Resistances range from 5 ohms to 10 megohms and wattage values from 1/2 w to 2 w. Overlapping ranges in capacitance allow the mounting of a uniform-size ceramic wafer, a uniform length of plastic film capacitor, and a standard size of glass capacitor. The capacitance range in modules, when is 1 μ f to 0.5 μ f. Small values of inductance can be printed on the surface of the wafer. Larger values, in the form of toroids and universally wound coils, have dimensions compatible to the size of the wafer, which is always 7/8 in. Inductors are produced with values from 0.25 microhenry to 10.0 millihenry.

Abstracted from *The Modular Concept*, Herbert H. Rosen, ACF Electronics, Amphenol Engineering News, January 1956.

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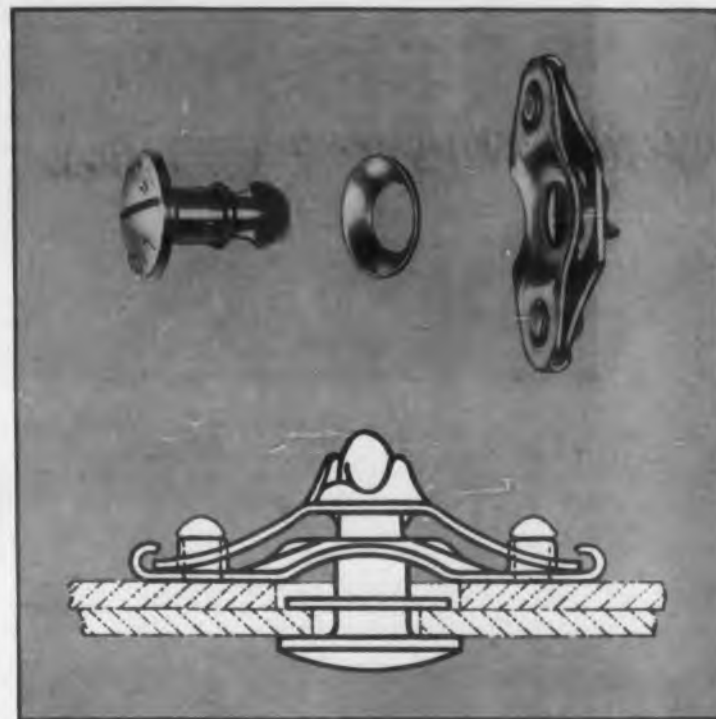
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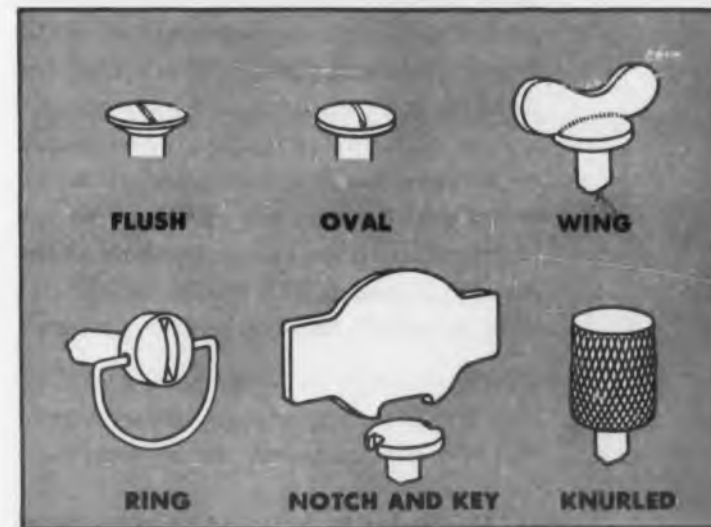
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Abstract

Transistorized Ma

CURRENTLY being investigated at Bell Laboratories is the feasibility of a large coincidence current magnetic core memory which is operated entirely by transistors. Transistor circuits have been developed and are being tested for use in such memory. Experience to date indicates that a transistor-driven memory of this kind is entirely feasible and quite attractive.

A block diagram of the memory system is shown in Fig. 1. It includes the memory proper, or storage array, magnetic core switches for selecting the desired memory locations, and transistor amplifiers.

Two basic types of amplifier circuits are employed in the memory: *drive amplifiers*, which provide currents for switching the magnetic cores; and *read amplifiers*, used to amplify the signal obtained from a switched core to a level which can drive circuits associated with the memory.

Drive amplifiers. Three drive amplifier designs known as the digit inhibit, selection switch set, and memory drive, are employed in the complete memory system. To switch the memory cores, a drive of 300 milliamperes lasting at least 4 μ sec is required. The memory is operated with coincident currents applied to single turn windings on the memory cores. Therefore, the digit inhibit and memory drive amplifiers must provide current pulses of about 160 ma lasting at least 4 μ sec. The cores in the magnetic selection switch have multiturn windings. The selection switch set amplifier should provide current pulses of about 70 ma lasting for 5 μ sec.

A schematic of the digit inhibit amplifier is shown in Fig. 2. Two germanium alloy junction transistors, one a low-level (*TR1*) and the other a high-level unit (*TR2*), are employed in this amplifier. Normally *TR1* is conducting, so that its collector is near ground potential. Thus *TR2* is cut off and no current flows through the magnetic core load. When a digit inhibit signal is received, *TR1* is cut off and its collector starts toward -8 v. This carries the base of the output transistor negative and it starts to conduct. Collector current very quickly reaches a value set by limiting re

Magnetic Core Memory

At the end of the digit inhibit signal, *TR1* again starts to conduct, bringing its collector near ground and turning off *TR2*. Current through *L1*, which cannot drop to zero abruptly, is forced to flow to the base of *TR2*, resulting in a very rapid switch-

The selection switch amplifier is quite similar to Fig. 2 except that *R3* is 300 ohms, and the applied voltage at the selection switch set winding is -20 v. Output current requirements are less than 100 ma, so the base input is decreased by increasing *R1*.

The memory drive amplifier, very similar in general arrangement to Fig. 2, supplies the current which re-sets the selection switch and flows through the selected address of the memory. The required 200 ma pulses are obtained from a circuit where the collector supply

voltage is -20 v and *R3* is about 70 ohms.

Read Amplifier. The read amplifier must accept the output of a digit plane and develop an output which can control a base current of about 1 ma in a memory control unit transistor. The digit plane output may be a pulse of either positive or negative polarity, making it necessary for a polarity-reversing scheme to be employed so that an output of the same polarity will be obtained regardless of the polarity of the input pulse. This can all be done by the circuit shown in Fig. 3.

Transistor *TR1* is biased so that it amplifies both positive and negative pulses. These pulses are fed to a full-wave bridge rectifier so that regardless of polarity, each input pulse to the bridge produces an output pulse which is further amplified by *TR2*.

Output of the read amplifier is combined with an

accurately-timed "strobe" signal in a gate circuit. In order for the voltage at point *F* (Fig. 3) to change, both *TR3* and *TR4* must be cut off simultaneously, which occurs when the output of the read amplifier is a "one" at the same time that the strobe signal is applied.

