ELECTRONIC DESIGN

JANUARY 8, 1958

B 689081

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DESIGN '58

FREED

Offers for Immediate Delivery

MIL-T-27A TRANSFORMERS

POWER TRANSFORMERS-STANDARD
All primaries 105, 115, 125 v., 60 c.p.s.

Cat. No.	Hi Volt Sec.	ct	DC Volts	DC Amps	Filament #1 Volt	Filament #1 Amp.	Filament #2 Volt	Filament #2 Amp.	MIL Case Size
MGP1	400/200	√	195	.070	6.3/5	2	6.3	3	HA
MGP2	650	√	260	.070	6.3/5	2	6.3	4	JB
MGP3	650	√	245	.150	6.3	5	5.0	3	KB
MGP4	880	√	318	.175	5.0	3	6.3	8	LB
MGP5	900	√	345	.250	5.0	3	6.3	8	MB
MGP6	700	√	255	.250					KB
MGP7	1100	√	419	.250					LB
MGP8	1600	√	640	.250					NB

FILAMENT TRANSFORMERS-STANDARD
All primaries 105, 115, 125 v., 60 c.p.s.

Cat. No.	Secondary Volt	Secondary Amp	Test VRMS	MIL Case
MGF1	2.5	3.0	2,500	EB
MGF2	2.5	10.0	2,500	GB
MGF3	5.0	3.0	2,500	FB
MGF4	5.0	10.0	2,500	HB
MGF5	6.3	2.0	2,500	FB
MGF6	6.3	5.0	2,500	GB
MGF7	6.3	10.0	2,500	JB
MGF8	6.3	20.0	2,500	KB
MGF9	2.5	10.0	10,000	JB
MGF10	5.0	10.0	10,000	KB

PULSE TRANSFORMERS

Cat. No.	Blocking Osc.	Int. Coupling	Low. Pow. Out.	Pulse Voltage Kilovolts	Pulse Duration Microseconds	Duty Rate	No. of Wdgs.	Test Volt. KVRMS	Char. Imp. Ohms
MPT1	√	√		0.25/0.25/0.25	0.2-1.0	.004	3	0.7	250
MPT2	√	√		0.25/0.25	0.2-1.0	.004	2	0.7	250
MPT3	√	√		0.5/0.5/0.5	0.2-1.5	.002	3	1.0	250
MPT4	√	√		0.5/0.5	0.2-1.5	.002	2	1.0	250
MPT5	√	√		0.5/0.5/0.5	0.5-2.0	.002	3	1.0	500
MPT6	√	√		0.5/0.5	0.5-2.0	.002	2	1.0	500
MPT7	√	√	√	0.7/0.7/0.7	0.5-1.5	.002	3	1.5	200
MPT8	√	√	√	0.7/0.7	0.5-1.5	.002	2	1.5	200
MPT9	√	√	√	1.0/1.0/1.0	0.7-3.5	.002	3	2.0	200
MPT10	√	√	√	1.0/1.0	0.7-3.5	.002	2	2.0	200
MPT11	√	√	√	1.0/1.0/1.0	1.0-5.0	.002	3	2.0	500
MPT12	√	√	√	0.15/0.15/0.3/0.3	0.2-1.0	.004	4	0.7	700

AUDIO TRANSFORMERS
Frequ resp. 300 to 10000 cps — 2 DB. All Case Sizes AJ

Catalog No.	Application	Impedance Prim Ohms	Ct.	Impedance Sec. Ohms	Ct.	DC Current Prim. P. Side MA	DC Current Max. Unbal MA	Max Level DBM
MGA1	Single or P.P. Plates — to Single or P.P. Grids	10K	√	90K Split	√	10	10	+15
MGA2	Line to Voice Coil	600 Split		4, 8, 16		0	0	+33
MGA3	Line to Single or P.P. Grids	600 Split		135K	√	0	0	+15
MGA4	Line to Line	600 Split		600 Split		0	0	+15
MGA5	Single Plate to Line	2.6K 4.8T		600 Split		40	40	+33
MGA6	Single Plate to Voice Coil	7.0K 4.8T		4, 8, 16		40	40	+33
MGA7	Single or P.P. Plates to Line	15K	√	600 Split		10	10	+33
MGA8	P.P. Plates to Line	24K	√	600 Split		10	1	+30
MGA9	P.P. Plates to Line	60K	√	600 Split		10	1	+27

TELEMETERING COMPONENTS

BAND PASS FILTERS

Catalog No. $Z_o = 500\Omega$	Catalog No. $Z_o = 2,500\Omega$	3DB Bandwidth per cent of F_o ± 9⅜	± 19⅓	Center Frequency F_o (KC)
FBP-10	FBP-34	√		4
FBP-11	FBP-35	√		5.6
FBP-12	FBP-36	√		7.3
FBP-13	FBP-37	√		9.6
FBP-14	FBP-38	√		13
FBP-15	FBP-39	√		17
FBP-16	FBP-40	√		23
FBP-17	FBP-41	√		30
FBP-18	FBP-42	√		39
FBP-19	FBP-43	√		54
FBP-20	FBP-44	√		73.5
FBP-21	FBP-45	√		105
FBP-22	FBP-46	√		123
FBP-23	FBP-47	√		145
FBP-24	FBP-48	√		220
FBP-25	FBP-49		√	220
FBP-26	FBP-50	√		300
FBP-27	FBP-51		√	300
FBP-28	FBP-52	√		400
FBP-29	FBP-53		√	400
FBP-30	FBP-54	√		525
FBP-31	FBP-55		√	525
FBP-32	FBP-56	√		700
FBP-33	FBP-57		√	700

DISCRIMINATORS

Catalog No.	Per cent Deviation of F_o 9½	19.	Per cent Linearity 0.5	1.0
DST-10	√		√	
DST-11	√		√	
DST-12	√		√	
DST-13	√		√	
DST-14	√		√	
DST-15	√		√	
DST-16	√		√	
DST-17	√		√	
DST-18	√		√	
DST-19	√		√	
DST-20	√		√	
DST-21	√		√	
DST-22	√		√	
DST-23	√		√	
DST-24	√		√	
DST-29		√		√
DST-25	√		√	
DST-30		√		√
DST-26	√		√	
DST-31		√		√
DST-27	√		√	
DST-32		√		√
DST-28	√		√	
DST-33		√		√

DISCRIMINATOR LOW PASS FILTERS

Catalog No.	Center Frequency F_o (cps)	Catalog No.	Center Frequency F_o (cps)	Catalog No.	Center Frequency F_o (cps)	Attenuation
OUTPUT						
LPO-10	6	LPO-19	81	LPO-28	790	.2 DB to 0.5 F_o; 7 DB to 1 F_o; 20 DB to 2 F_o; 30 DB from 2.5 F_o
LPO-11	8	LPO-20	110	LPO-29	980	
LPO-12	11	LPO-21	160	LPO-30	1,050	
LPO-13	14	LPO-22	185	LPO-31	1,200	
LPO-14	20	LPO-23	220	LPO-32	1,600	
LPO-15	25	LPO-24	330	LPO-33	2,100	
LPO-16	35	LPO-25	450	LPO-34	7,200	
LPO-17	45	LPO-26	600	LPO-35	10,000	
LPO-18	60	LPO-27	660			
Characteristic impedance of all = 330!!						
INPUT						
LPI-10	400	LPI-17	3,000	LPI-23	14,500	.05 DB at 9⅜% F_o; 30 DB at third Harmonics; 50 DB at fifth Harmonics
LPI-11	560	LPI-18	3,900	LPI-24	22,000	
LPI-12	730	LPI-19	5,400	LPI-25	30,000	
LPI-13	960	LPI-20	7,350	LPI-26	40,000	
LPI-14	1,300	LPI-21	10,500	LPI-27	52,500	
LPI-15	1,700	LPI-22	12,300	LPI-28	70,000	
LPI-16	2,300					
Characteristic impedance of LPI-10 thru 23 = 30,000!! of LPI-24 thru 28 = 5,100!!						

MINIATURE COMPONENTS

For Delivery From Stock
(MEET MIL-T-27A SPECIFICATIONS)

MINIATURE AUDIO TRANSFORMERS

Catalog No.	Input	Coupling	Power Level	Balanced DC Current	Unbalanced DC Current	Impedance Ohms pri.	Impedance Ohms sec.
			DBM	MA	MA		
PMA-1	√		+8	0	0	50/200/500	60,000 center tapped
PMA-2	√		+8	0	0	4/8	
PMA-3	√		+8	0	0	50/200/500	
PMA-4		√	+8	0	0	15,000	
PMA-5		√	+8	2	2	15,000	
PMA-6	√		+8	0	0	15,000	50/200/500
PMA-7	√		+8	2	2	15,000	
PMA-8	√		+8	2	.25	30,000 ct	
PMA-9		√	+8	0	0	60,000	
PMA-10		√	+8	0	0	50/200	

All units ±2 DB 30 to 20,000~; PMA 5 and 7 ±2 DB 200 to 10,000~. Case size 15/16"D x 1½" high, flanges 1½" long.

TRANSISTOR TRANSFORMERS

Catalog No.	200 to 15,000 DB	300 to 15,000 DB	Unbalanced DC Current MA	Max. Power Out W.	Impedance Ohms pri.	Impedance Ohms sec.
TMA-1	±1		0	.25	500	500
TMA-2		±2	3	.25	50K	500
TMA-3		±2	3	.25	50K	6
TMA-4		±3	1	.25	100K	1.2K ct.
TMA-5	±2		3	.25	25K	1.2K ct.
TMA-6		±2	3	.25	50K	1.2K ct.
TMA-7	±1		4	.25	600/150	1.2K ct.
TMA-8	±2		3	.25	25K	600
TMA-9	±1		1	.25	4K ct.	600/150
TMA-10	±2		10	.25	2K	3.2
TMA-11	±1		1	.25	4K ct.	3.2
TMA-12		±2	4	.25	20K	50
TMA-13		±2	8	.25	1K	50
TMA-14		±2	0	.10	100K	1K
TMO-15		±2	1	.04	20K	50
TMO-16		±2	1	.04	20K	600
TMO-17		±2	3	.06	1K	50
TMO-18		±2	0	.10	100K	1K
TMA-19	±2		20	1.	1K	3.2

Case size 1"D x 1.5" high, flanges 1⅜". Specify TMO for open, TMC for encapsulated units.

MINIATURE HIGH Q TOROIDS

Cat. No.	Ind. MHY	Cat. No.	Ind. MHY	Cat. No.	Ind. MHY	Cat. No.	Ind. MHY
to 15 KC		10 to 50 KC		30 to 75 KC		50 to 200 KC	
F2050	1.	F2100	0.1	F2140	0.1	F2180	0.1
F2051	3.	F2101	0.2	F2141	0.2	F2181	0.2
F2052	5.	F2102	0.3	F2142	0.3	F2182	0.3
F2053	10.	F2103	0.4	F2143	0.4	F2183	0.4
F2054	15.	F2104	0.5	F2144	0.5	F2184	0.5
F2055	30.	F2105	1.0	F2145	1.0	F2185	0.6
F2056	50.	F2106	2.0	F2146	2.0	F2186	0.7
F2057	75.	F2107	3.0	F2147	3.0	F2187	0.8
F2058	100.	F2108	4.0	F2148	4.0	F2188	0.9
F2059	150.	F2109	5.0	F2149	5.0	F2189	1.
F2060	200.	F2110	7.5	F2150	7.5	F2190	2.
F2061	300.	F2111	10.	F2151	10.	F2191	3.
F2062	400.	F2112	15.	F2152	15.	F2192	4.
F2063	500.	F2113	20.	F2153	20.	F2193	5.
F2064	750.	F2114	30.	F2154	30.	Case size: ¾"x11/32" x25/32h.	
F2065	1,000.	F2115	50.	F2155	50.		
F2066	1,250.	F2116	75.	F2156	75.		
F2067	1,500.	F2117	100.	F2157	100.		
F2068	1,750.	Encapsulated 1"dx⅞"h. When ordering hermetically sealed units add H, encapsulated units MR to Cat. No.					
F2069	2,000.						

Send for NEW 48 page transformer catalog. Also ask for complete laboratory test instrument catalog.

FREED TRANSFORMER CO., INC.
1727 WEIRFIELD ST., BROOKLYN (RIDGEWOOD) 27, NEW YORK

COVER STORY

≤ CIRCLE 1 ON READER-SERVICE CARD

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January 8, 1958 Vol. 6

NUMBER 1

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CIRCLE 2 ON READER-SERVICE CARD

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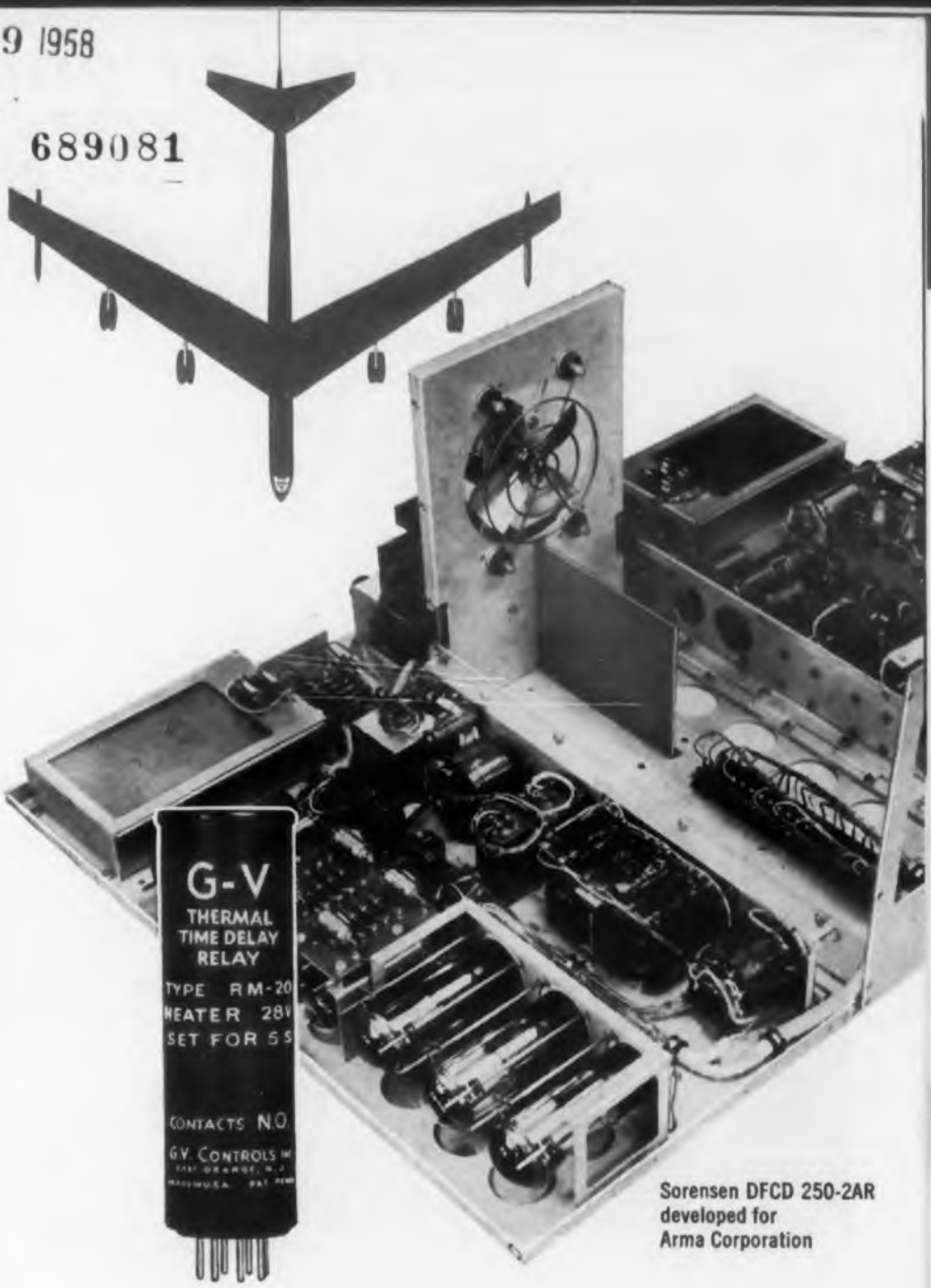


Sorensen DFCD 250-2AR
developed for
Arma Corporation

Sorensen Specifies
G-V Thermal Time Delay Relays
"...to enhance reliability..."