Over-All Memory System. The complete developmental magnetic core memory can store 1024 eighteen bit numbers. To accomplish this, 18,432 memory cores and 48 switch cores are employed. Transistor complement includes 98 low-level and 62 high-level units. Total power consumption is less than 50 w.

From a paper by E. LeRoy Younker, Bell Telephone Laboratories Inc., presented at the 1956 National Conference on Aeronautical Electronics at Dayton, Ohio, May 14-16, 1956.

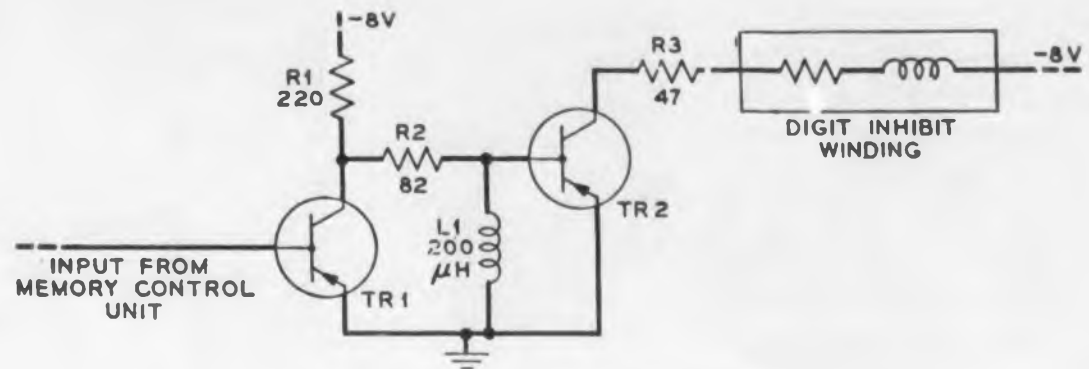


Fig. 2. Schematic of Digit Inhibit Amplifier

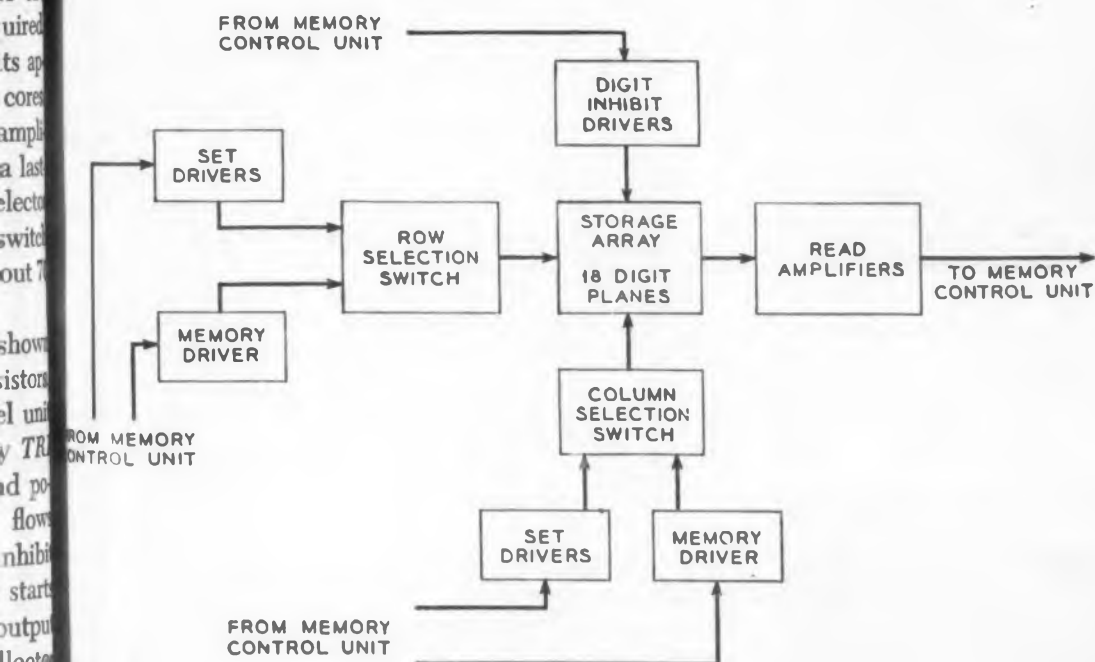


Fig. 1. Block Diagram of Memory System

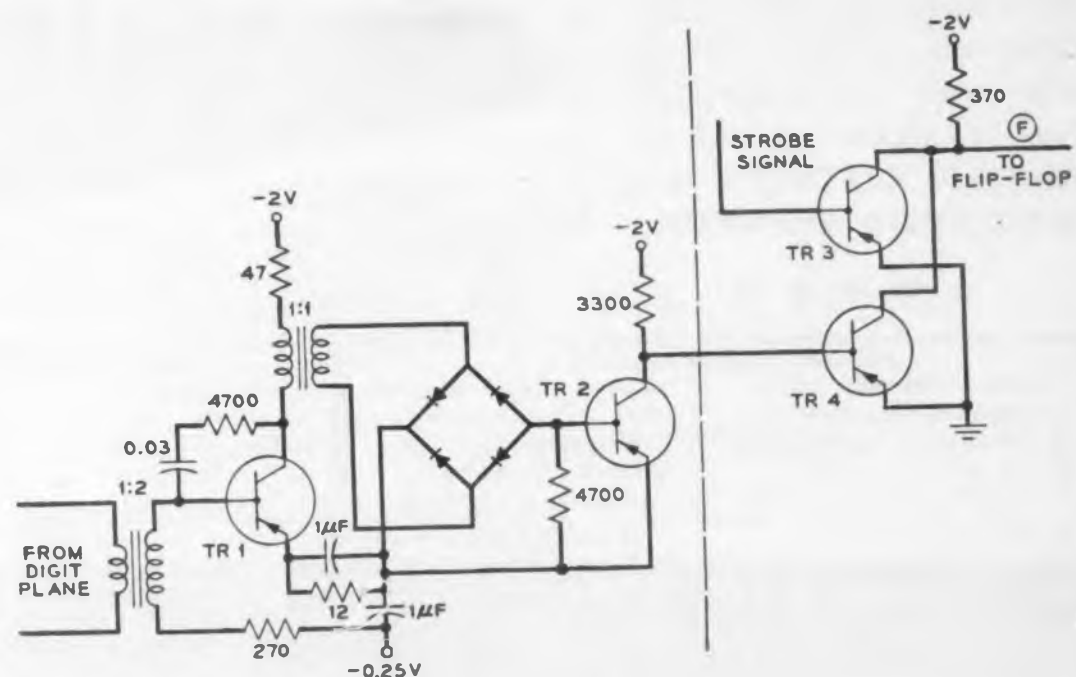


Fig. 3. Read Amplifier and Strobe Circuit

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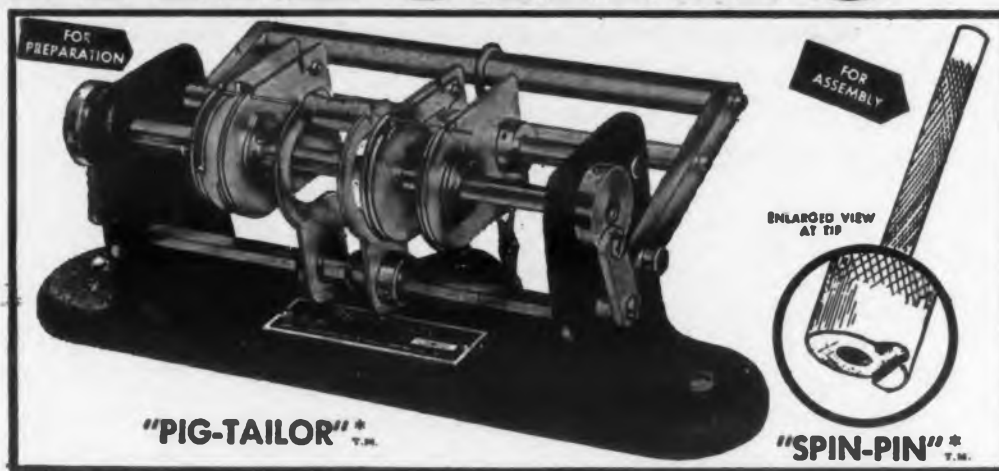
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10. Haphazard assembly methods.

* PATENT PENDING

Write for illustrated, descriptive text on "PIG-TAILORING" to Dept. ED-9 P

BRUNO-NEW YORK INDUSTRIES CORPORATION

DESIGNERS AND MANUFACTURERS OF ELECTRONIC EQUIPMENT

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CIRCLE 282 ON READER-SERVICE CARD FOR MORE INFORMATION

Government Reports

High-Speed Pa

RESEARCH at the National Bureau of Standards on the logical design of electronic computers has resulted in a method for adding two 53-binary-digit numbers in 1 microsecond. When incorporated into a computer's arithmetic unit, this adder will provide a saving in time over the currently used parallel adders in solving long, complex scientific computation and data-processing problems.

High speed of the adder results from a logical arrangement that permits the simultaneous formation of large groups of "carries," i.e., the numbers that are carried over to the next more significant digital positions in addition problems.

In the Bureau's method of addition, whole groups of adjacent carries are formed simultaneously and independently of each other. An analysis using Boolean algebra techniques shows that it is feasible to generate all carries in a limited number of time periods. Specifically, for a 53-binary-digit adder, all 52 carries are formed in only 3 steps of a 5-step operation.

The complete addition operation is performed in 5 steps, briefly described as follows:

1. During the first step, each of the two operands to be added is made available in parallel, usually from a parallel memory because of its rapid success.