In this B-52 power supply control unit, developed by Sorensen & Company, a G-V relay serves as the initial time delay to protect functional thyratron circuitry. Another G-V relay recycles the equipment under overload conditions. Sorensen states that, "These G-V units enhance system reliability and extend life of thyratron tubes and all other circuitry".

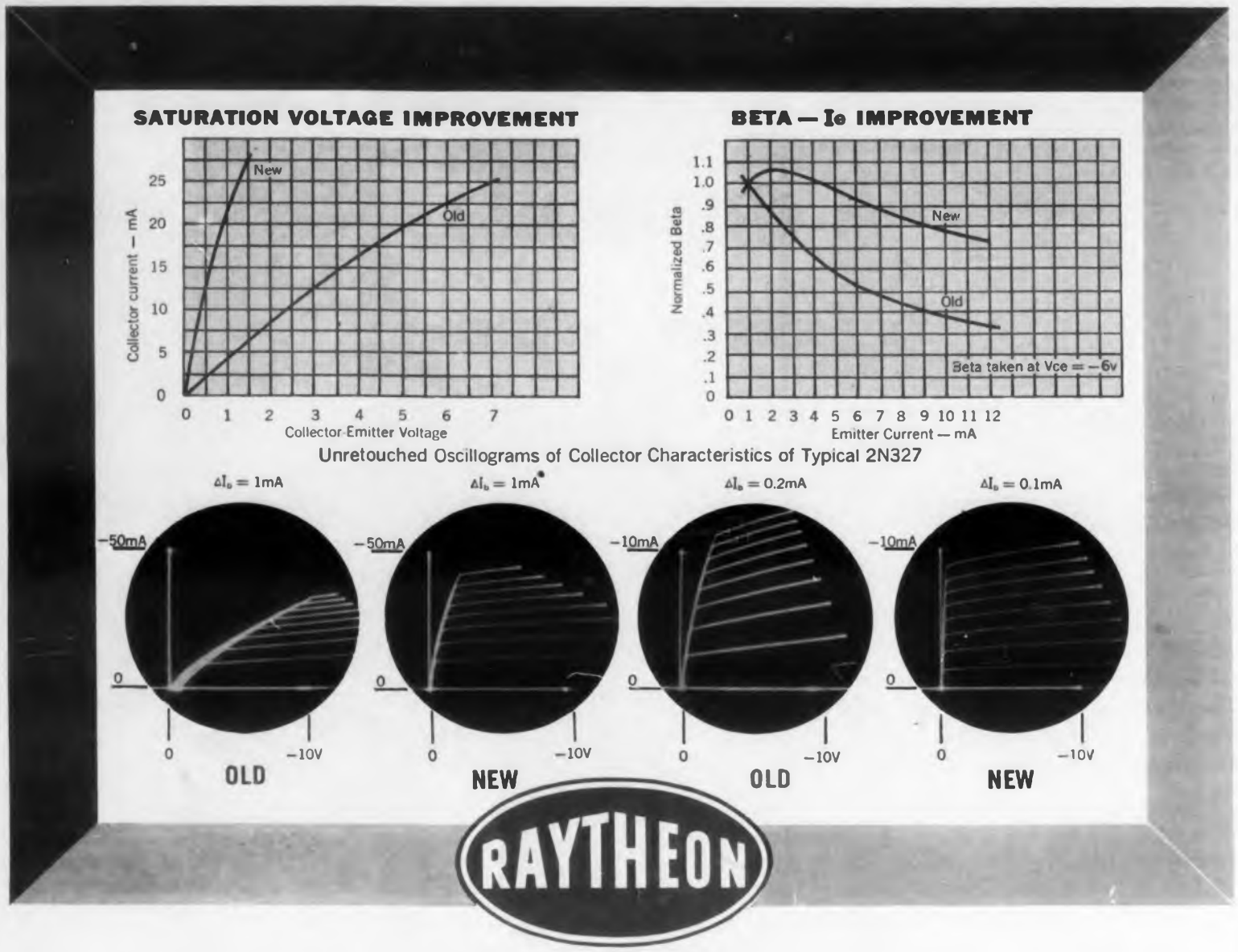
In both military and industrial equipment, G-V thermal relays are providing long, dependable, proven service in time delay applications, voltage and current sensing functions and circuit protection.

Write for extensive application data
and catalog material.

G-V CONTROLS INC.
18 Hollywood Plaza, East Orange, N. J.

PICTURE OF PROGRESS

in PNP SILICON transistor performance



These "pictures" are worth a thousand words as evidence of

higher, more constant beta
lower saturation voltage

the result of Raytheon processing advances.

RAYTHEON NEW HIGH TEMPERATURE SILICON TRANSISTORS

Type	Reverse Current at—20V* Collector μA	Reverse Current at—20V* Emitter μA	Beta	Base Resistance ohms	Collector Resistance kilohms	Noise Figure db(max.)	Collector Capacity μμf	Alpha Freq Cutoff KC
2N327A	0.005	0.005	14	1200	500	30	65	200
2N328A	0.005	0.005	25	1400	500	30	65	300
2N329A	0.005	0.005	50	1500	500	30	65	400
2N330A	0.005	0.005	18	1300	500	15	65	250

*at 25°C

OTHER ADVANTAGES

- the JETEC 30 package
- 0.200" pin circle dia. — ideal for printed circuits
- minus 65°C to plus 160°C
- welded — hermetically sealed
- lowest noise figure
- made by the Raytheon Fusion-Alloy process which assures extreme reliability (less than one open in 800,000 hours during 20,000,000 hours of life tests)

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CIRCLE 3 ON READER-SERVICE CARD

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Engineering Review

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

Airborne Digital Computer in Production

A miniaturized digital computer, small enough to fit into the cabinet of a 21 in. table model TV, is now in production by Hughes Aircraft Company. This assembly-line hardware is rated at 9600 additions or subtractions per minute and is designed for installation in jet interceptors. It will handle the aircraft through all phases of supersonic combat, from takeoff to touchdown.

While engaged in navigational operations the Digitair samples 33 analog and 28 digital inputs per sec while computing 14 analog and 16 digital outputs. Designed for rugged environment, it will operate over a range of ambients from −67 to +160 F, and will withstand 15g shocks.

Built to make life easy for the Air Force technician, the new digital computer has a built-in self-testing unit. Through use of dialing devices the technician can determine if each part of the control system is working right. If not, he can instantly substitute complete black boxes.

The Digitair has been flight-tested 1100 hours, can navigate, control target approach and bomb release, communications, flight functions, direct armament and escape maneuvers, return the aircraft to its base in the proper landing order.

Above: Plug-in-assemblies like this one help keep size of the computer to that of a table model TV. **Right:** Magnetic memory drum of computer is precision balanced as it rotates on jets of air. Computer, first in actual production, will be used in Air Force all-weather jet interceptors.

669

NEW—Raytheon Amplitron

Now—peak power 800 kw, bandwidths of 10% with efficiencies of 50-70% over entire band

QK520 Amplitron
Typical Operation (Pulsed)

Anode Voltage	40 kV
Anode Current	35 amps
Peak Power Output	800 kw
Average Power Output	1200 watts
Efficiency	55%
Operating Band (±1 db)	1225-1350 Mc
Peak Power Input	80 kw
Phase Stability with Anode Current	1°/amp

The Amplitron is a new type of tube capable of power amplification at microwave frequencies. Amplification is obtained over a broad range of frequencies without need of mechanical or electrical adjustments. The Amplitron is a derivative of the magnetron and retains many of its advantages—high operating efficiency, simple construction, small size, light weight, low operating voltage.

The Amplitron uses crossed electric and magnetic fields, a reentrant beam produced by a magnetron-type cathode, and a non-reentrant broadband circuit matched at either end to external circuits.

Variations in anode current or voltage have little effect upon the total phase shift. This results in very low phase pushing and excellent reproduction of the input spectrum even under pulse conditions with slow rise time and ripple. Because of low insertion loss, duplexing may be accomplished at the input rather than the output of the final rf amplifier.

A limited quantity of preliminary literature is now available. To be sure of your copy, write now. *Amplitrons in other frequency bands are currently in development. Inquiries are invited.*

RAYTHEON MANUFACTURING COMPANY

RAYTHEON

Excellence in Electronics

Microwave and Power Tube Operations, Section PT-20
Waltham 54, Massachusetts

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CIRCLE 5 ON READER-SERVICE CARD

Engineering Review

Predict Vending Machine Boom

The first practical robot cashier to accept a dollar bill and make change automatically has been unveiled by a Chicago scientist.

The new device, called the Bill Changer, can create a long-predicted revolution in the vending machine industry, according to its inventor, William A. Patzer, President of the A.B.T. Mfg. Corp., 715 N. Kedzie Ave., Chicago, Illinois. The Bill Changer will go into production soon and the first models will be available in 1958.

It will first be manufactured as a change-making device for installation in hotels, transportation terminals, near food vending machines and telephones.

IRE Announces 1958 Officers

Donald G. Fink, Director of Research of the Philco Corporation, has been accorded one of the highest engineering honors with the announcement of his election as president of the Institute of Radio Engineers for 1958. Mr. Fink succeeds John T. Henderson, Principal Research Officer of the National Research Council, Ottawa, Canada, as head of this international society of 62,000 radio engineers and scientists.

Carl-Eric Granqvist, Director of Svenska Aktiebolaget Gasaccumulator, Stockholm-Lidingo, Sweden will succeed Yasujiro Niwa, President of Tokyo Electrical Engineering College, Tokyo, Japan as IRE Vice President.

Elected as directors for the 1958 to 1960 term are G. S. Brown, Professor and Head of the Department of Electrical Engineering, Massachusetts Institute of Technology, Cambridge, Mass. and W. H. Doherty, Assistant to the President of Bell Telephone Laboratories, Inc., New York, N.Y.

Solid State Rectifier Can Replace Thyratron

A commercially practical solid state rectifier has been operated by engineers at General Electric's Clyde, New York Rectifier Engineering Laboratory. This silicon controlled rectifier operates in the same manner as a thyratron, and is capable of switching 1000 watts. A power rating of this magnitude is sufficient for most military and commercial applications.

The device is expected to be first used in missiles. Applications possible with this rectifier are; the replacement of mechanical power converters and latching relays.

Present operating models of the device have performed satisfactorily at temperatures of 150 C. A control load of 5 amps at 200 v has been switched in 1.5 μsec with an injected power of 15 mw.

The size of the silicon controlled rectifier is approximately twice that of a signal type transistor and 1/100 the size of a thyratron. The predicted life of the device is over 300,000 hours as compared to the 1000 hour life of a thyratron.

Wide commercial use of the device is expected. It can control the rise and fall current in a welding machine, lighting intensity, cooking heat in electric ranges, and motor speed control in appliances. Wide applications in the automotive industry are also anticipated.

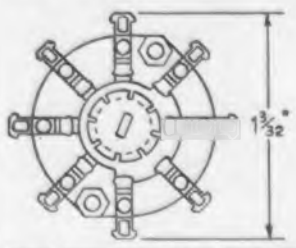
Scientific Salaries Up

Salary levels of engineering, scientific, and administrative employees in American industry rose an average of 5.9 per cent between June, 1956, and June, 1957, according to a survey recently distributed to subscribers by the American Management Association's Executive Compensation Service.

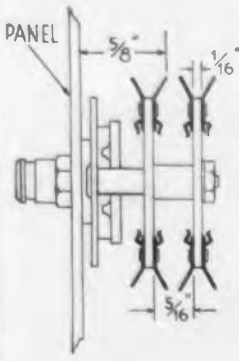
This increase is appreciably lower than the 8.6 per cent average salary rise reported for the same group for the year ended in June, 1956. The change may indicate, the AMA report suggests, that the compensation of engineers is returning to normalcy. This year's average pay increase for technical and administrative workers closely approximates those found by the Executive Compensation Service in recent surveys of top and middle management compensation, suggesting that administration of salaries at all levels has become relatively uniform of late.

The study, the fourth annual survey of administrative and technical compensation by the Executive Compensation Service, covered rates and ranges of pay for 33,797 employees engaged in 58 major engineering, scientific, and administrative activities in 263 companies located throughout the United States and Canada.

NEW miniature switch....



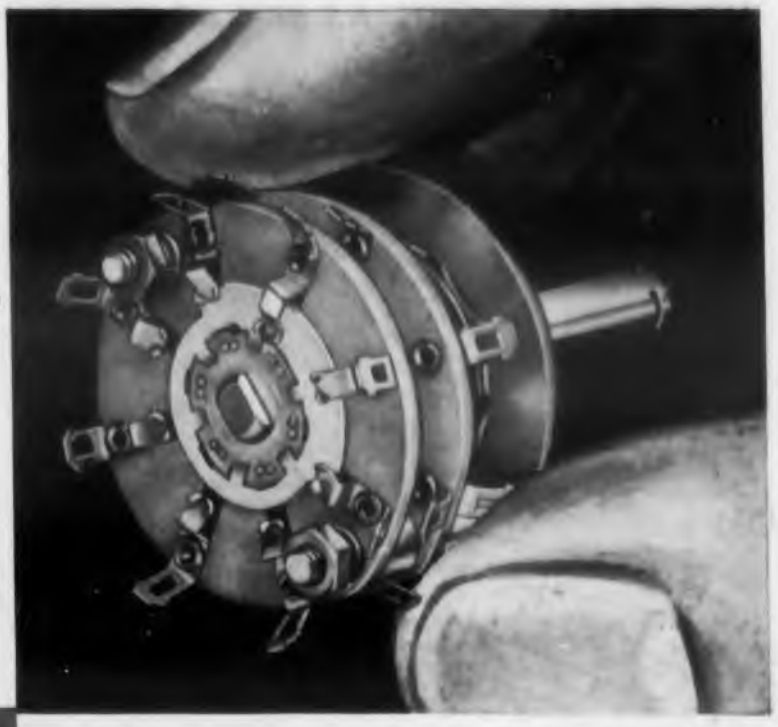
FITS IN 1-3/32" CIRCLE



MINIMUM DEPTH BEHIND PANEL—ONLY 5/8" FOR A SINGLE-SECTION SWITCH

SWITCH SECTION IS ONLY 1/16" THICK

MINIMUM SPACE BETWEEN SECTIONS—5/16" WITH CLIPS ON FRONT AND BACK



OAK

SERIES "A"

LOW-CURRENT ROTARY SWITCH

- UP TO 18 CONTACTS PER SECTION
- 1/4" SHAFT, STANDARD
- LOW CAPACITANCE
- SAME HIGH QUALITY AND RELIABILITY AS LARGER OAK SWITCHES

Here's new help in the battle of miniaturization. This tiny switch can pare critical space and weight from your designs. The large number of contacts it provides enables you to handle complex circuits, too. The clips on the Series "A" are a miniature version of the famous Oak double-wiping design—long accepted as the standard of the industry for reliability and long life. Oak engineers will be glad to furnish complete information, and work with you in developing the exact variation you need.

Write on Company Letterhead for a Copy of the Oak Switch Catalog

SPECIFICATIONS

Index—Double ball bearing, hill and valley type with stainless steel spring. Fixed and adjustable stops, and locating key available.

Shafts and Bushings—1/4" shaft with 3/8-32 bushing is standard; 5/32" shaft with 3/8-32 bushing and 1/8" shaft with 1/4-32 bushing can be supplied also. Water seal bushings optional.

Sections—8, 10, or 12-position, stacked in any number up to a total depth of three inches. The 12-position section provides up to 18 insulated contacts—12 on front, 6 on back. *No insulating blocks are needed on back.*

Poles	8-Position (45° throw)	10-Position (36° throw)	12-Position (30° throw)
1 pole	2 to 8	2 to 10	2 to 12
2 poles	2 to 4	2 to 5	2 to 6
3 poles	2 to 3	2 to 4	2 to 5
4 poles	2	2 to 3	2 to 3
5 poles	. . .	2	2
6 poles	. . .	. . .	2

Clips—Solid spring-silver alloy or silver-plated spring brass, fastened by solid rivets.

Insulation—Stator is silicone fiber glass, meeting specification MIL-P-997 type GSG; rotor is KEL-F®, known for its excellent mechanical and electrical properties.

Finish—Commercial or 50 and 200-hour salt spray.

OAK MFG. CO.

1260 Clybourn Avenue, Dept. D, Chicago 10, Illinois
Phone: MOhawk 4-2222

CIRCLE 6 ON READER-SERVICE CARD

TUNG-SOL GERMANIUM PNP TRANSISTORS

in JETEC 30 (TO-5 OUTLINE) Package

. . . the Industry-Standard Package

All desirable electrical characteristics, without difficulty over mechanical and electrical interchangeability, are available to users of germanium PNP transistors in the industry-standardized JETEC 30 (TO-5 OUTLINE) package.