2. During the second step, the four least significant carries, C_1 through C_4 , are generated in parallel from the four least significant digits of each operand. Because the logical gating structure is restricted to a limited number of inputs, not more than four carries can be economically generated during this step. However, the remaining digits of the operand generate an array of auxiliary carries at the same time the true carries, C_1 through C_4 , are generated. These auxiliary carries are formed by examining groups of digits in the addend and augend, and permit the subsequent formation of true carries during later steps in the operation. They are formed at certain selected digit positions to check for many of the

ENGINEERS

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to engineers*

Two years ago, world attention centered on Electric Boat at Groton, Connecticut where scientific boldness harnessed the power of atomic energy to launch the Nautilus, which will soon be followed by its sister ship, Seawolf. Next to glide down the ways will be even more powerful versions... a third, fourth and fifth nuclear powered craft.

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- a) **Naval Architects**
- b) **Mechanical and Electrical Engineers** with 3 to 5 years experience in the application of mechanical and electrical marine power plant equipment.
- c) **Electrical and/or Mechanical Engineers** for basic design using analog computers, with respect to control systems, motor control circuits, power plant, speed and voltage regulators or fluid flow and thermodynamics. Familiarity with engine room and reactor plant electrical systems and controls desirable.

At Electric Boat your professional success is spurred by company sponsored courses at the plant, advanced study at leading universities, and by attention to broader professional growth by immediate supervision.

Electric Boat's location in Groton on the lovely shore of Long Island Sound makes life as pleasant as your job is stimulating. The surrounding resort area is well known for its year-round sports and recreational activities. And, you have all the advantages of nearby New York and Boston as well.

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Parallel Adder

Stand- conditions prerequisite to the formation of actual carries.

3. During the third step, the second and larger group of carries, C_5 through C_{20} , is generated in parallel by means of the appropriate operand digits and auxiliary carries.

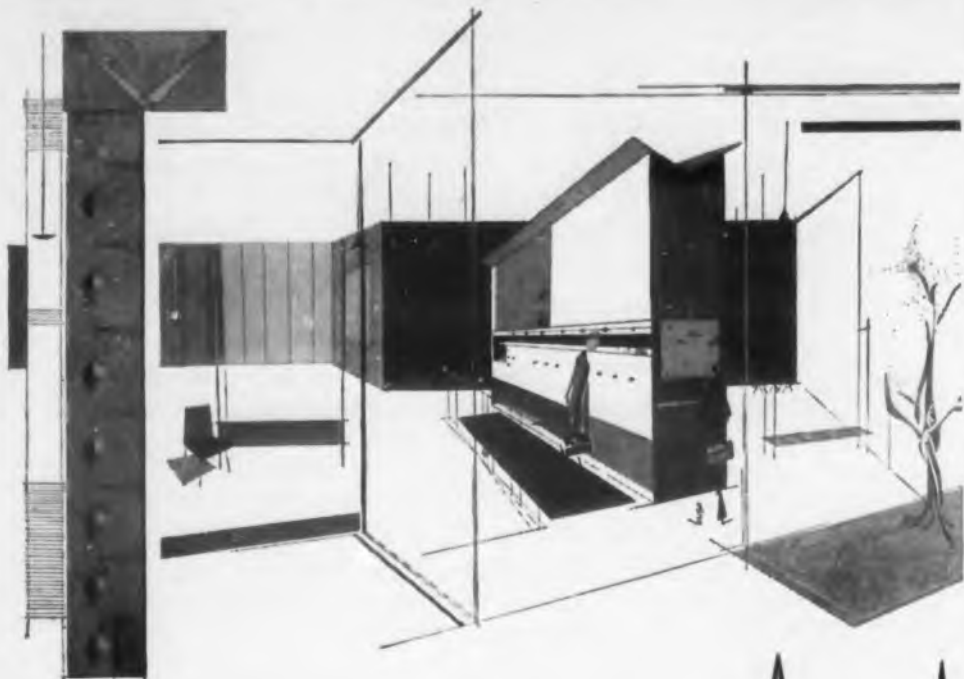
Simultaneously, a second array of auxiliary carries is formed from the first array to aid in the subsequent formation of the third and final group of carries.