The JETEC 30 package can be welded to produce a more dependable hermetic seal with complete absence of flux gases. Its cylindrical shape, plus flange and base design, has high mechanical strength and facilitates uniform and positive welding. The form factor and basing design facilitate accurate, automatic assembly with printed circuits.

Tung-Sol JETEC 30 transistors are hermetically sealed in a controlled atmosphere to insure freedom from moisture and other contamination often produced by heat-conducting substances . . . the ultimate assurance of high reliability and long operating life.

For additional information contact Semiconductor Division, Tung-Sol Electric Inc., Newark 4, N. J. or the sales office nearest you.

PRINCIPAL CHARACTERISTICS OF TUNG-SOL TRANSISTORS

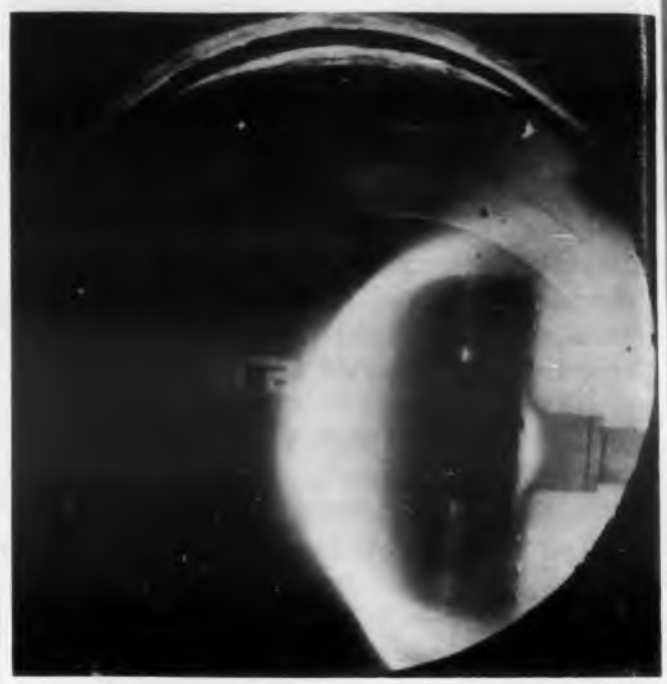
2N381	200 m.w.	dissipation rating	high current	beta control
2N382	200 m.w.	dissipation rating	high current	beta control
2N383	200 m.w.	dissipation rating	high current	beta control
2N398	105v	collector voltage		
2N404	12 m.c.	frequency cut off		
2N425	4 m.c.	frequency cut off	20v	V_{ceo} rating
2N426	6 m.c.	frequency cut off	18v	V_{ceo} rating
2N427	11 m.c.	frequency cut off	15v	V_{ceo} rating
2N428	17 m.c.	frequency cut off	15v	V_{ceo} rating
2N460	200 m.w.	dissipation rating	45v	collector rating
2N461	200 m.w.	dissipation rating	45v	collector rating

SEMICONDUCTOR DIVISION TUNG-SOL ELECTRIC INC., NEWARK 4, N. J.

SALES OFFICES: ATLANTA, GA.; COLUMBUS, OHIO; CULVER CITY, CALIF.; DALLAS, TEXAS; DENVER, COLO.; DETROIT, MICH.; IRVINGTON, N. J.; MELROSE PARK, ILL.; NEWARK, N. J.; SEATTLE, WASH.

CIRCLE 7 ON READER-SERVICE CARD

Engineering Review



The force of air over this hemisphere-cylinder test shape provides light for the photograph in the "Hotshot" tunnel developed for the ARDC. Tests are made in primary research studies associated with re-entry problems.

Tunnel "Hotshot" 15,000 F&C Mach 20

Difficult aerodynamic problems associated with re-entry of missiles or aircraft flying "far-hypersonic" speeds into the earth's atmosphere are under investigation for the Air Force in "Tunnel Hotshot" at ARDC's Arnold Engineering Development Center, Tullahoma, Tenn.

The tunnel has special rapid-response instrumentation developed for the Air Research and Development Command by scientists of ARO, Inc., operating contractor for AEDC. This instrumentation permits conventional model pressure distribution and heat transfer distribution measurements during the test runs which have lasted up to a 25th of a sec.

Temperatures over 15,000 deg F, and speeds from Mach 10 to approximately Mach 20 have been generated in the electrical-arc driven intermittent tunnel during the first test programs for the weapon systems of industry customers. The first test runs were made early this year.

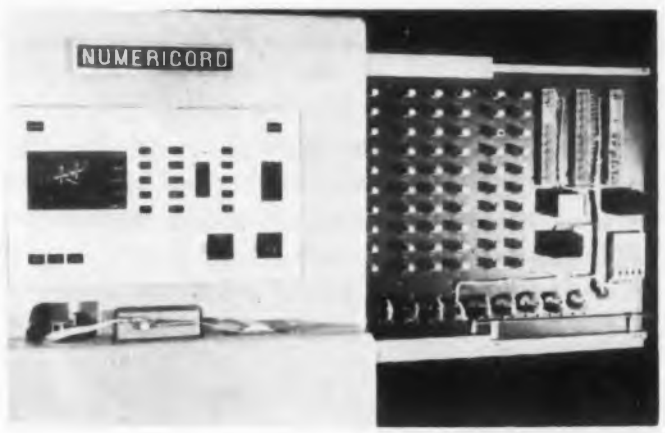
In addition to the extreme Mach numbers, high temperatures and pressures, "Hotshot" provides simulation of the real gas effects of vibrational excitation, dissociation and ionization which are encountered in studying aerodynamics of extremely high-speed aircraft or missiles flying within the earth's atmosphere.

DC Power Supply Erratum

New Product review *DC Power Supply; 0.001 μsec recovery* (page 79, November 1 ED) contained certain inaccuracies. The heading should read 0.001 sec recovery instead of 0.001 μsec. Line 6: Output 6 v adjustable ±5 per cent, 0.5 a, should read: Output 6 v adjustable ±5 per cent 0-5 amp.

Milling Machine Control

The numerical control product by Concord Control Inc. Boston Mass, operates any milling machine that has suitable magnetic tape conversion equipment. Giddings and Lewis skin milling machines and G & L Variax milling machines, operating from magnetic tapes have up to five simultaneously controllable motions, all under numerical control. They provide for a drastic reduction in set-up time, consistent accuracy and reliable duplication of the most complex of aircraft parts. Mass production economies can be realized in the short and broken run production that typifies aircraft and missile manufacture. The system is actually a data processing center for machine tool control. It consists of four subassemblies, a paper tape preparation unit, an electronic computer and converter called the "director," a magnetic tape recording unit, and a power supply. Purpose of the director system is to provide extreme flexibility in set-up for machining and completely automatic operation once the set-up is made. Machining instructions are previously prepared and punched on paper tape. This keeps the operation completely free of cams, templates, models, or manual control.



The operator is in complete control of the program and can check its progress at all times. Indicators give positional information, to an accuracy of 0.0005 in. By pressing buttons marked R (for reverse), tapes originally programmed for right handed parts automatically produce left handed parts. In this photograph the control panel circuits are shown extended to the right on their roller slide for ease of maintenance.

ARNOUX ... announces

ELECTRONIC COMMUTATION ... FOR Airborne TELEMETRY

Model ETC-30-10-P.A.M.-1

30 Channels — 10 Samples /Sec.

- Directly replaces mechanical commutators in 0-3 Volt and 0-5 Volt airborne telemeter applications.
- Available in all standard sampling rates required for P.A.M. and P.D.M. commutated systems.
- Meets all I.R.I.G. requirements, exceeds MIL E-5272A specification.
- Errors due to drift, cross-talk and non-linearity less than 0.50 percent under MIL E-5272A environment.
- Noise-free operation assured for thousands of hours without maintenance.
- Twenty-Seven (27) information channels, plus Master pulse.
- Unique limiting feature eliminates need for limiters elsewhere in system.
- Power Requirement: 150V DC at 12 ma.
- Size: 3" diameter x 5" long.
- Weight: Less than 2 pounds
- Extreme reliability is achieved through use of a simplified counter circuit in conjunction with an advanced-design silicon diode switching matrix.
- Design life expectancy is at least 5000 hours without maintenance of any kind.

WRITE FOR ARNOUX BULLETIN 700

ARNOUX CORPORATION

Designers and Manufacturers of Precision Instrumentation

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CIRCLE 8 ON READER-SERVICE CARD

Hughes
Quick Recovery
Silicon Junction
Diodes

HIGH SPEED
HIGH TEMPERATURE
HIGH VOLTAGE

Now, in circuits where germanium once provided the only possibility, you can use quick recovery silicon diodes from Hughes. Speeds are fast enough for most high frequency or fast switching applications. And every diode is well able to stand up under high voltages at high temperatures. In fact, the breakdown voltage *increases* with temperature, thereby providing maximum protection when temperatures reach unexpected levels. This is real ruggedness, the kind that ensures reliability under the most severe operating conditions.

NEW HIGHER CONDUCTANCE TYPES — Here's a new group of related diodes, each with excellent voltage and temperature characteristics plus the added advantage of higher forward current.

*Special high conductance types are available in *all* voltage classes covered by the standard line.

SPECIFICATIONS *

Type Numbers	WIV (min.)	Forward Current @ 1.5V (min.)	Reverse Current at Specified Voltage @ 25°C (max.)	@ 100°C (max.)	Recovery (mod. IBM "Y" test circuit)
1N625	30V	4mA	1 μA @ −10V 10 μA @ −20V	50 μA @ −20V	15 KΩ (min.) in 0.15 μsec
1N626	50V	4mA	20 μA @ −35V	100 μA @ −35V	400 KΩ (min.) in 1 μsec
1N627	100V	4mA	20 μA @ −75V	100 μA @ −75V	400 KΩ (min) in 1 μsec
1N628	150V	4mA	20 μA @ −125V	100 μA @ −125V	400 KΩ (min.) in 1 μsec
1N629	200V	4mA	20 μA @ −175V	100 μA @ −175V	400 KΩ (min.) in 1 μsec
HD6573	150V	6mA	20 μA @ −125V	100 μA @ −125V	400 KΩ (min.) in 1 μsec
HD6635	50V	15mA	20 μA @ −35V	100 μA @ −35V	400 KΩ (min.) in 1 μsec
HD6641	150V	15mA	20 μA @ −125V	100 μA @ −125V	400 KΩ (min.) in 1 μsec
HD6642	50V	6mA	20 μA @ −35V	100 μA @ −35V	400 KΩ (min.) in 1 μsec

Ambient Operating Temperature Range: −80°C to +150°C

Perhaps you would like to discuss your particular requirements with us. If so, please write:

SEMICONDUCTOR DIVISION • HUGHES Aircraft Company
International Airport Station, Los Angeles 45, California

Creating a new world with ELECTRONICS

HUGHES PRODUCTS

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CIRCLE 9 ON READER-SERVICE CARD

Engineering Review

Aircraft Flight Indicator Shows Altitude and Radio Beam: Development of this aircraft flight director and altitude indicator allows a pilot to control his aircraft in altitude, intercept a selected radio beam smoothly, and fly his course in relation to this signal.

The device, developed by Lear Inc., Grand Rapids, Michigan, allows the pilot to align a horizontal line on a two tone background sphere with a miniature airplane reference. The coincidence of the two items indicates that the plane is in level flight. By reference to cross-pointers, the pilot can maneuver in reference to localized glide path, omnirange, or "command" signals.

The sphere is free to rotate 360 deg in both pitch and roll, providing unlimited altitude indication during aerobatics. Twin vertically placed roll pointers refer to a conventional roll angle scale on the upper portion of the presentation.

The altitude director indicator system is remotely referenced. The fully transistorized amplifier may be packaged within the indicator housing, or installed remotely, if space limitations are critical. The indicator has successfully undergone extensive flight testing in USAF jet aircraft, and is now in production.

Chemical Memory Cell Used to Replace Tape

Microscopic cells containing a photosensitive liquid may provide a practical chemical memory system. National Cash Register Company, Dayton, Ohio, has demonstrated a large scale prototype system that prints, reads and erases information on a photosensitive film. The basic

technique involves the encapsulation forming of a "solid liquids" by composing tiny droplets of liquid a millionth of an inch in diameter in gelatin film. The substance is then coated on paper or other material.

The basic ingredient in the process is a special oil called metachromatic dye. Exposure to blue light causes the dye to turn a brilliant blue. When a yellow light shines on the exposed material, it becomes colorless. This chemical switch can be made indefinitely.

The dye is placed in a microscopic capsule, and can be handled like a solid. It is in this form that it is applied to computer use.

Although the chemical memories are similar to the magnetic tapes now in use, they have the advantage of eliminating spreading. They also promise computers with a high storage capacity, high access speed and low cost. Ideally, one million bits would be stored on one square inch.

Applications of this technique have provided NCR scientists with interesting by products.

A carbonless business form is one of these applications. The paper is coated with the dye cells. As the key of the typewriter hits the paper, the cell breaks, and leaves a print.

It is also foreseen that the same technique will provide a means of printing with magnetic characters to be read by both people and machines.

Superfast Chemistry and Optics

An instantaneous sequence of chemical reactions like those that take place in rocket explosions can be analyzed by *time-of-flight-mass-spectrometer*. Produced by the Cincinnati Division of Bendix Aviation, the new device can complete a chemical analysis in 100 μsec. The instrument reveals the respective molecular masses of vaporized liquids, solids, and gases.

A four-foot metal ion gun is used in the pulsing of ionized particles from one end of the tube to the other. The time of flight is measured and appears on an oscilloscope as a wave pattern or spectrum. The device will find use in identifying the harmful materials that may foul and destroy an engine. It is expected that the new spectrometer will be used to learn why engines flame out when the plane flies into the exhaust of its own rockets.

On the obverse of this same coin Precision Technology, Inc. has developed an image converter camera capable of exposure times as short as 0.5 μsec. The new camera will be used to photograph rocket explosions, as well as shock tube studies, detonation processes, spectrographic transients and hypersonic ballistics. It should be possible to record a virtually continuous detonation and disintegration of solid rocket fuel particles.

New from Clevite!

SILICON JUNCTION DIODES

These latest additions to Clevite's complete line of computer and general-purpose diodes offer you the advantages of:

ULTRA FAST RECOVERY TIME . . . (JAN-256)
(Typical: from +5.0 ma to −40v
. . . 400K in 0.3μs)

HIGH FORWARD CONDUCTANCE
(Typical: 50 ma at 1.5v)

EXTREMELY LOW REVERSE CURRENT

FREEDOM FROM THERMAL RUNAWAY
at high voltage and up to 150°C

RUGGED, HERMETICALLY SEALED GLASS PACKAGE

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CIRCLE 10 ON READER-SERVICE CARD

ESC WIDE BAND VIDEO TRANSFORMERS have been engineered and developed to offer... subminiature units of unusually wide bandwidth (50 CPS to 8.0 MC). They are used to replace bulkier and more costly components, thereby creating greater economy, and increasing equipment efficiency.

ESC ELECTRONIC COMPONENTS DIVISION specializes in the design and development of Wide Band Video Transformers to meet your particular applications. Each transformer prototype is accompanied by a comprehensive laboratory report, which includes submitted electrical requirements, photo-oscillograms (which indicate input and output pulse shape and output rise-time), the test equipment used, and evaluation of the electrical characteristics of the prototype.

WIDE BAND VIDEO TRANSFORMERS

ESC PART NUMBER	TURNS RATIO	PRIMARY IMPEDANCE (OHMS)	SECONDARY IMPEDANCE (OHMS)	BANDWIDTH at 1 db POINTS	APPROXIMATE PHYSICAL DIMENSIONS
4001	1:1	600	600	50 CPS to 8.0 MC	1-5/8" OD x 1/2"
		3500	3500	1 KC to 1.5 MC	
		10,000	10,000	1.6 KC to 800 KC	
4002	4:1	1600	100	100 CPS to 320 KC	1-1/8" OD x 3/8"

Transformers Are Supplied With Solder Terminals

Meet All Applicable Mil-Specs

Complete catalog data on request

electronic components division

ESC® CORPORATION • 534 BERGEN BOULEVARD • PALISADES PARK, NEW JERSEY

exceptional employment opportunities for engineers experienced in pulse techniques

Pulse transformers • Medium and low-power transformers • Filters of all types • Pulse-forming networks • Miniature plug-in encapsulated circuit assemblies

Engineering Review

U.S. AEC Office Opened in Tokyo

An Atomic Energy Commission office was opened in Tokyo, Japan on November 15, 1957. The Tokyo office will assist in the scientific and technical aspects of the rapidly expanding atomic energy developments in Japan. This will include liaison with the Japanese atomic energy authorities and scientists in connection with problems associated with implementation of the bilateral agreement for cooperation concerning energy uses.

The AEC Scientific Representative will also assist the Department of State, ICA, USIA and other agencies in nuclear energy matters.

Microwave Generator Radiates 17 Million Watts

Microwave or radar-like signals many times more powerful than believed possible, have been transmitted by Cornell Aeronautical Laboratory, Inc., Buffalo, New York. Believed to be the largest peak power ever radiated, 17 million watts have been emitted by a special microwave generator. Under contract with Army Ordnance, Cornell Aeronautical Laboratory is conducting research applicable to USA missile systems.

Editor's Note: Additional information on this project is classified.

Inside the Brain

Apparatus designed to "get right inside the brain" of a man has been described in a paper by Dr. W. J. Johnson of Defense Research Medical Laboratories, Toronto, Canada. The author shows how a robot can compute sensations of a man who is subjected to extreme tests of acceleration and dizziness.

The apparatus consists of an assembly of gyroscopes which are attached to the subject's head. Each sensing device is approximately the size of a spool of thread. With this computer it is possible to determine

CIRCLE 11 ON READER-SERVICE CARD

the subject's equilibrium and his impression of orientation and destination.

The findings of this study have proved extremely useful in understanding the experiences of people subjected to different types of motion.

Small Radar Sets for Landing Craft

The Navy may soon be able to land assault troops on an enemy beach in fog or other conditions of zero visibility day or night with pin-point accuracy and timing.

Small amphibious forces landing craft, the LCPL (personnel) and the LCV (vehicles), will be outfitted shortly with rugged lightweight radars supplied by Raytheon Mfg. Company, Waltham, Mass., to help place invasion troops at strategic, tactical beachhead positions. These craft replace the World War II ship-carried LCVP's and LCM's.

The Navy has awarded a contract for 133 of these small-boat radars. They are modified versions of the company's "Mariners Pathfinder 1500."

By adapting the "Mariners Pathfinder," the Navy can place radars economically on landing craft for the first time.

The new Navy model—designated the AN/SPS-35 (Army-Navy/Surface Craft, Radar, Search)—proved extremely accurate and rugged, and easy to operate and maintain during recent tests at the Navy's Little Creek, Va. amphibious base. First deliveries are scheduled for the end of the year.

The radars will help boatswain mates to safely navigate small craft through uncharted or dangerous waters by providing needle-sharp, high definition targets on a 10-inch radar scope. These can be compared against known landmarks or beacons. Navigational hazards like exposed reefs and floating debris, as well as other craft also appear on the scope.

The equipment can detect the smallest navigational markers, such as buoys only 18 inches in diameter, as close as 50 yards from the vessel, while land can often be detected as far away as 32 miles.

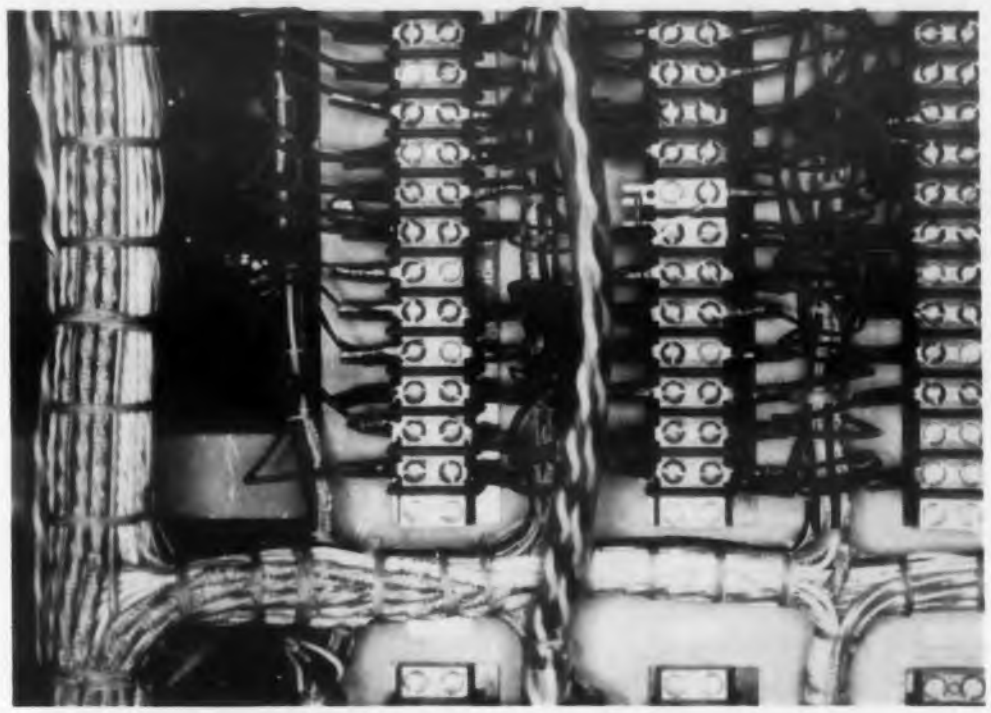
CIRCLE 12 ON READER-SERVICE CARD ➤

DU PONT

ELECTRONIC DESIGN NEWS

LATEST PROPERTY AND APPLICATION DATA ON TEFLON® tetrafluoroethylene resins

Wire insulation of Du Pont TEFLON® tetrafluoroethylene resins reduces danger of short circuits . . . withstands cabinet heat



FRAYING and failure of insulation at bends was eliminated by the use of wire protected by a TEFLON resin. The insulation in this simulator rack is unaffected by heat to 260°C. (Equipment by Otis Elevator Co., Electronic Division, Brooklyn, N. Y.; wire insulated with a TEFLON tetrafluoroethylene resin by Plastoid Corp., Hamburg, N. J.)

Tight wiring, hot enclosures, danger of shorts — these are problems every electronics designer has to face. They were solved at the Otis Elevator Corporation's Electronic Division by the use of wire protected by a TEFLON resin. Required was an insulation that was compact, durable, would not chafe at bends, and could withstand high temperatures such as those experienced in soldering. The high dielectric strength of the TEFLON resin permitted use of wires with exceptionally small outer diameters. No aging or embrittlement problems are encountered with this insulation. The extremely low surface friction of TEFLON resins permits slippage of twisted pairs without chafing. Rated as Class H electrical insulating materials, the resins are unaffected by temperatures to 260°C.

Insulation of TEFLON resins offers many advantages in the design of electronic equipment. For example, signal losses may be held to an absolute minimum due to a dissipation factor of less than 0.0003 over the entire frequency spectrum measured to date — from 60 cps to 30,000 mc. What's more, dissipation factor and the low dielectric constant of TEFLON resins are practically constant with respect to temperature and frequency over the rated ranges.

You can obtain detailed design data on Du Pont TEFLON tetrafluoroethylene resins plus information showing how their properties are applied. Simply send the coupon to us today.

Use of TEFLON® tetrafluoroethylene resins increases reliability of flight-control equipment

The remarkable stability of TEFLON resins in the face of heat, cold, corrosives and electrical stresses makes them ideal for tasks in aircraft and guided missiles.

(Microsyne Position Indicator, by Minneapolis - Honeywell Regulator Co., Boston, Mass., uses wire insulated with a TEFLON tetrafluoroethylene resin by Tensolite Insulated Wire Co., Inc., Tarrytown, N. Y. The insulated wire, called "Flexolon," is designed to provide the maximum of versatility in electronic applications.)

TEFLON®

is a registered trademark...

TEFLON is Du Pont's registered trademark for its fluorocarbon resins, including the tetrafluoroethylene resins discussed herein. This registered trademark should not be used as an adjective to describe any product, nor should it be used in whole, or in part, as a trademark for a product of another concern.

SEND FOR INFORMATION

For additional property and application data on Du Pont TEFLON tetrafluoroethylene resins, mail this coupon.

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Dept.
Room 18-1-18 Du Pont Building, Wilmington 98, Delaware

Please send me more information on Du Pont TEFLON tetrafluoroethylene resins. I am interested in evaluating them for_____

Name_____

Company_____ Position_____

Street_____

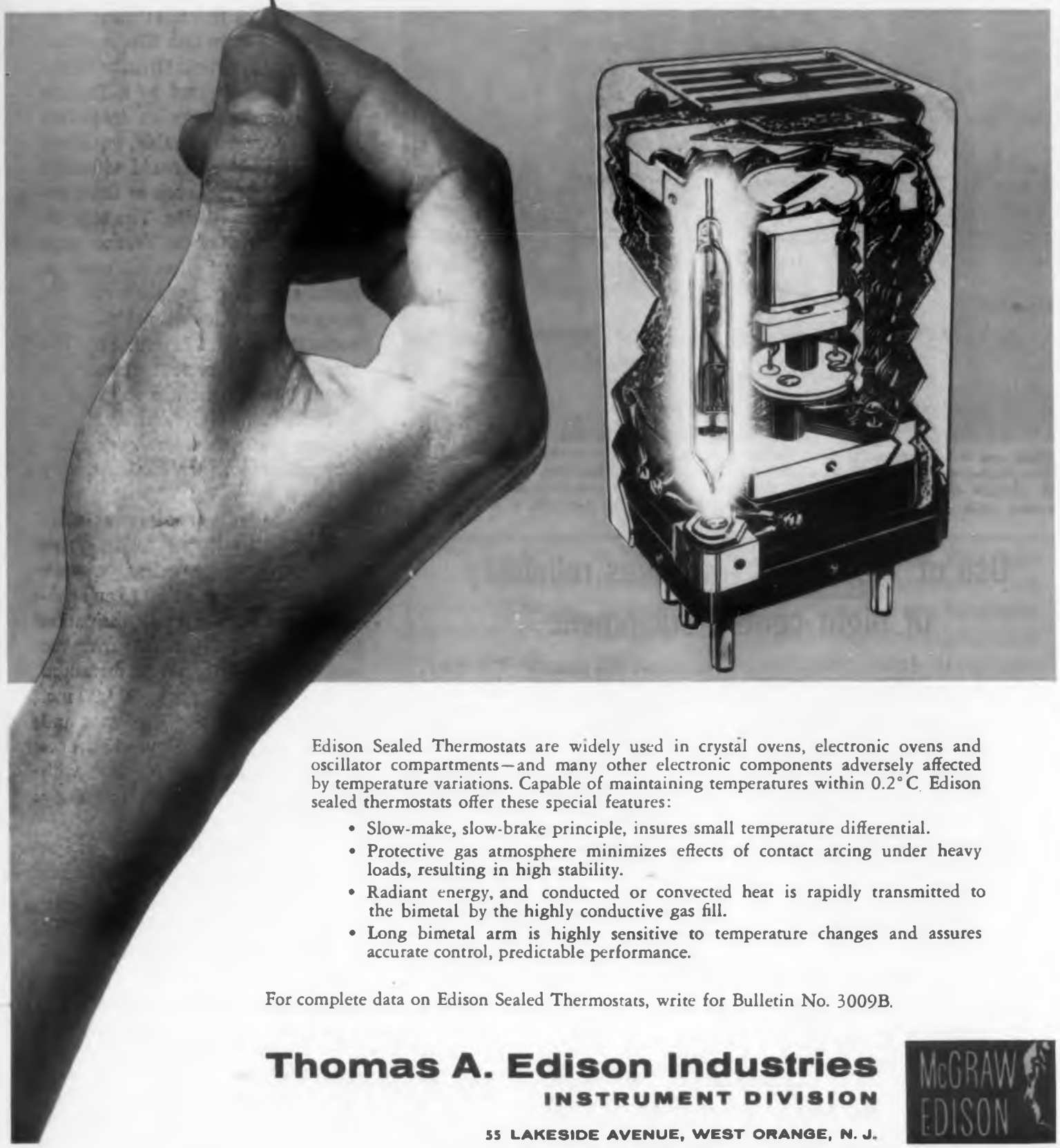
City_____ State_____

Type of Business_____

THOMAS A.

EDISON

sealed thermostats feature close control, lasting stability



Edison Sealed Thermostats are widely used in crystal ovens, electronic ovens and oscillator compartments—and many other electronic components adversely affected by temperature variations. Capable of maintaining temperatures within 0.2° C. Edison sealed thermostats offer these special features:

- Slow-make, slow-brake principle, insures small temperature differential.
- Protective gas atmosphere minimizes effects of contact arcing under heavy loads, resulting in high stability.
- Radiant energy, and conducted or convected heat is rapidly transmitted to the bimetal by the highly conductive gas fill.
- Long bimetal arm is highly sensitive to temperature changes and assures accurate control, predictable performance.

For complete data on Edison Sealed Thermostats, write for Bulletin No. 3009B.

Thomas A. Edison Industries
INSTRUMENT DIVISION
55 LAKESIDE AVENUE, WEST ORANGE, N. J.

McGRAW EDISON

CIRCLE 13 ON READER-SERVICE CARD

Engineering Review

Igloo for Rocket Launching

An igloo has been constructed in the subarctic for use as an all-weather rocket launching facility by American, British and Canadian scientists during the International Geophysical Year. The igloo is located at Fort Churchill, Manitoba, Canada.

Recently, the Aerobee-Hi, a rocket produced by Aerojet-General Corp., Azusa, Calif., which also designed the igloo, was fired from the Canadian site. The rocket is about 30 ft tall and, when fully loaded, including instruments, weighs more than 1800 lb. When the booster is fired, an 18,000 lb thrust is developed. As soon as it has lifted the rocket up a foot or so from a concrete and steel pad, the sustainer engine, with a thrust of 4100 lb, starts. The facility must, therefore, remain intact under a total thrust of approximately 22,100 lb, which is roughly equivalent to having a multi-engine jet aircraft take off within a hanger. The entire launching building including the launching platform is within closed buildings having a steel frame and metal-covering. Inside are metal stairways and galleries permitting all parts to be reached for inspection, adjustment and fueling. The building is 40 ft sq and 56 ft high. Above it projects the tower that guides the rocket.

The high winds created as the rocket slowly pushes through the roof into the open air could cause shifts in direction. A turntable-type pad, which permits the tower to be revolved at will and sloped as required at angles up to 10 deg in any direction, was developed to counteract winds from any quarter. To accommodate a tower that not only rotates but leans, a considerable opening had to be made in the top ridge of the building posing an interior heating problem. The solution was a tent of nylon fabric fitted to the tower loosely to permit swivel. Finally, mechanisms were designed to raise the metal panels forming the lower walls of the launching structure as soon as all preparations for launching have been made and personnel have taken cover, so that the force of the blast does not demolish the structure. The rockets are then fired by remote control.

Wire Permanent Magnets

Permanent magnets as small in diameter as a human hair have been made from Cunife at the National Bureau of Standards magnetic measurements laboratory. Cunife is an alloy of approximately 60 per cent copper, 20 per cent nickel, and 20 per cent iron with an unusual combination of magnetic and mechanical properties. For example, Cunife—instead of requiring casting or

CIRCLE 14 ON READER-SERVICE CARD ➤

GENERAL ELECTRIC

TUBE DESIGN NEWS

FROM THE RECEIVING TUBE DEPARTMENT OF GENERAL ELECTRIC COMPANY

General Electric's DC Tube-Short Testing Method Covers Critical Area of Equipment Reliability!

DOTTED PATTERN shows area of intermittent tube shorts.

BROKEN LINE is limit for shorts that affect equipment reliability.

A-A encloses partial area that is controlled by AC testing.

B-B shows how DC testing covers the entire area of intermittent short-circuits which affect equipment reliability.

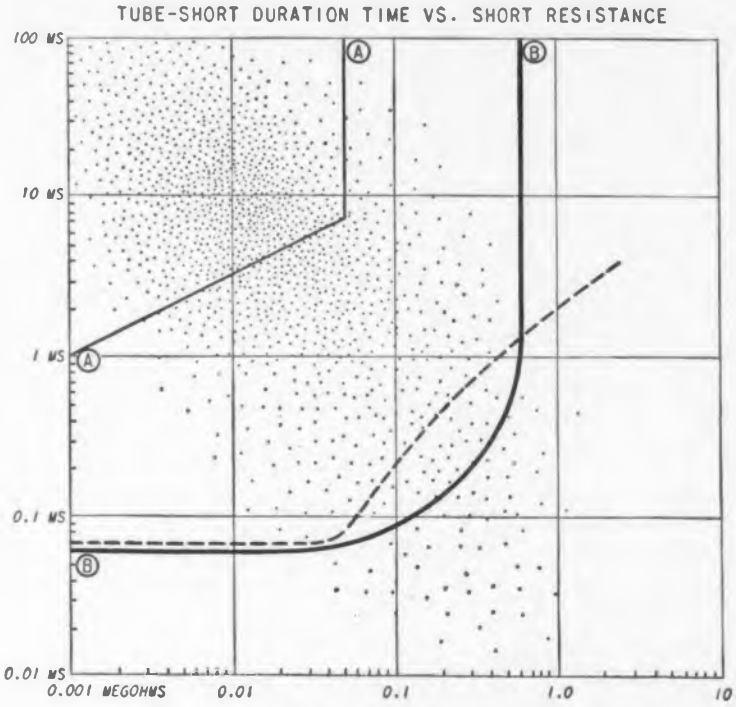


Chart above shows how General Electric DC testing greatly increases the area of short protection, as against conventional AC test methods. The entire incidence of intermittent short-circuits which affect equipment reliability, falls within G.E.'s new DC test limits!