4. During the fourth step, the last and largest group of carries, C_{21} through C_{52} , is generated in parallel by means of the appropriate operand digits and auxiliary carries.

5. Finally, after all the actual carries, C_1 through C_{52} , are obtained, all the sum digits are formed in parallel during the fifth step in a conventional manner, each by means of the corresponding addend and augend digits together with the carry from the previous digit position.

The adder can be constructed from basic BEAC-type pulse repeater stages. The circuitry consists essentially of three levels of diode gates in an OR-AND-OR (mixer-coincidence-mixer) logical array followed by a transformer-coupled pulse amplifier. The rate at which successive pulses pass through such a stage is determined by the 1-Mc clock frequency. The transit time of a pulse through a stage, however, is much less than 1 μ sec. For this reason, the clock pulses are made available in several phases so that successive gating-amplifying units can be timed by clock pulses of successive phases. With a five-pulse clock, signals can be dispatched sequentially through five sets of OR-AND-OR gating units in 1 μ sec. The five steps of the complete addition operation can therefore be performed during the five successive clock-phase periods occurring in 1 μ sec. *Abstracted from A High-Speed Parallel Adder for Electronic Computers. National Bureau of Standards Technical News Bulletin, June 1956, Vol. 40, No. 6.*

MARS outstanding design **SERIES**



chef-less restaurant

This concept of Sue Vanderbilt, Pratt industrial-design graduate now designing GM auto interiors, would assemble a whole meal and cook it by microwave in a few seconds. Customer would merely check picture menu, insert money, push buttons. By the time he reached the far end of the counter the meal would be waiting, piping hot. All components already exist.

Many designs that will make news tomorrow are still in the "bright idea" stage today. No one knows which will flower into reality. But it will be important in the future, as it is now, to use the best of tools when pencil and paper translate a dream into a project. And then, as now, there will be no finer tool than Mars—sketch to working drawing.

Mars has long been the standard of professionals. To the famous line of Mars-Technico push-button holders and leads, Mars-Lumograph pencils, and Tradition-Aquarell painting pencils, have recently been added these new products: the Mars Pocket-Technico for field use; the efficient Mars lead sharpener and "Draftsman's" Pencil Sharpener with the adjustable point-length feature; and — last but not least — the Mars-Lumochrom, the new colored drafting pencil which offers revolutionary drafting advantages. The fact that it blueprints perfectly is just one of its many important features.

The 2886 Mars-Lumograph drawing pencil, 19 degrees, EXEXB to 9H. The 1001 Mars-Technico push-button lead holder. 1904 Mars-Lumograph imported leads, 18 degrees, EXB to 9H. Mars-Lumochrom colored drafting pencil, 24 colors.



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Abstracts

Government Reports

Electron Physics Tables

A publication, which was designed to facilitate the computations of scientists working in the field of electron physics, replaces the out-of-print and partly obsolete tables published in 1941 as Part II of Miscellaneous Physical Tables, Planck's Radiation Functions and Electronic Functions, National Bureau of Standards Mathematical Tables 17.

Calculations of the tables were done on the NBS automatic digital computer, SEAC, with each of the eight tabulated quantities given in eight significant figures. Electron energies range from 0.206 ev. to 3.353×10^{12} ev. Quantities which are more in line with the changed requirements in physics and engineering today were used for this tabulation.

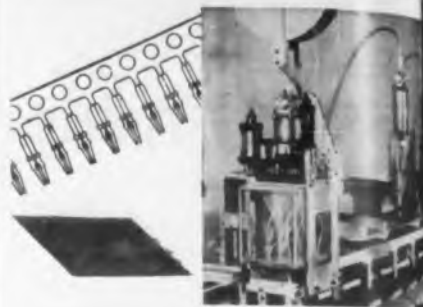
The quantities tabulated are: potential differences in absolute volts required to impart a kinetic energy E expressed in electron volts to an electron initially at rest; effective relativistic potential difference; product of magnetic field in oersteds and the radius of curvature of electron path in centimeters; de Broglie wavelength of electron; the momentum of the electron measured in units of m_0c , where m_0 is the rest mass of the electron and c is the velocity of light; the kinetic energy, m_0c^2 ; total energy of the electron measured in units of the rest energy; and the ratio of the electron velocity to the velocity of light. *Electron Physics Tables*, by L. Marton, and W. G. Hall, National Bureau of Standards Circular 571, March 30, 1956, 83pp, 50 cents.

Electrical & Electronic Patents

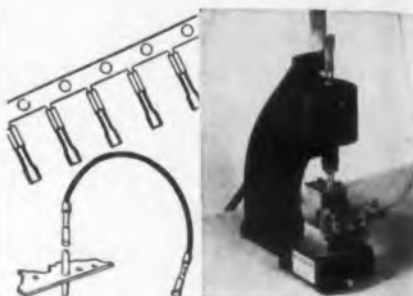
Described in this book are 1915 Government owned inventions applicable to the electrical and electronic apparatus industry, covered by patents active as of December 31, 1953. For each invention the title of the invention, the United States patent number, the name of the inventor, the name of the Government agency administering the patent, and an abstract of the patent on the invention are given. Evaluation of the invention with respect to its industrial application can be made by examining the technical data contained in the abstract. Inventions are divided into over forty classifications.

The material in this publication has been prepared by the Office of the Chairman of the Governments Patent Board and is based upon the records of the Index of Inventions maintained at that Office. It has been published by the United States Department of Commerce and the Small Business Administration as a service to American business. PB-111468, Office of Technical Services, U.S. Department of Commerce, Washington 25, D.S. \$4.00.

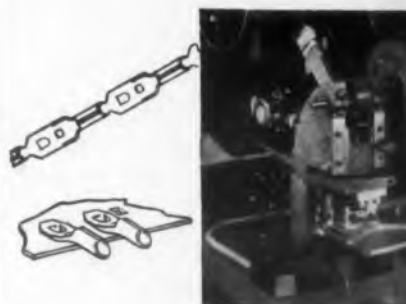
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Printed Circuit Hardware
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Tubular Pin Terminals—Insert automatically into printed circuit board at huge production savings. Snap into position with positive locking action by means of self-retaining snap-in feature. Double ends permit wrapping or inserting leads at either end. Ask for Bulletin 550 and 551.



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Line Card Interlock Terminals—For single or multiple lead connections. Another Malco automation development to provide production short cuts and assembly economy. Terminals are staked quickly and firmly into printed circuit boards. Ask for Bulletin 554.