Now being extended to all 5-Star high-reliability tubes—miniatures and subminiatures—General Electric's process of DC-testing for intermittent short-circuits covers the entire area where tube shorts will cause malfunctioning of military and industrial electronic equipment.

The limits of this critical duration-time-vs-resistance short area have been established through extensive tests of units that included (1) all electronic circuits of a key long-range guided missile, (2) all electronic circuits of a surface-to-air defense missile, (3) the complete radar-navigating and bomb-control system of a manned military aircraft, (4) all tubes of a typical industrial computer.

G.E.'s new short-testing method has a further advantage. Conventional AC testing relied on an easily-missed light-flash indication. Intermittent tube shorts now show as continuous illumination of a warning light. The test operator must turn this light off before proceeding further.

Pulse Emission Key Factor in Choosing Tubes for Blocking-Oscillator Service

While numerous characteristics play important parts in selecting tubes for blocking-oscillator work, General Electric studies show that the main determinant of satisfactory tube performance is pulse-emission capability in relation to circuit needs.

Turn page to study the requirements of three different, typical blocking-oscillator circuits plus recommended max pulse-current values on nine General Electric tubes. Any G-E office listed on the next page will be glad to supply further facts.

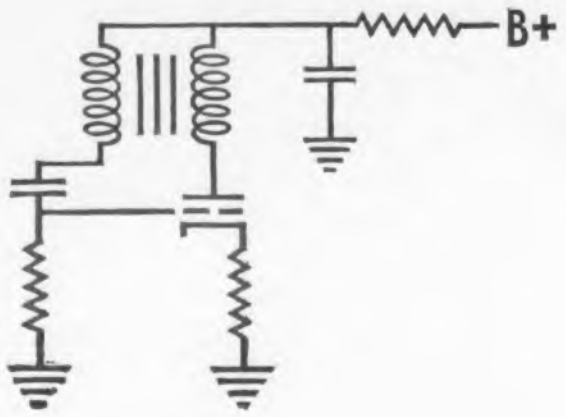
G-E 5-Star workers are shown checking tubes for intermittent short-circuits, employing General Electric's positive method of DC testing whereby a warning light at the right of the panel (arrow) continues to glow until the operator removes the faulty tube.

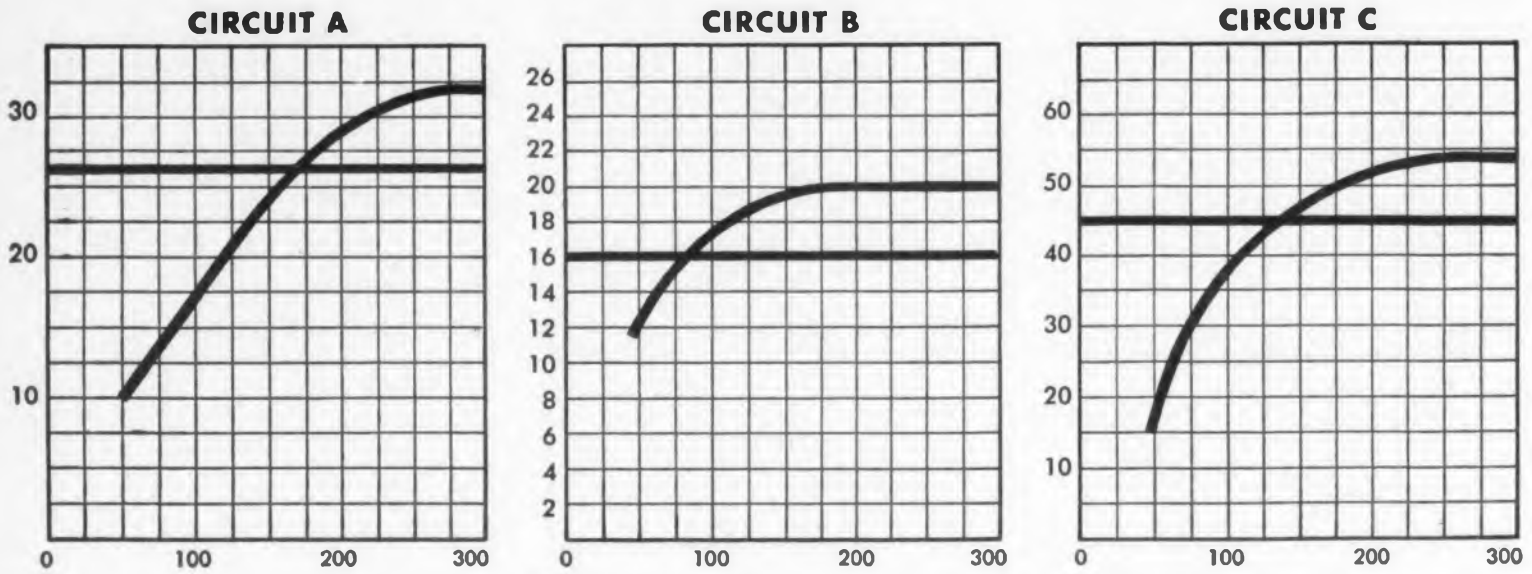
Tear off and keep this sheet for reference. It contains useful tube-application data.

WHEN SELECTING TUBES FOR BLOCKING-OSCILLATOR WORK...

Tube pulse-emission capability should safely exceed circuit requirements.

Relative outputs of three different blocking-oscillator circuits are shown below, against the tube pulse-emission characteristics. The straight horizontal lines indicate minimum acceptable circuit output, while the curves show the relation of circuit output to pulse-emission capability . . . Note that circuit output changes with each circuit, due to difference in components used. In particular, the "knee" where circuit output tends to level off, is established by the circuit saturation point . . . For satisfactory long-term service, the pulse-emission capability of a tube should exceed the circuit "knee" figure. Thus any slight deterioration in tube emission that comes from long use, will not reduce performance below the acceptable circuit-output level.





Vertical: relative output. Horizontal: pulse emission in ma.

For your assistance in correlating circuit output to tube pulse-emission capabilities, a General Electric commercial engineer is available at each of the tube regional offices listed at the bottom of this page. Under no circumstances should the operating pulse currents exceed the values at right for nine G-E tubes recommended for blocking-oscillator service.

5670	300 ma	6111	300 ma	6463	450 ma
5814-A	300 ma	6201	300 ma	6829	400 ma
6021	300 ma	6414	200 ma	6840	500 ma

Above values are based on a pulse of 10 microseconds duration, 1% duty cycle, and 1000-cycle repetition rate.

For further information, phone the nearest office of the G-E Receiving Tube Department below:

EASTERN REGION
200 Main Avenue, Clifton, New Jersey
Phones: (Clifton) GRegory 3-6387
(N.Y.C.) WIsconsin 7-4065, 6, 7, 8

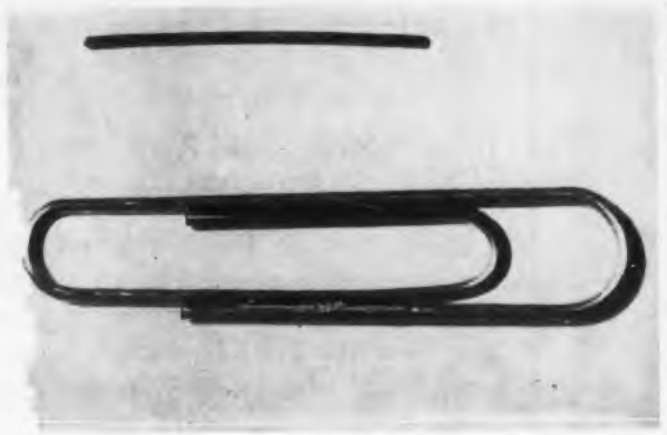
CENTRAL REGION
3800 North Milwaukee Avenue
Chicago 41, Illinois
Phone: SPring 7-1600

WESTERN REGION
11840 West Olympic Boulevard
Los Angeles 64, California
Phones: GRanite 9-7765; BRadshaw 2-8566

Progress Is Our Most Important Product

GENERAL ELECTRIC

12-11-201



Wire-sized permanent magnets as small as a human hair have been made from Cunife, an alloy of copper, nickel, and iron.

sintering into a desired shape like most highly coercive magnet materials—can be cold drawn. This ductility suggested its posible use for very small magnets.

Several investigators have reported on the magnetic properties of Cunife wire and on the effects of cold working and subsequent heat treatment. Their results have shown that even if the material is cold worked to the point at which the magnetic properties are adversely affected, the initial magnetic properties may be recovered or improved by a simple heat treatment or baking.

The Bureau's evaluation entailed cold drawing Cunife to a diameter at which its magnetic properties change and then observing the effect of various heating procedures on the restoration of magnetic properties. Cunife is available commercially in the form of wire with a diam of 0.025 in. This wire was first cold drawn to 0.020 in. through carboloy dies and further reduced to 0.005 in. through diamond dies.

Free-Floating Metals

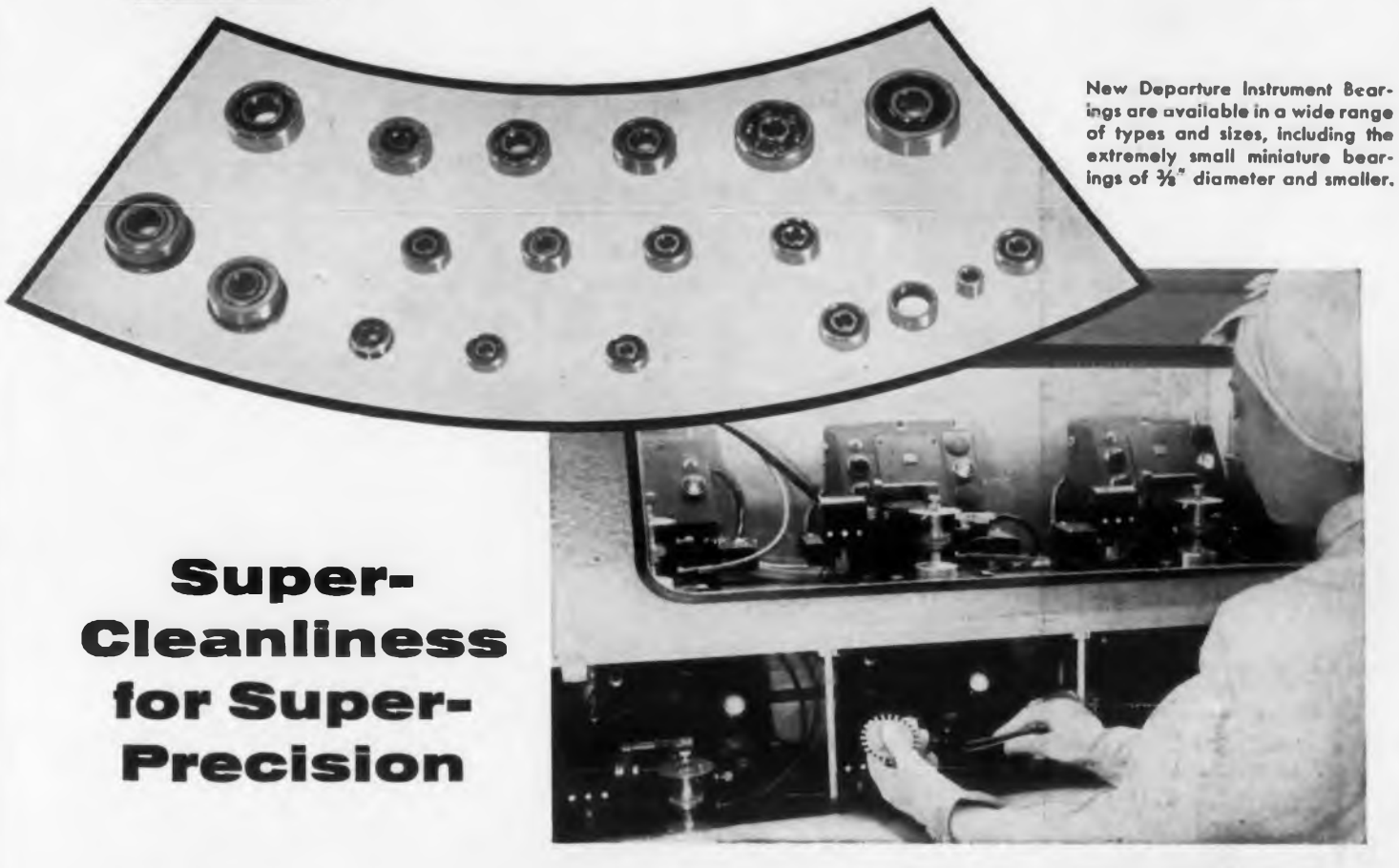
Purified metals are investigated by Westinghouse researchers by heating them to 5000 F while the metals float free in space. Compressed powdered niobium, zirconium, titanium or other metals are placed inside a copper coil which carries high frequency current. The current generates a field that suspends the metal charge inside the coil and at the same time converts the metal into a white hot mass, in seconds.

At temperatures of 4500 to 5000 F, these metals are extremely active chemically, and react with any known vessel in which they are melted. The traces of impurities they pick up can not be tolerated in research.

Levitation melting developed at the Westinghouse Research Laboratories, eliminates this problem. No containing vessel is required since the molten metal floats free, confined only within itself. The whole process is carried out inside a sealed vessel, containing an inert gas, such as helium or argon.

◄ CIRCLE 14 ON READER-SERVICE CARD

ND FACTS



New Departure Instrument Bearings are available in a wide range of types and sizes, including the extremely small miniature bearings of 1/8" diameter and smaller.

Super-Cleanliness for Super-Precision

Torque testing instrument bearings in a "super-clean" area behind sterile shield.

One "super-clean" area where various inspection and assembly operations are performed under conditions bordering on surgical cleanliness.

New Departure ball bearings for highly sensitive instruments are so small . . . so super-precise . . . the tiniest speck of dust can adversely affect their performance. That's why extreme cleanliness governs throughout the assembly and final inspection of every single New Departure instrument bearing.

Such work is carried out in individual cabinets for each operation. Filtered, electronically cleaned air fed to each cabinet, flows outward to prevent the entrance of air-borne contaminants. In addition, the rooms in which the operations are performed are supplied with cleaned air that is pressurized to prevent inward flow at any entrance point.

Catalog sent upon request

1908–1958 GM FORWARD FROM FIFTY

NEW DEPARTURE
DIVISION OF GENERAL MOTORS, BRISTOL, CONN.
NOTHING ROLLS LIKE A BALL

CIRCLE 15 ON READER-SERVICE CARD

the mighty nine plus two!

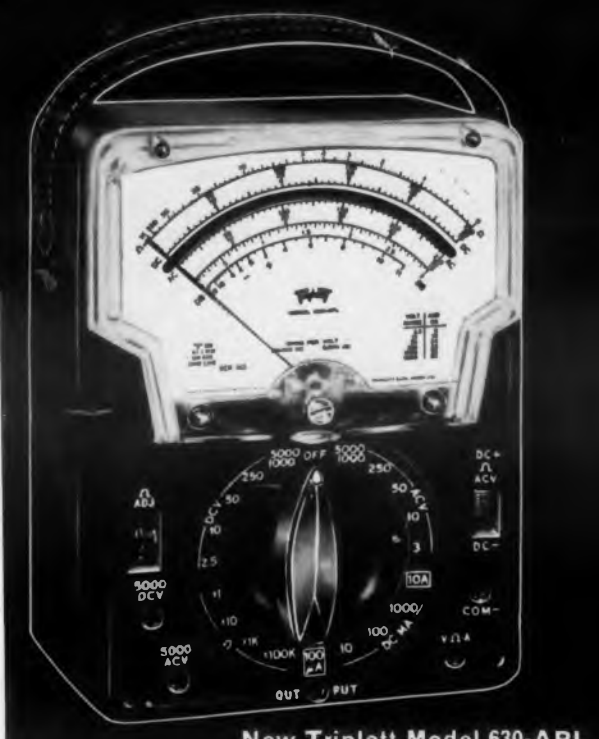
New Triplett Model 630-PL

TWO NEW VOLT-OHM-MILLIAMMETERS

Now the Triplett Mighty Nine Has Expanded to A Line of 11 VOMs Tailored to Meet Your Preference, Purse or Purpose. Only Triplett Offers So Complete A Variety.

With the new 630-PL and 630-APL you get these important new features:

- Voltage scales for those who want ranges reading by 10's (2.5-10-50-250-1000-5000).
- Instant-vision, wider spread scales; streamlined case, handsome modern design.



New Triplett Model 630-APL

- D.C. Polarity Reversing Switch.
- 5 to 500,000 Cycles per second frequency response in A.C. measurements.
- 5000 ohms per volt sensitivity in A.C. ranges; 20,000 ohms per volt D.C.

Both new testers — with the popular continued Models 630 and 630-A—offer these proved Triplett advantages:

- One switch will select any range; minimizes chance of incorrect settings and burnouts.
- Reads from .1 ohm (4.4 ohm center scale) to 100 megohms; four ranges.
- Molded circuit panel for instant component replacement.
- Models 630-APL and 630-A feature ½% resistors for greater accuracy; long mirrored scales to eliminate parallax in reading.
- Banana-type leads for low contact resistance at jacks.

how do you want it?

X 3s or X 10s

Triplett Models 630 and 630-A read volts 0-3-12-60-300-1200-6000); or Triplett New Models 630-PL and 630-APL reading 2.5-10-50-250-1000-5000.

Choose your preference in range reading.

MODEL 630-PL... Dealer Net $44.50
MODEL 630-APL. Dealer Net $54.50
MODEL 630..... Dealer Net $44.50
MODEL 630-A.... Dealer Net $54.50

Only Triplett offers 11 VOM's — a line complete enough to give you exactly what you want.

Triplett Model 630

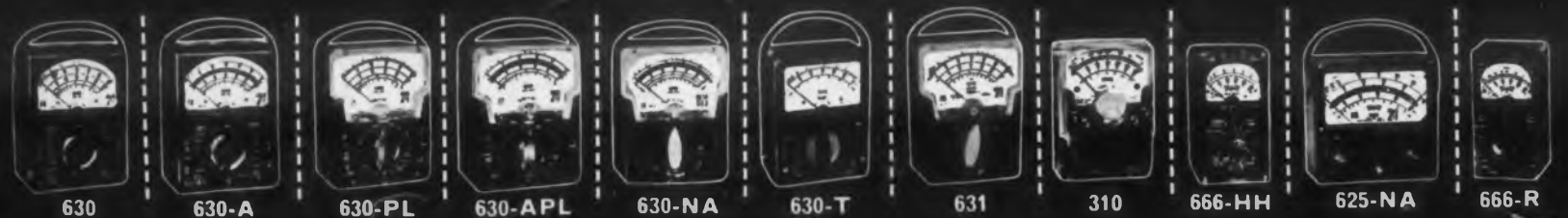
TRIPLETT

Triplett Electrical Instrument Co.
Bluffton, Ohio

53 Years of Experience

Burton Browne Advertising

Triplett Model 630-A



630 630-A 630-PL 630-APL 630-NA 630-T 631 310 666-HH 625-NA 666-R

Engineering Review

Third "North" Pole Proposed to Aid Arctic Navigators

Relocating the North Pole on the Equator was suggested as an aid to polar navigation by Patrick J. McKeown of the Ford Instrument Company, Long Island City, N.Y. in a talk to the Institute of Radio Engineers.

The navigation of high speed jet planes over the strategic North Pole region is complicated at present by the numerous longitudinal lines converging at the poles, McKeown said. The greater distance between longitudinal lines at the equator, however, makes navigation simpler. He suggested arbitrarily locating the North Pole at the junction of the normal equator and the 180 degree meridian. This would place the new equatorial region right on top of the polar region and the new "forbidden" area right in the middle of the Pacific Ocean.

Freed from coping with the numerous longitudinal lines, McKeown stated, today's "robot" navigators could with minor changes be used in the polar regions to tell a pilot where he is, what course to follow, and how far he is from his destination. The use of this system would make these navigational computers operable throughout the world.

To avoid confusing the "new" North Pole with the present Mercator map pole and the magnetic pole pointed to by magnetic compasses, McKeown called his suggested equatorial pole, the "Innorth Pole" after the Inverse Mercator system upon which it is based.

Computer Prepares Tables

Johns-Manville Corp. is using an IBM 704 to prepare heat transmission tables and tables showing recommended insulation thicknesses based on economic considerations. Calculation formulas, thermal conductivities, surface coefficients, pipe dimensions and thicknesses are given to the data

◀ CIRCLE 16 ON READER-SERVICE CARD

processing Service Bureau Corp., a subsidiary of IBM, for heat transmission tables. To calculate economic thicknesses, additional information is required regarding the cost of heat, annual hours of operation, unit cost of insulation and the yearly fixed charge for insulation.

Red-Green Instead of Dot-Dash?

Signalling by blinker lights is notoriously slow because of the persistence of vision (the image of a bright light lingers on the human retina for an appreciable time after the light has gone out). This phenomenon effectively limits the speed of flashing light Morse telegraphy to 8 to 12 words per minute, depending on how one defines a word. Blinkers operated faster than this appear as meaningless fluctuating lights rather than as crisp dots and dashes.

When Dr. Morse created his code of dots and dashes he wisely chose the shortest combinations for the most frequently occurring letters. But a dash is still three times as long as a dot, and if a message could be sent all in dots the transmission speed would be stepped up considerably. Consequently, Naval Research Laboratory, Washington 25, D.C. has recently been experimenting with red and green blinker lights—red for dots and green for dashes, all dots in length. For instance the letter A is experimentally RED GREEN instead of DOT DASH.

The principal disadvantages of a two-color system lie in the additional intensity needed for the signalling light and somewhat greater complexity in its design, and the need for training to read the two-color system.

Experiments were performed in the laboratory using five subjects viewing dot-dash and two-color sequences. The results are encouraging in that for equal reliability in identifying messages the rate of transmission can be increased 25 per cent by using a two-color system in lieu of the dot-dash system. Consideration has not yet been given as to the optimum color pair (including white as a color).

COLD . . . but still in control!

Chances are you've never seen a sealed relay frozen in an ice-cube tray. But, this illustration does dramatize the ability of General Electric miniaturized sealed relays to operate in similar low-temperature regions. G-E sealed relays can function normally in solid ice!

The fact is, the best of laboratory equipment is used to check the continuous operation of all G-E hermetically sealed relays at ambient temperatures of *minus 65 C*—about 65 degrees colder than the ice cubes in this tray! Inherent temperature-resistant characteristics qualify *all* General Electric sealed relays for use on any job where cold is a serious environmental problem.

Extreme low-temperature operation is just one of the many "plus" features—such as high-shock resistance, high-vibration resistance, high-temperature operation, and rugged construction—you get with *all* Miniature, Sub-miniature, and Micro-miniature G-E sealed relays. Today, General Electric relays are proving their reliability on a variety of military and industrial electronics jobs.

What's more, you get all of General Electric's complete line of standard-listed relays on only *3-week shipment from receipt of order*—plus—immediate service on samples and prototypes.

For further information, contact your G-E Apparatus Sales Office—or—write to General Electric Co., Sect. 792-8, Schenectady 5, N. Y., for complete relay data. *Specialty Control Dept., Waynesboro, Virginia.*

CIRCLE 17 ON READER-SERVICE CARD

Progress Is Our Most Important Product

GENERAL ELECTRIC

TEST EQUIPMENT FOR SERVO SYSTEMS AND COMPONENTS

Kearfott recognizes that test equipment must provide precision, convenience and speed in testing plus versatility and non-obsolescence. Accordingly the equipment illustrated combines these features with the assurance that the buyer uses the same techniques and precision in testing servo components and systems as the manufacturer.

INDEX STANDS

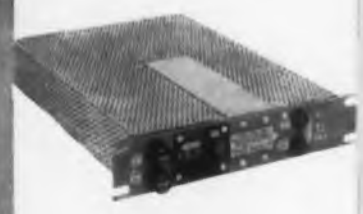
INDEX STAND WITH PRECISE INTEGRAL BRIDGE

Accuracy of stand within 24 seconds of arc. Tests performed at 5 degree intervals. Positional accuracy of bridge, 10 seconds of arc. Electrical accuracy .002%. Higher accuracies on request.

PORTABLE INDEX STAND

Calibrated to 24 seconds of arc. Available for sizes 8, 11, 15, and 18 components. Simplicity of Index Stands makes them desirable for high volume testing.

ANGLE POSITION INDICATORS



RACK PANEL UNIT

Provides a counter presentation of an unknown angular position of a synchro to be measured. The compact unit shown is for both laboratory and production use. May be supplied in carrying case for field tests. Accuracy 6 minutes of arc in standard unit, higher accuracies available.

"JAN" UNIT

Packed to meet the design requirements of MIL-D-8512. May be installed in aircraft control panel or in portable carrying case. Accuracy 6 minutes standard, higher accuracy can be provided.

OTHER KEARFOTT TEST EQUIPMENT COMPONENTS:

Scorsby and tilt tables, ratiometers, PSVM and VTVM, automatic ohmmeters, synchro and resolver bridges, power supplies and other related equipment.

MODULAR FUNCTIONAL TEST CONSOLES

Kearfott provides functional test equipment for gyros, servo systems and other components, or complete systems in modular form permitting universal use of the component pieces regardless of the component or system.

Exemplifying Kearfott's ability to provide complete weapon system ground support test equipment are automatic analog and digital systems now being produced for this purpose.

KEARFOTT COMPANY, INC., LITTLE FALLS, N. J.

Sales and Engineering Offices: 1378 Main Avenue, Clifton, N. J.
Midwest Office: 23 W. Calendar Ave., La Grange, Ill.
South Central Office: 6211 Denton Drive, Dallas, Texas
West Coast Office: 253 N. Vinedo Avenue, Pasadena, Calif.

CIRCLE 18 ON READER-SERVICE CARD

Kearfott

A SUBSIDIARY OF GPE
GENERAL PRECISION EQUIPMENT CORPORATION

Washington Report

Herbert H. Rosen

A Strong Man at the Helm

The Wilson Era is closed. A new Secretary of Defense now leads the Pentagon forces. After only a month in the post, Neil H. McElroy instituted the following changes:

- Redefined DOD's stake in basic research.
- Started the Army in the satellite business by authorizing preparation for using the Jupiter C as a launching vehicle.
- Rechartered the Defense Science Board to give it broader authority over the $5.3 billion research and engineering program.
- Set wheels in motion for naming a single manager over the next defense missile project—irrespective of ultimate service user.
- Named William Holaday as the new Director of Guided Missiles, giving him increased authority and responsibility.
- Was probably instrumental in the appointment of Dr. James Killian as Special Assistant for Scientific Matters to the President of the United States.

In earlier actions, McElroy also restored $170 million to the R & D expenditure budget and eliminated the ceiling on defense spending. He added some $400 million to the $38 billion check account, and implied that if it is needed, more will be added.

When Charles Wilson settled the feud between the R & D and the Applied Engineering Secretariates, he started a chain reaction. All of the advisory committees to each secretariate had to be combined and given new missions. This included the top-dog committee of them all, the Defense Science Board. Under its new charter, the membership of the board has been enlarged from 25 to 28. The new members are the chairmen of the scientific advisory committees to Missile Chief Holaday and ODM Chief Gordon Gray, and the General Advisory Committee of the Atomic Energy Commission. Noteworthy of this addition is Dr. I. Rabi of ODM Committee.

Under the general chairmanship of Dr. H. P. Robertson, the Defense Science Board must be concerned with some $5.3 billion in research and engineering programs. Its mission is advisory to the Secretary of Defense through the Assistant Secretary for R & E, Dr. Paul D. Foote. Specific advice the Board is to give includes:

"Preferred administrative practices and policies for the effective prosecution of scientific research and development in areas of interest to the Department of Defense; the desirable scope, in-

ternal balance and, where appropriate, the substance of research, development, and engineering effort that should be pressed by the Department of Defense in answer to its valid interests viewed broadly from the national perspective and in full consideration of current programs in the civilian economy; and the effectiveness of research and development in providing combatworthy weapons systems, with attention to prompt and effective utilization of new knowledge, the rapid translation of new scientific opportunities into weapons, and the evaluation of the effectiveness of the projected weapons systems in meeting military requirements."

Research Defined

Unlike the first DOD research policy statement of June 1952, Directive No. 3210.1 defines the term "basic research." It is "that type of research which is directed toward increase of knowledge in science. It is research where the primary aim of the investigator is a fuller knowledge or understanding of the subject under study."

Once defined, the term became the basis for the basic research policy of the Department.

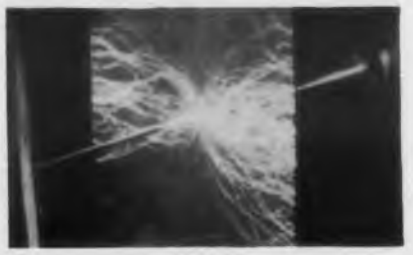
"To support a broad and continuing basic research program to assure the flow of the fundamental knowledge needed by the military departments of the prime users of scientific facts and to evolve novel weapons of war; and to maintain, through such a broad support program, an effective contact between the military departments and the scientists of the country so that the military departments are continuously and growingly aware of new scientific developments and the scientists are aware of the military needs. It is further the policy of the Department of Defense to coordinate its basic research program with the National Science Foundation and to encourage the support of sound basic research programs by government and private agencies, recognizing that these programs are essential to the full development, utilization and growth of the nation's scientific resources and, hence, to national defense."

Besides making the above policy, the directive emphasizes the need for long-term and consistent support of basic research. It names, in the order indicated, these recipients of support: educational and nonprofit institutions, industry, and government laboratories.

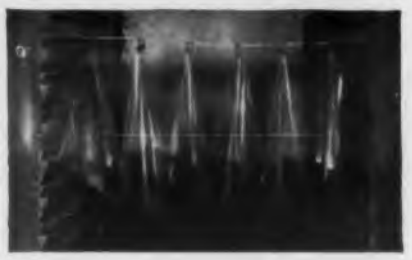
According to Defense's Director of Science, Dr. Orr Reynolds, between $80 to $90 million are spent annually on basic research. Studies are about completed through which ways are being sought to increase this figure. If it were raised to about $180 million, Reynolds thought there would be enough money to pay for all the promising projects requiring DOD support. Among these would be basic electronics, semiconductors, biology, aeronautics, nuclear energy, etc.

"MYLAR" *offers a unique combination of properties valuable for electrical design*

HIGH TENSILE STRENGTH. "Mylar" is the strongest plastic film. Instron tester shows an average strength of 20,000 lbs. psi.



HIGH DIELECTRIC STRENGTH. Average of 4,000 volts per mil . . . average power factor of 0.003 to 60 cycles . . . dielectric constant above 3.0 at 72°F., 1,000 cycles.



THERMAL STABILITY. "Mylar" has an effective operating range from -80° to 300°F. . . . won't become brittle with age.

Core binder tape made with Du Pont MYLAR® helps Western Electric speed production of communication cable

PROBLEM: Western Electric's new long-life, high-dielectric communications cable posed a challenging problem for production engineers. The problem was this—how to efficiently extrude an outer jacket of polyethylene without fusing the inner pairs of wires also coated with polyethylene.

SOLUTION: After extensive tests with combinations of materials, a tape of Du Pont "Mylar"* polyester film and rubber was selected to act as a heat barrier.

RESULTS: Western Electric reports that abrasion-resistant "Mylar", with its hard, durable surface, helps the core binder tape run smoothly on its equipment without snagging or tearing. Because of its high tensile strength and melting point, "Mylar" helps prevent corrugations of the electrostatic aluminum shield from breaking through the tape and shorting the cable.

HOW CAN "MYLAR" HELP YOU? Whether you make guided missiles or tinycomponents,you may be able to capitalize on the outstanding combination of properties found in tough, transparent "Mylar" film. For a booklet containing technical data plus information on successful applications, send in the coupon below.

DU PONT
REG. U. S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

DU PONT **MYLAR®** POLYESTER FILM

*"MYLAR" is Du Pont's registered trademark for its brand of polyester film.