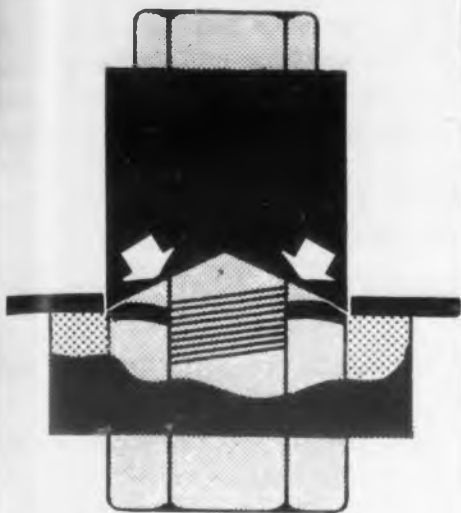
Malco printed circuit hardware can be engineered to your specific requirements. Give us the facts about your operation. We'll show you how your costs can be lowered and your production increased. Ask for Bulletin 551.

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Save time and labor with the "TAPER-WEDGE" design . . . a permanent, precision cutting edge that bites into metal and plastic. WALSCO Pioneer Chassis Punches make hole punching *faster, easier, more accurate*. Complete size range available at Parts Jobbers everywhere.

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Analog Computation with Magnetic Cores

A rugged, fast, static method of performing analog computations has been developed by Naval Research Laboratory. The method utilizes a square loop magnetic core in conjunction with switching transistors. Computations are dependent only upon the waveform of periodic functions and the ability of a high remanence magnetic core to store a given number of volt-seconds for a half cycle of a supply frequency. A large number of computations can be performed, and the accuracy of 2% or better has been obtained. *PB111900 Transcendental Function Analog Computation with Magnetic Cores. D. H. Schaefer and R. L. Van Allen, Naval Research Laboratory, Feb. 1956. 11 pages. 50 cents.*

Capacitor Research

Research conducted in an attempt to produce a hermetically sealed, oil filled, three-gang tuning capacitor for the Signal Corps is reviewed in detail in a report released to industry. Although it was concluded that mechanical tolerances, particularly of ceramic parts, necessary to obtain the required performance made it impossible to achieve the ultimate goal, there is recorded in the report a large amount of data believed to have substantial value in related fields, such as fixed capacitors, air dielectric concentric trimmer capacitors, and ceramic dielectric capacitors. *PB 111-961 Development of Capacitor, Variable, Hermetically Sealed, Three Sections. Sprague Electric Co. for U.S. Signal Corps. June 1955. 139 pages. \$3.50.*

Tests for Treated Magnesium Surfaces

Research toward development of an accelerated performance test for treated magnesium alloys is described in an Air Force report released in industry. Test methods for evaluating the quality of chemical and electro-chemical surface treatments with respect to corrosion resistance afforded by the treatments to the base metal, and the adherence between paint type coatings and the base metal afforded by the treatments, are needed to determine the acceptability of magnesium alloys submitted to the military services. Corrosion resistance tests included pH increase in 1.0N KCl, open circuit potential comparisons, short circuit current comparisons, and hydrogen evolution rates in 1.0N KCl (gasometric method). Tests of adhesion to zinc chromate primer to the treated surfaces included adhesion in shear (wrought alloy specimens), adhesion in tension (cast alloy specimens), and impact, ultrasonic vibratory, and pressure-sensitive type tests (qualitative). *PB 121140 Research on Treated Magnesium Surfaces, S. E. Rohowetz, Bjorksten Research Laboratories Inc., for Wright Air Development Center. July 1955, 187 pp. \$4.75.*

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for electronic brains



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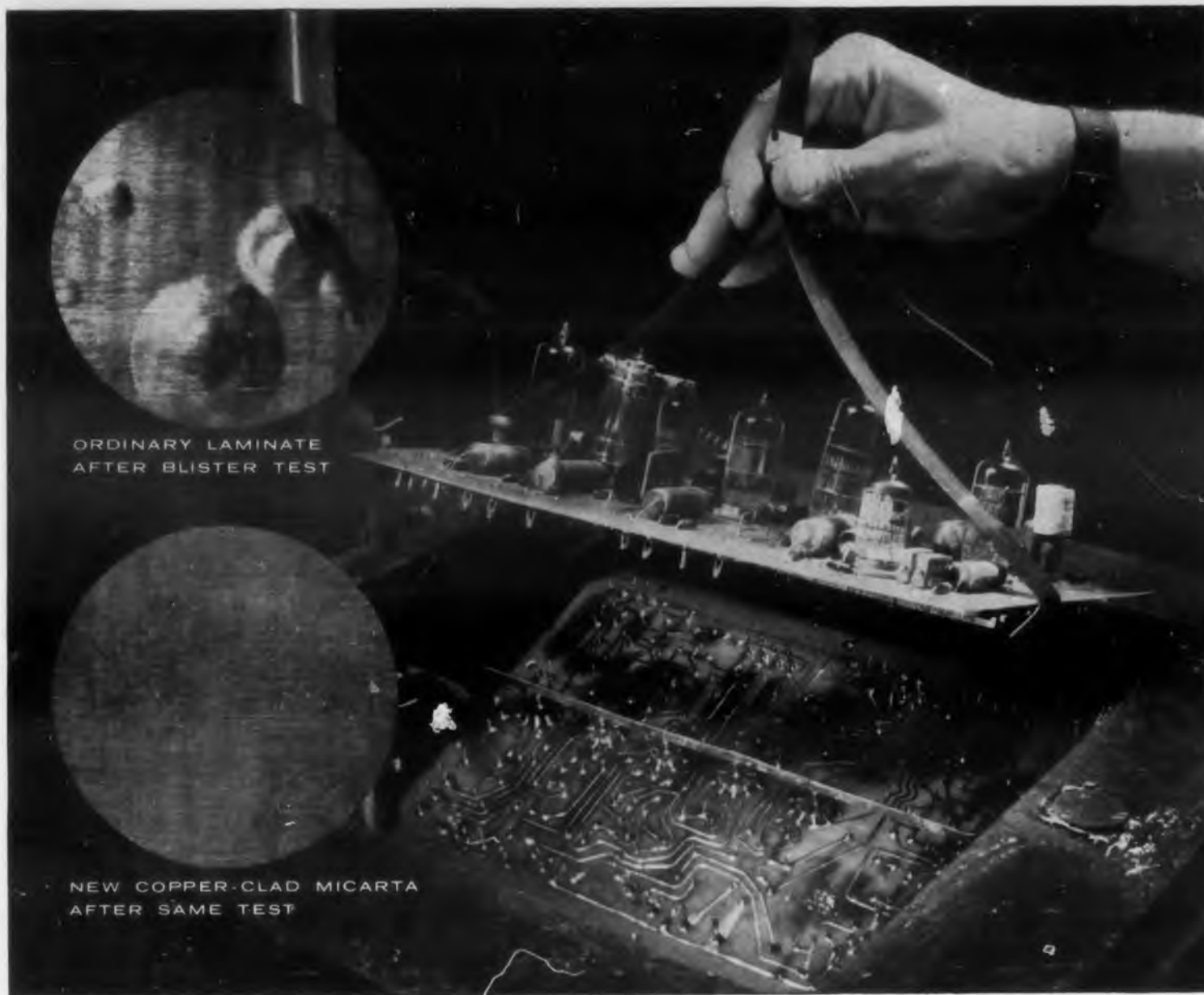
● Eliminating the headaches of brittle materials in critical electronic circuits—Chemelec (made of duPont TEFLON) Insulators withstand rigid government tests for mechanical and thermal shock and vibration. Now—COLOR CODED in the 10 standard RMA colors, maintaining the same specified electrical characteristics.