E. I. du Pont de Nemours & Co. (Inc.)
Film Dept., Room EX-1 Nemours Bldg., Wilmington 98, Del.
Please send the new booklet listing properties, applications and types of "Mylar" polyester film available (MB-11).

Application _____
Name _____ Title _____
Company _____
Address _____
City _____ State _____

CIRCLE 19 ON READER-SERVICE CARD

KEEP UP-TO-DATE ON MAGNETICS

Here's how magnetic amplifier design will be affected by tape wound core standardization

If you design and manufacture magnetic amplifiers, you'll welcome news that standard sizes for tape wound cores have been proposed by the A.I.E.E.* You are going to benefit from a high in consistency of core performance, brought about by our being able to concentrate on your most important sizes. *Here's how . . .*

Magnetics, Inc. is now stocking all of the proposed standard core sizes in both aluminum and phenolic core boxes for immediate delivery. Consistency of core performance is increased because each size is made in large lots taken from the same alloy batch and dry hydrogen anneal. They all bear our exclusive Performance-Guarantee.

We shall be happy to send size, construction and magnetic material data upon request. Please write to *Magnetics, Inc., Dept. ED-44, Butler, Pa.*

MAGNETICS inc.

*Paper 57-206, *Proposed Size Standards for Toroidal Magnetic Tape Wound Cores. Report of the Magnetic Amplifiers Material Sub-Committee, at the 1957 Winter General Meeting, A.I.E.E.*

CIRCLE 20 ON READER-SERVICE CARD

Meetings

Jan. 14-15: Second Yankee Instrument Fair and Symposium

Hotel Bradford, Boston, Mass. Sponsored by the Boston, Connecticut Valley, and Fairfield County Sections of the Instrument Society of America. There will be exhibits of automatic control and laboratory measuring instruments. Papers to be read will deal with instrumentation for paper mills, nuclear reactors, satellite tracking, precision calibration work, and selection and training of instrument men. For details write to ISA—Boston Section, Inc., Box 282, Boston 1, Mass.

Jan. 22-24: EIA Conference on Automation

Arizona State College Auditorium, Tempe, Ariz. Sessions will consider the place of automation in the electronic industries, the application of computers to control of machinery outside the electronic industries, and the economic, educational, and social aspects of automation. Write to the Engineering Office, Electronic Industries Association (formerly RETMA), Rm. 650, 11 W. 42nd St., New York 36, N.Y. for full details.

Jan. 27-28: Sixth Scintillation Counter Symposium

Hotel Shoreham, Washington, D.C. Sponsored by the IRE, AIEE, AEC, and NBS. There will be four half-day sessions covering Phosphor and Cerenkov Scintillators; Photomultipliers; Energy and Time Resolution; and Scintillation Counter Applications. Papers on components, equipments, and applications will be read. Write IRE, 1 E. 79th St., New York 21, N.Y., for information.

Jan. 27-Mar. 10: Monday Evening Lecture Series on Modern Circuit Theory from an Elementary Point of View

Western Union Bldg., 160 W. Broadway, New York City. Jointly sponsored by the IRE Professional Group on Circuit Theory and the AIEE Basic Science Division. Starting with Jan. 27 and ending with Mar. 10 there will be a lecture every Monday evening at 7:00 p.m. Registration must be made in advance. Tickets will not be sold at the door.

Individual lectures are: The Complex Frequency Plane by Dr. W. H. Huggins of Johns Hopkins University (Jan. 27); Network Synthesis Techniques by Dr. J. G. Truxal of the Polytechnic Institute of Brooklyn (Feb. 3); Approximation Techniques by Dr. S. Darlington of Bell Telephone Labs. (Feb. 10); Design of Networks by A. J. Grossman of Bell Telephone Labs. (Feb. 17); Distributed Parameter Networks by Dr. H. J. Carlin of the Microwave Research Institute (Feb. 24); Time Domain Synthesis by M. S. Corrington of RCA (Mar. 3); and Feedback Circuits by Dr. J. R. Ragazzini of Columbia University (Mar. 10).

Registration requests should be sent to E. Schutzman, New York University, College of Engineering, University Heights, New York 53, N.Y. They should be accompanied by a self-addressed envelope and a check or money order payable to the New York Section, IRE. Registration fees are $4.00 for members of the IRE, AIEE, AIME, ASCE, or ASME and $6.00 for others.

Jan. 28-31: Fourteenth Annual National Technical Conference of the Society of Plastics Engineers

Sheraton-Cadillac Hotel, Detroit, Mich. The theme of the conference will be "Progress Through Plastics Engineering." Its sessions will deal with radiation and plastics, epoxy resins and embedment, extrusion, injection molding, education, packaging, plastic tooling, mold design, new materials, test methods, reinforced plastics, color and finishing, foams, compression molding, sheet forming, and research. For further details write to Lewis A. Bernhard, Society of Plastics Engineers, Inc., Suite 116-18, 34 E. Putnam Ave., Greenwich, Conn.

Feb. 3-4: Flight Control—Panel Integration Symposium

Biltmore Hotel, Dayton, Ohio. Sponsored by the USAF, Flight Control Lab., WADC. Philosophy of flight instrumentation, system integration, and many other topics will be covered. For reservations and program information write to John H. Kearns, Box 942, Dayton, Ohio.

Feb. 3-4: Instrument Society of America National Conference on Progress and Trends in Chemical and Petroleum Instrumentation

Wilmington, Del. For information and advance programs write to H. S. Kindler, Director of Technical Programs, ISA, 313 Sixth Ave., Pittsburgh 22, Pa.

KEEP UP-TO-DATE ON MAGNETICS

Here are laminations for miniaturization

If you are making transformers for transistorized or other miniaturized equipment, information about our ultra-small size "performance-guaranteed" laminations can be important news to you. These nickel-iron laminations are produced in standard gauges, and are available in Hy Mu 80, 48 Alloy and, if required, Orthonol.

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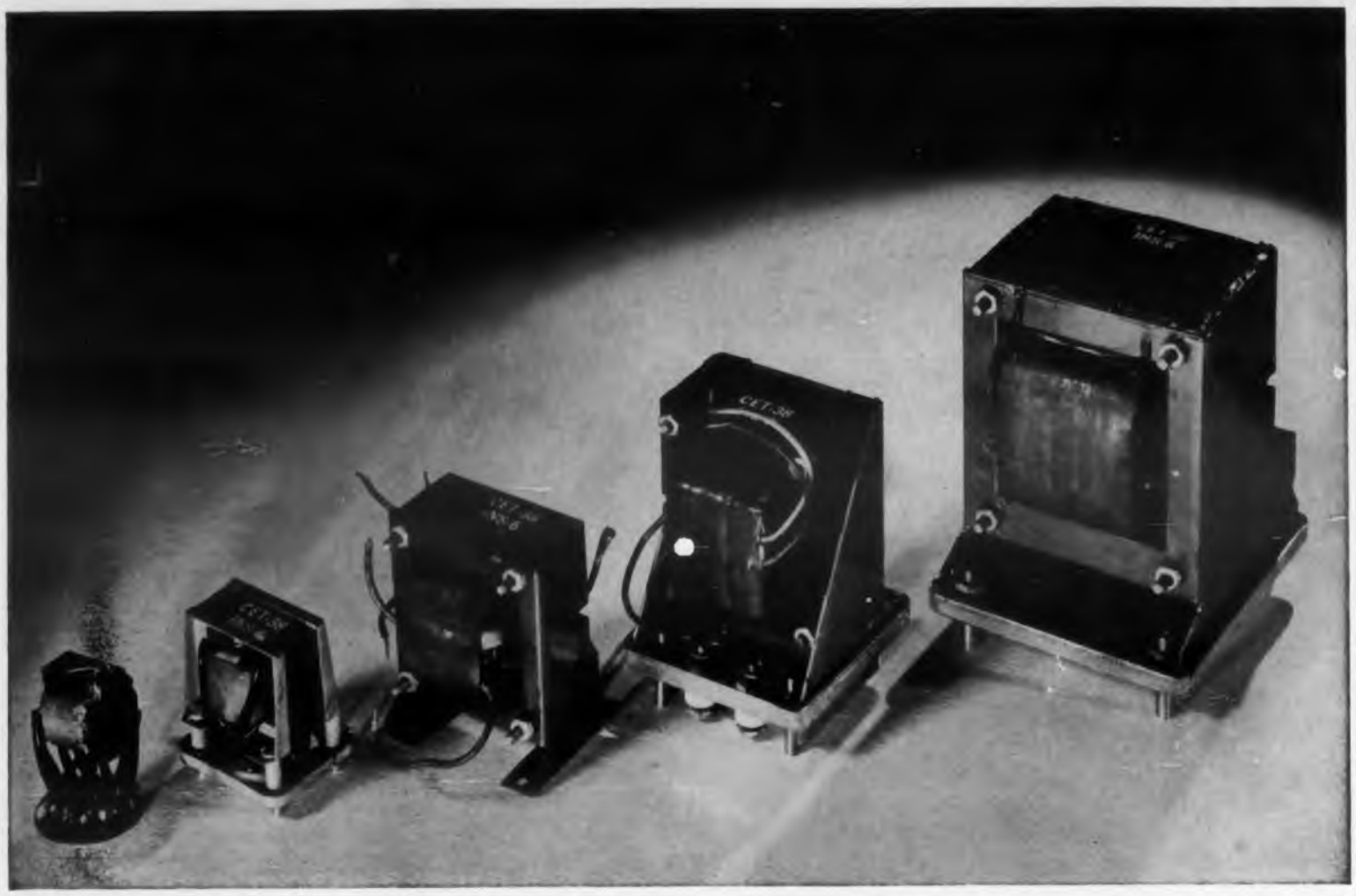
There's no room here for the really detailed story, but for complete information on our "Performance-Guaranteed" magnetic laminations, send for our newest catalog—just published—ML-301. Write today. *Magnetics, Inc., Dept. ED-41, Butler, Pennsylvania.*

MAGNETICS inc.

CIRCLE 21 ON READER-SERVICE CARD



A Transformer becomes a precision device with Allegheny Magnetic Materials in the core

★ **ALLEGHENY SILICON STEEL**

★ **ALLEGHENY 4750**

★ **ALLEGHENY MUMETAL**

The operation of a transformer is no better than the magnetic core around which it is built. With Allegheny magnetic materials in the core, you get the *best*—uniformly and consistently.

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In addition, our service on magnetic materials includes complete lamination fabrication and heat treatment facilities. What's more, this extensive experience in our own lamination stamping department is a bonus value for all users of A-L electrical sheets or strip. ● Let us supply *your* needs. ***Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.***

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"TRANSFORMER LAMINATIONS"

84 pages of valuable technical data on standard and custom-made laminations from all grades of Allegheny Ludlum magnetic core materials. Prepared from carefully checked and certified laboratory and service tests —includes standard dimensions, specifications, weights, etc. Sent free on request . . . ask for your copy.

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Allegheny Ludlum

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AL STEELS FOR THE ELECTRONIC AGE

CIRCLE 22 ON READER-SERVICE CARD

Meetings

Feb. 3-7: AIEE Winter General Meeting

Statler and Sheraton-McAlpin Hotels, New York City. The 96 sessions will encompass power generation and computing devices; data communications and telegraph systems; radio communication; television and aural broadcasting; telegraph systems and wire communications; industrial power rectifiers and systems; industrial control; feedback control; electric heating; nucleonics; basic sciences; dielectrics; electrical techniques in medicine and biology; magnetic amplifiers; metallic rectifiers; solid state devices; high frequency instruments; recording and controlling instruments; and a variety of other subjects. For information write AIEE, 33 W. 39th St., N.Y.C.

Feb. 4-6: Thirteenth Annual Technical and Management Conference of the Reinforced Plastics Division of the Society of the Plastics Industry, Inc.

Edgewater Beach Hotel, Chicago, Ill. The basic theme for the 18-session program will be the new and improved in materials, test results, quality controls and processing techniques. There will be papers on reinforced plastics tooling, industrial design, speed-temperature-radiation behavior of reinforced plastics, the development of reinforced plastic motors, filament winding, quality control of electrical applications, and other subjects. For information, write George L. Smead, Manager, Reinforced Sales, L-O-F Glass Fiber Co., 1810 Madison Ave., Toledo, Ohio.

Feb. 18: Fourteenth Annual Quality Control Clinic

War Memorial, Rochester, N. Y. Sponsored by the Rochester Society for Quality Control. The 20 technical papers to be read will cover all phases of quality control and industrial statistics. Exhibits of the latest equipment for data processing and electronic and mechanical gaging and measuring will be demonstrated throughout the clinic. For full details write to Edward F. Winterkorn, Eastman Kodak Co., Navy Ordnance Div., 50 Main St. W., Rochester 14, N. Y.

Feb. 20-21: 1958 Transistor and Solid State Circuits Conference

University of Pennsylvania and Sheraton Hotel,

Philadelphia, Pa. Sponsored by the IRE, AIEE, and University of Pennsylvania. Papers will deal with high speed circuits, analytical techniques for system integration, device characterization, high and low power circuits, memory, magnetics, and related topics. For further information send to J. H. Milligan, Jr., Dept. of E. E., New York University, New York 53, N. Y.

Feb. 20-24: 1958 EIA (formerly RETMA) Industrial Relations Conference

Town and Country Hotel, San Diego, Calif. Collective bargaining in the electronics industry, and technical manpower development and utilization are among the topics to be discussed. For information write to D. H. Stover, Industrial Relations Dept., Electronic Industries Assoc., 1721 De Sales St., N.W., Washington 6. D. C.

Mar. 11-13: Eighth Annual Conference on Instrumentation for the Iron and Steel Industry

Roosevelt Hotel, Pittsburgh, Pa. Sponsored by the Pittsburgh Section of the Instrument Society of America. For details write to Frank K. Briggs, Westinghouse Electric Corp., Atomic Power Div., Large, Pa.

Mar. 16-21: 1958 Nuclear Congress

Chicago Amphitheatre and Palmer House, Chicago, Ill. Sponsored by the AICE, AIEE, IRE, and many others. The congress will include five separate conferences: The Fourth Nuclear Engineering and Science Conference (Mar. 17-21), The Fourth International Atomic Exposition (Mar. 16-21), The Sixth Atomic Energy in Industry Conference (Mar. 17-19), The Sixth Hot Laboratories and Equipment Conference (Mar. 19-20), and The American Power Conference (Mar. 17-19). For more information write to the American Institute of Chemical Engineers, 25 W. 45th St., New York 36, N. Y.

March. 18-19: Conference on Extremely High Temperatures

Air Force Cambridge Research Center, L. G. Hanscom Field, Bedford, Mass. Sponsored by AFCRC. The purpose of the Conference is to further the exchange of information among those interested in research into temperatures above 30,000 Kelvin. Emphasis will be placed upon theoretical and experimental aspects although the Conference will also cover applications. Write Dr. Heinz Fischer, AFCRC, L. G. Hanscom Field, Bedford, Mass. for details.

Concerned with microwave test equipment?

Only NARDA offers you these exclusive features!

TURRET ATTENUATORS

Only Narda offers you a UHF-only attenuator. This represents a considerable savings in cost for applications in this frequency range. Each of three models offers the Designer or Development Engineer 12 steps of attenuation from d.c. to 1,500 mc with a VSWR of 1.25. Designed for bench use or mounting into test equipment packages.

One unit can give a maximum of 30 db attenuation; two units can be used in series to provide a wide range of control in small steps.

Model 705—0, 3, 6. 9, 12, 15, 20, 25, 30 db
Model 706—0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20 db
Model 707—0, 3, 6, 9, 12, 15, 18, 21 INF db

ALL MODELS . . . **$275** each

COAXIAL DIRECTIONAL COUPLERS

10, 20 and 30 DB . . . 225 to 4,000 mc.

Only Narda offers coaxial directional couplers in 10 and 30 db values, as well as 20 db. In addition, all models offer such advantages as these:

1. Flat Coupling—values with 1 db of nominal over a full octave frequency range, with calibration provided to ± 0.2 db accuracy.
2. Machined from solid blocks of aluminum—hence, more rugged.
3. Directivity exceeding 20 db.
4. Frequency Ranges: 225-460. 460-950, 950-2000. 2000-4000 mc.

Write for complete specifications.

$100 to $225

S to X BAND FREQUENCY METER

Narda offers the only single instrument covering this complete band of frequencies—2,350 to 10,500 mc. In addition, no combination of other meters can cover these frequencies at a comparable price!

An easy to read nomograph type calibration chart, mounted in the lid, converts digital counter readings to frequency in megacycles—to the rated accuracy of 0.2%. No calculations or interpolations are needed.