Replacing less durable insulators in electronic computers, guided missiles, fire control, radar, etc., the assembly cost savings of *compression mounting and color coding* are more than paying for Chemelec Insulators' higher mechanical and electrical qualities.

Write for Catalog, No. EC-756. FLUOROCARBON PRODUCTS, INC.,
Division of United States Gasket Co., Camden 1, New Jersey

Fluorocarbon Products Inc.

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ORDINARY LAMINATE
AFTER BLISTER TEST

NEW COPPER-CLAD MICARTA
AFTER SAME TEST

New copper-clad **MICARTA**[®] takes dip solder bath without blistering!

New H-3032 copper-clad MICARTA[®] cuts costs and production time of printed circuits. Copper-clad MICARTA speeds up soldering, without the normal accompaniment of an increase in rejects and missed connections. It can be cold punched without cracking or chipping.

The laminate won't blister even when dip soldered for 10 seconds at 500°F! Examine the two close-up photographs. One shows an ordinary laminate after a laboratory test. Note the blistering, then look at the MICARTA dip soldered for the same length of time—and there is no blistering!

A special adhesive is used which has the same

high electrical properties, solvent resistance and low moisture absorption as the MICARTA laminate itself. Actually, adhesive strength is increased during soldering.

Because of a new adhesive process, copper-clad MICARTA keeps its high bond strength—from 10 to 13 pounds versus an industry standard of six pounds—even after heating and cooling is repeated many times. This is especially valuable for electronic circuits.

Copper-clad MICARTA may be the answer to your circuit assembly problem. Write for further information and technical data to Westinghouse Electric Corp., MICARTA Div., Hampton, S. C.,

J-06624

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CIRCLE 293 ON READER-SERVICE CARD FOR MORE INFORMATION

Standards and Specs

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.

ASTM Standards

METALLIC MATERIALS FOR ELECTRICAL HEATING, ELECTRICAL RESISTANCE AND ELECTRICAL CONTACTS

This spec is being revised to include a standard method of test for Maximum Loading Stress at Temperature of Thermostat Metals (Cantilever Beam Method). The standard method for test for Flexivity of Thermostat Metals is being revised.

MATERIALS FOR ELECTRON TUBES AND SEMICONDUCTOR DEVICES

The tentative methods of Testing Sleeves and Tubing for Radio Tube Cathodes is being revised. It is also proposed to revise the tentative spec for Molybdenum Wire under 20 Mils in Diameter.

Resistors

MIL-R-11B, RESISTORS, FIXED, COMPOSITION (INSULATED), NOTICE-1 17 MAY 1956

The spec sheets previously required with this spec have been cancelled and replaced by "MS" Military Standards. The previous standard sheet MS91374, entitled "Standard Resistance Values with Corresponding Color-Code Markings" has also been cancelled.

MIL-R-19438 (NORD), PRECISION WIRE-WOUND VARIABLE RESISTORS, 1 MAY 1956

Accurate wire wound variable resistors having a maximum resistance tolerance of 2% are covered by this spec. These resistors are suitable for continuous full load operation at any ambient temperature up to 65 C (150 F).

Cables

MIL-C-19381 (SHIPS), CABLES, SPECIAL PURPOSE, ELECTRICAL, (NUCLEAR PLANT), 29 FEBRUARY 1956

Electric cable for operation in high ambient conditions aboard Naval vessels are covered by this spec. This type of cable must pass 24 hours at 500 F with no visual external derangement, such as end drip or sheath exudation.

Capacitors

MIL-C-3965, CAPACITORS, FIXED, ELECTROLYTIC (TANTALUM), 2 MAY 1956

Speaking Directly to Management, Electronic Week Will Report America's Fastest Growing Industry

Electronic News

ELECTRONIC WEEK will act as the sole reporting source for the \$9,000,000,000 infant giant known as the electronic industries. Oddly enough, the very field which has contributed so much to communication for others, has never had a means of communication for itself. To date, publications covering this field have been aimed solely toward technical or research aspects. Now, ELECTRONIC WEEK offers management a convenient central source of

news and industry information, timed to keep pace with this fastest-growing of all industries.

Editorials in ELECTRONIC WEEK will consist of electronic news, business, marketing methods, finance, taxes, government outlook, foreign news, military trends, and their interpretations, written with management's problems in mind. It will also report new plants, new broadcast stations, changes in personnel, distribution, etc.

Here, for the first time, is an opportunity for advertisers to be sure of reaching the controlling management group where major decisions are made.

Business

In ELECTRONIC WEEK business trends currently reported by a wide variety of sources will be brought together into concise editorial material. Major developments in radio, communications, aircraft, business machines, computers, electronic sub-assembly, basic materials, as well as research and U.S. Government activities, will be covered. Foreign correspondents will add an international note, help to bring this world-wide industry into sharp focus.

Finance

Written by Wall Street experts about the electronic industries. Latest transactions will be explored with particular emphasis on their electronic implications. Will provide management with a financial survey normally found only between the lines or in financial journals.

Taxes

Current and proposed tax legislation as it affects this fast-changing industry. Case studies, abstracts, and latest regulations will be reported from the management point of view. Comprehensive reporting will include group or association efforts tending to influence the tax picture, as well as other economic and political influences.

Meetings

Meeting highlights of the Institute of Radio Engineers, the American Institute of Physics, the American Institute of Electrical Engineers, and other technical and industrial organizations will be abstracted for concise treatment in ELECTRONIC WEEK.

Forms Open for Advertising Sept. 15th Issue

The first issue of ELECTRONIC WEEK to accept advertising will be Sept. 15, 1956. Closing Date Sept. 1, 1956. No advertising will be carried in the first six issues.

Wire Publishers Collect

Inquiries concerning ELECTRONIC WEEK should be addressed to The Publishers, ELECTRONIC WEEK, 19 East 62nd Street, New York 21, N.Y. TEmpleton 8-1940.

Marketing

Marketing aspects of the expanding electronics industries will be covered as a regular feature. Significant developments and trends in distribution, sales, merchandising, etc. presented in capsule form will brief-in this important phase—assist management in their own marketing plans as well as keep them informed of competitors' activities.

People & Plants

New plants, new broadcast stations, personnel shifts, new personalities—all these newsworthy items will be collected under a single department in ELECTRONIC WEEK. Profiles, success stories give color to the men behind this growing industry, help to further identify the industry and define its growth and progress.

Labor

A new departure in labor reporting. For the first time a publication will have labor presenting its views to management on current problems, rather than have management talking to itself about labor. Written by a labor expert who is himself affiliated with the I.U.E. of A.F.L.-C.I.O., ELECTRONIC WEEK will scan labor's opinions each week.

Washington Report

Written with a Washington date line, ELECTRONIC WEEK'S Washington report will provide a direct line to government rulings affecting the electronic industries. FCC and other government agencies will, of course, be covered, as well as all pertinent activities and events in the nation's capital.

Foreign

Major news from European and South American capitals of interest to U.S. electronic firms will be cabled direct by ELECTRONIC WEEK correspondents. Such comparative technology is of vital importance to the development of international trade and the peacetime security of the United States.

Other Departments

Other departments will include defense contracts, awards, etc., new product information of interest to management, and articles written by prominent industrialists in the electronic field.

Three specs MIL-C-14006 (Sig C), dated 21 March 1955, MIL-C-18211 (NAVY), dated 21 February 1955, and MIL-C-25102 (USAF), dated 2 September 1955 are superseded by this spec. This spec covers tantalum, electrolytic, fixed capacitors, polarized and nonpolarized, for use in filter and bypass applications requiring large capacitance values where close tolerances are not an important factor. Although the scope of this spec includes nonpolarized types, none are included at the present time. The basic style designation for these capacitors is "CL". Qualification approval testing will be required.

Standards

ASA Z24.17-1955, DESIGN CONSTRUCTION AND OPERATION OF CLASS HI (HIGH-IMPACT) SHOCK-TESTING MACHINE FOR LIGHTWEIGHT EQUIPMENT

By means of the standardized design of a shock-testing machine described in this standard, the ability of various types of equipment to withstand shock loadings may be compared. This standard does not attempt to establish criteria for acceptance or rejection of specimens shock-tested by the machine. The standard covers general design and construction, principles of operation, method of operation, and care and maintenance. An assembly drawing of the machine is included as well as views of the shock machine foundation and typical methods of mounting of test apparatus. Copies of this standard may be obtained from ASA for \$1.00.

ASA Z24.18-1955, ULTRASONIC THERAPEUTIC EQUIPMENT

Suitable methods for calibration of the intensity and distribution of the ultrasonic beam produced by therapeutic equipment are recommended by this spec. The recommendations are in a form to permit both manufacturers and supervising agencies to provide proper labelling. This spec relates only to the physical characteristics of ultrasonic therapy equipment employing circular transducers in accordance with present practice. Included are terminology, safety and control, tolerances, calibration procedure, and labelling. Copies of this spec are available from ASA for \$0.75.

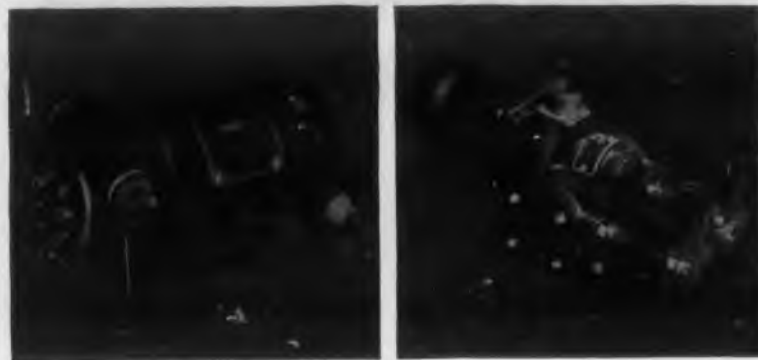
Lacing

MIL-T713A, TWINE AND TAPE, LACING AND TYING (FOR USE IN ELECTRICAL AND ELECTRONIC EQUIPMENT), 11 MAY 1956

This revision supersedes JAN-T-713 and MIL-T-14014 (Sig C). Waxed nylon narrow tape and Type P waxed nylon twine have been added. Type VCR viscose rayon twine has been deleted. Tape has been added since it is less likely to cut through insulation. Waxed twine and waxed tape have been added since they are easier to tie. Cotton has been added as one of the materials that can be used in manufacturing Type N twine.

★ **AIRCRAFT PUMPS**

Precision-built to rigid government specifications, a broad selection among Eastern pumps offers flexibility to your choice. Modifications can be made, or custom-made units designed to suit your project. Trim in size, light in weight, Eastern Aircraft Pumps give reliable long-term service.



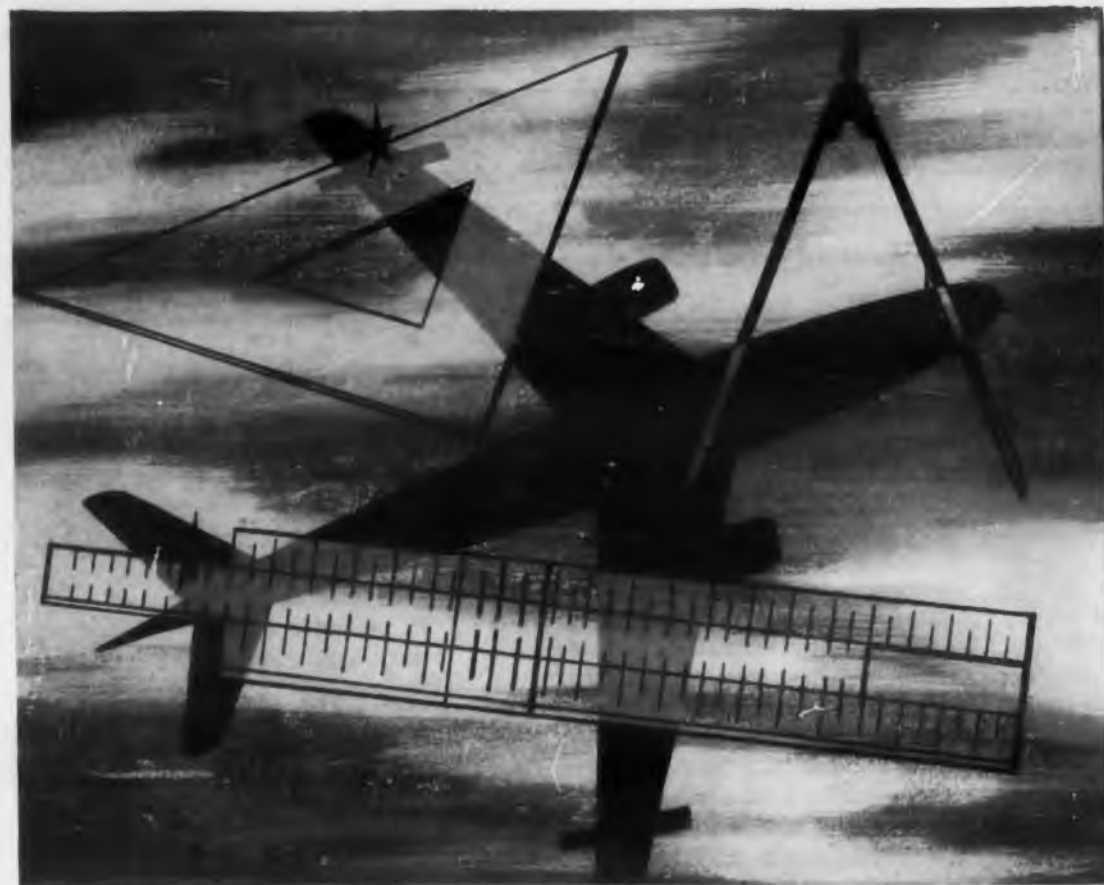
★ **PRESSURIZATION**

Eastern pressurization units for airborne electronic equipment are available in many capacities to handle a broad range of requirements. Units consist of an air pump and motor assembly, pressure switch, check valve, tank valve, and terminal connectors. They meet government specifications and can be modified to your needs.



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★ **COOLING UNITS**

Hold temperatures to safe operating limits in liquid cooled electronic tubes or similiar devices. By virtue of long experience and using standard component parts, Eastern can suit your specific needs at a minimum cost for equipment.

★ **REFRIGERATION-TYPE**

Enable specified components to be held to fairly constant temperatures by use of various types of refrigeration units. Because of the variation in methods possible, Eastern units fill every requirement where the use of a refrigeration cycle is called for.

★ **SPECIAL UNITS**

Eastern's continual research and development program keeps pace with the growing aviation industry. As new problems occur with progress in aircraft development, Eastern units are constantly developed to fill their function as planes fly higher, or faster, or with greater load capacity.

Eastern welcomes the chance to help engineers "take out the bugs" with equipment that cools, pressurizes, or pumps. From the extensive line of existing units, new adaptations, or custom-made designs, Eastern is ready to meet every challenge for equipment that handles your needs *the best today . . . better tomorrow.*



Write for Aviation Products Catalog, Bulletin 330.

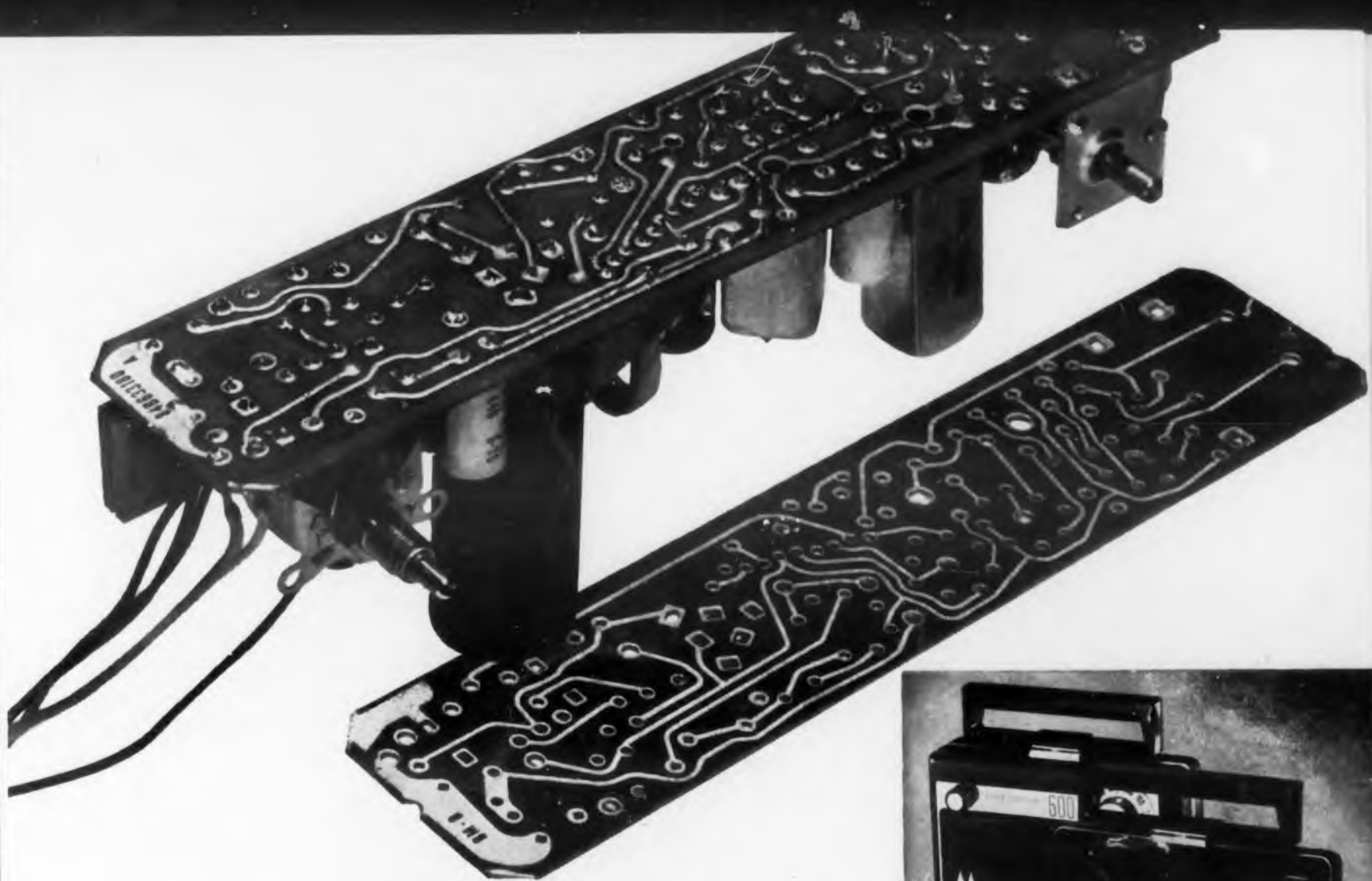
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September 1, 1956

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What this resin does for Motorola's plated circuits

- ... gives a good base for bonding of copper firmly to the laminate
- ... provides high insulation resistance and low dielectric loss
- ... forms a translucent laminate permitting easy checking of reverse side circuit alignment
- ... withstands 500° F. heat of dip-soldering
- ... results in a lamination that exceeds U. S. Government standards and NEMA specifications.

All these advantages are found in BAKELITE Brand Phenolic Resin CLSA-3914, a superior hot punch laminating varnish used in the Motorola "Ranger" portable radio shown here. When high surface resistance is needed, CLSA-3914 is used on paper stock pre-treated with 12 to 16 per cent of a water-miscible resin, such as BAKELITE Phenolic Resin BLL-3913. Both XXXP and XXXP-1R grade laminates are produced by this method.

Technical information on BAKELITE Laminating Varnishes made especially for printed circuits is available by writing Dept. XX-00.

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The Motorola "Ranger" achieves compact, sturdy construction and fast assembly with plated circuits on laminated stock produced by Farley & Loetscher Mfg. Co., Dubuque, Iowa, using BAKELITE Laminating Varnishes.



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