The unit is completely self contained, with built-in detector and indicating meter. A sensitivity control allows use with strong signals; for signals below 5 mw., the external meter jack may be connected to an amplifier or oscilloscope.

Model 802B . . . $785

UHF FREQUENCY METER DETECTORS . . . Direct Reading

The only direct reading frequency meter detectors available for the UHF range—and they're from Narda, of course! Absorption type meters, with 0.2 db insertion loss, each includes a resonant cavity, coaxial switch, crystal detector, current meter, sensitivity control and type N terminals.

SPECIFICATIONS

Frequency (mc)	Accuracy	Loaded Q	VSWR	Sensitivity for full scale deflection	NARDA Model	Price
200-500	0.5 mc	500	1.15	0.2 mw	804	$375
500-1500	1 mc	700	1.15	0.2 mw	805	375
1500-2400	2 mc	500	1.25	0.5 mw	806	375

Complete Coaxial and Waveguide Instrumentation for Microwaves and UHF — including:

DIRECTIONAL COUPLERS	TUNERS	ATTENUATORS
TERMINATIONS	ECHO BOXES	STANDARD REFLECTIONS
FREQUENCY METERS	SLOTTED LINES	BOLOMETERS
HORNS	BENDS	THERMISTORS

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CIRCLE 23 ON READER-SERVICE CARD

DELCO'S FAMILY OF HIGH POWER TRANSISTORS

Typical Characteristics at 25°C

	DT100	**2N174A	2N174	2N173	2N443	2N278	2N442	2N277	2N441
Maximum Collector Current	13	13	13	13	13	13	13	13	13 amps
Maximum Collector Voltage (Emitter Open)	100	80	80	60	60	50	50	40	40 volts
Saturation Voltage (13 amp.)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7 volts
Max. Square Wave Power Output at 400 ~ P-P*	400	310	310	225	225	180	180	135	135 watts
Max. Sine Wave Power Output at 400 ~ P-P*	180	140	140	100	100	80	80	60	60 watts
Power Dissipation (Stud Temperature 25°C)	70	70	70	70	55	55	55	55	55 watts
Thermal Gradient from Junction to Mounting Base	1.0°	1.0°	1.0°	1.0°	1.2°	1.2°	1.2°	1.2°	1.2° °C/watt
Nominal Base Current I_B (V_{EC} = —2 volts, I_C = —1.2 amp.)	-19	-19	-19	-13	-24	-13	-24	-13	-27 ma

*Adequate Heat Sink

**Designed to meet MIL-T-19500/13 (USAF) 18 JUNE 1957

Offer a wide range of performance characteristics to meet your switching, regulation or power supply requirements

These nine Delco Radio alloy junction germanium PNP power transistors are now in volume production. They are characterized by high output power, high gain, and low distortion. And all are normalized to retain superior performance characteristics regardless of age.

Check the data chart above—see how they fit your particular requirements in current switching, regulation or power supply. Write for detailed information and engineering data. Delco Radio maintains offices in Newark, N. J. and Santa Monica, Calif. for your convenience.

DELCO RADIO
Division of General Motors
Kokomo, Indiana

CIRCLE 24 ON READER-SERVICE CARD

Meetings

Mar. 24-27: IRE National Convention

Coliseum and Waldorf-Astoria, New York City. A comprehensive program of 275 papers, covering the most recent developments in the fields of all 27 IRE Professional groups, will be presented in 55 sessions. The high point of the program will be two special symposia on "Electronics in Space" and "Electronic Systems in Industry," to be held Tuesday Evening, March 25. The complete program will be announced sometime in January.

Mar. 27-29: Ninth Biennial Electrical Industry Show and Fifth Electrical Maintenance Conference

Shrine Exposition Hall, Los Angeles, Calif. Some of the topics to be discussed are maintenance to prevent breakdown, maintenance of electrical and electronic equipment, and maintenance of lighting to assure peak output. For more details write Paul H. Henrichs, Southern California Edison Co., P.O. Box 351, Los Angeles, Calif.

Mar. 31-Apr. 2: Instruments and Regulators Conference

University of Delaware, Newark, Del. Sponsored by the IRE, ASME, AIChE, and ISA. For details send to E. M. Grabbe, P.O. Box 45067, Airport Station, Los Angeles 45, Calif.

Apr. 2-4: ASME Conference on Automatic Optimization

University of Delaware, Wilmington, Del. AIEE, IRE, ISA, AIChE with professional groups analogous to the RE will participate in the conference by sponsoring technical papers centered around the theme, "Automatic Optimization." For details write W. E. Vannah, Control Engineering, 330 W. 42nd St., N. Y. 36, N. Y.

Apr. 8-10: Sixth National Conference on Electromagnetic Relays

Oklahoma State University, Stillwater, Okla. Sponsored by the National Association of Relay Manufacturers. More information may be obtained from Charles F. Cameron, Dept. of Electrical Engineering, Oklahoma State University, Stillwater, Okla.

Apr. 8-10: Symposium on Electronic Waveguides

Auditorium of Engineering Societies Bldg., 33 W. 39th St., New York. Sponsored by IRE, PGED and PGMTT, and the Department of Defense Research Agencies. The symposium will deal with the interaction of electromagnetic fields and electron or plasma beams in general waveguide regions. The symposium covers the fields of electron beams, plasmas, and electromagnetics to compare the rather widely disparate theories and techniques employed to describe the wave phenomena encountered in the interaction of such fields. For further information contact the Polytechnic Institute of Brooklyn, 55 Johnson St., Brooklyn 1, New York.

Apr. 10-12: IRE South West Regional Conference and Electronics Show

San Antonio Hotel and Municipal Auditorium, San Antonio, Tex. Write for details to J. O. Parr, Jr., 202 Janis Ave., San Antonio, Tex.

Apr. 14-16: Conference on Automatic Techniques

Statler Hotel, Detroit, Mich. Sponsored by the IRE, AIEE, and ASME. Information may be obtained by writing to J. E. Eiselein, Radio Corporation of America, Bldg. 10-7, Camden 2, N. J.

Apr. 17-18: Second Annual Technical Meeting of the Institute of Environmental Engineers

Hotel New Yorker, New York. A display of the earth satellite model and an address by Kurt R. Stehling, Propulsion Head of the Vanguard Missile Project, Naval Research Laboratory, will highlight the meeting. Write Institute of Environmental Engineers, 9 Spring St., Princeton, N. J., for further information.

Apr. 22-24: 1958 Electronic Components Conference

Ambassador Hotel, Los Angeles, Calif. Sponsored by the IRE, AIEE, EIA, and WCEMA. With "Reliable Application of Component Parts" as its main theme, the conference has been planned to cover the following general topics: resistors, capacitors, and dielectrics; transistors and solid state devices; component reliability; electron tubes and their application; and progress with materials. For complete information write to David M. Knox, Packard-Bell Electronics Corp., 12333 W. Olympic Blvd., Los Angeles 64, Calif.

6 cps to 100,000 cps at

1,000 WATTS CONTINUOUS DUTY

...with the new Genisco-Savage high-output amplifiers!

Seven models—rugged enough for production line testing; versatile enough for almost all laboratory needs.

Here's the new line of quality, high-output amplifiers you've been waiting for! All seven models feature high power output, low distortion, exceptionally high reliability and stability, and excellent output voltage waveform.

The Model KLF, shown at left, is particularly useful as an exciter for vibration testing equipment and as a variable frequency power supply for a multitude of production and laboratory needs. It will operate *continuously* with an output of 1,000 watts from 6 to 2,000 cps.

Components of all Genisco-Savage Amplifiers are mounted on 19" vertical panels to facilitate easy inspection and maintenance. Quick-release grill covers make all tubes readily accessible from the front. Numerous built-in safety features protect the equipment from operator errors.

Two New Shake Tables Available The new Model V1000 Genisco-Savage Shaker features a very light moving coil assembly, high thrust-to-weight ratio, automatic impedance matching, and an excellent output waveform. A continuous alternating thrust of ±600 lbs. is produced at 1,000 watts control power. Thrust can be increased to ±750 lbs. peak by use of a blower (Model V1000B). Both models have been stress-tested to withstand continuous operation at accelerations of 100 G's.

The Genisco-Savage Model V1000 Shaker

BRIEF SPECIFICATIONS	MODELS						
	BM2	DM2	KM2	10K	KM2S	KLF	KRF
Output	250 w at 50 or 100 v	500 w at 50 or 100 v	1000 w at 50 or 100 v	10,000 w maximum	1000 w at 50 or 100 v	1000 w at 50, 100, or 200 v	1000 w at 25, 50 or 100 v
Frequency Range	50 to 10,000 cps at 250 w	50 to 10,000 cps at 500 w	50 to 10,000 cps at 1000 w	40 to 10,000 cps at 10,000 w	50 to 10,000 cps at 1000 w	6 to 2000 cps at 1000 w	5 to 100 kc at 1000 w
Sensitivity	0.036 v at 600 ohms	0.04 v at 600 ohms	0.1 v at 600 ohms	0.16 v rms at 600 ohms for 10,000 w output	0.1 v at 600 ohms	0.05 v at 600 ohms	0.5 v at 600 ohms
Distortion	1% at 250 w, 1000 cps	0.75% at 500 w, 1000 cps	Less than 0.75% at 1 kw, 1000 cps	Less than 3% at 10 kw, 1000 cps	Less than 0.75% at 1 kw, 1000 cps	Less than 5% at 1 kw, 10 to 1000 cps	

Price and delivery of both amplifiers and shakers are exceptionally good. For complete specifications and prices send for the new four-page illustrated brochure.

Genisco Savage

Genisco, Incorporated
2233 Federal Avenue
Los Angeles 64, California

CIRCLE 25 ON READER-SERVICE CARD

Engineering problem:

Pressure-tight fastening of transit cases

The solution:

A specially modified LINK-LOCK

Applied Design Company engineers worked with Simmons to develop this successful LINK-LOCK application

Simmons LINK-LOCK, with design modifications developed in cooperation with the Engineering Department of Applied Design Company, Buffalo, New York, resolves special closure requirements in rigidly specified transit cases like the aluminum equipment container shown.

Here, the bowed LINK-LOCK engagement blade provides the double advantage of maintaining constant fastener pressure and permitting considerable mounting tolerance. This container is just one of many important products in which Applied Design specifies standard and special Simmons Fasteners.

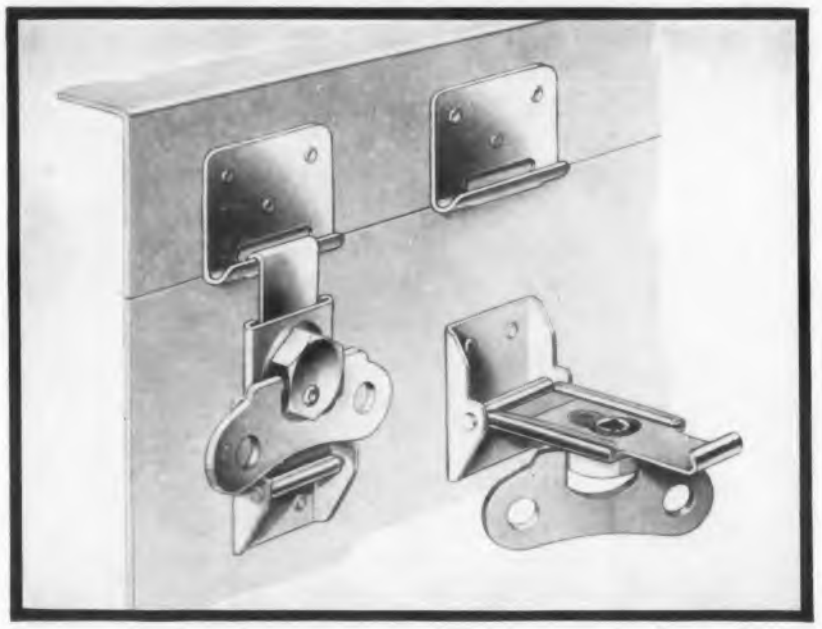
Here's why LINK-LOCK is ideal for use on military cases produced to exacting specifications as well as on inexpensive commercial containers:

- Impact and shock resistant (positive-locking).
- High closing pressure with light operating torque... insures pressure-tight seals where required.
- Available in 3 sizes, for heavy, medium, and light duty.
- Compact design... lies flat against case even when unlocked.
- Opening and closing by wing-nut, screwhead, or hex nut.
- Flexible engagement latch design... can be varied to suit different conditions.

Also available: Spring-Loaded LINK-LOCK. Ideal for the less expensive containers where costs won't permit precision production. Spring provides take-up to compensate for set in gasketing, irregularities of sealing surfaces, and mounting inaccuracies.

SEND TODAY for the Simmons Catalog for complete information and engineering data on LINK-LOCK and other Simmons Industrial Fasteners. Engineering service is available; outline your particular fastening problems. Samples on request.

Twelve special loop-blade LINK-LOCK fasteners are used in this aluminum transit case designed by Applied Design Company.



Standard No. 2 LINK-LOCK (Medium-Duty). Available with screwhead, wing-nut as shown, or hex nut.

SIMMONS

FASTENER CORPORATION

1763 North Broadway, Albany 1, New York

See our 8 page catalog in Sweets 1958 Product Design File

QUICK-LOCK • SPRING-LOCK • ROTO-LOCK • LINK-LOCK • DUAL-LOCK • HINGE-LOCK

CIRCLE 26 ON READER-SERVICE CARD

Plans '58

A few months ago we itemized topics that should be covered by an up-to-date report. As might be expected, we came up with more than we could undertake timewise. We've gone ahead, though, and committed ourselves publicly on some—we hope we can come out with others without fanfare.

A few Special Reports that will follow this issue on Design '58 are:

- Reliability—What are guides on the subject of reliability that an equipment designer can implement now?
- Thermistors—What is the status and trend in thermistors? Where is their use being neglected?
- High Temperature Components—A rundown on components available for high temperature operation.
- Printed Circuits—What techniques and standards should be specified to get military-reliable printed wiring boards?
- Plastics for Electronics—Are you picking the right material for the job at hand?

We'll also publish our annual Transistor Data Chart—the sixth. Transistors will be followed by a report on semiconductor diodes. The activity in transistors is still so great that we're running a supplementary listing next issue. Watch for it.

Your Article "Deadline"

You can help us on these special reports by submitting timely articles. We're pretty well along on the first reports mentioned, but if you can contribute to our high temperature components, printed circuits, plastics, transistors, or diodes issues, please send us an outline or abstract by January 20.

If you've often felt, "Why don't they run an article on such and such?", drop us a line giving us your views. Our Plans '58 have to reflect your needs.

EDITORIAL

Single Source for All New Product Information

A single source for all new product information is what ELECTRONIC DESIGN pledges to give you starting with this issue. No longer will you have to scan sundry publications to keep abreast of the latest in components, materials, and test equipment. We will publish all announced new products generally specified in designing electronic original equipment.

As you have noticed, we came close to this goal in 1957. We published more than 2500 products. Over twice as many as any other magazine in our field.

Quite frankly, we're delighted to be able to become a single source book for new product information. We know that there is so much literature to read these days that an engineer could spend all of his time reading and no time producing. We hope you will look forward to every other Wednesday—our new publication schedule—as new idea day.

You can help us keep our New Products section as reliable as possible. We try to screen our listings to ascertain that the manufacturer will furnish you more data and can deliver in a reasonable time should you place an order. If you feel a manufacturer does not give you the service you should expect, write us. Incidentally, your inquiries will be handled more promptly in 1958. We have added new data processing equipment and Reader Service cards from the Western states will be airmail postpaid.

We expect you to find more items to inquire about. We have redesigned our card often to add more numbers. Frequently there are over 500 items every two weeks to inquire about. We realize this is a vast number. If you have ideas on how to better present this information for your easy use, drop us a line.

As many of you found out to your dismay, there is a backlog of design engineers who want to receive ELECTRONIC DESIGN. The editors can't improve the situation, and all we can do is suggest you let your colleagues see the issue and use the extra Reader Service card. For those of you who have reported your library does not get ELECTRONIC DESIGN, we are happy to say librarians have recently been told how they can subscribe for $15 a year.

Although we're quite flushed with the compliments we've received on our past efforts, we hope we can coolly go about serving you the best we can in 1958.

matching antenna systems to RF equipment —with TRANSCO on the R&D

Tailoring a complete antenna system to RF equipment can be easier, faster, more economical—if you put TRANSCO on the R&D. Ten years of RF work on military and commercial systems have produced a wealth of experience that you could be using. Extensive test facilities are your assurance of reliability.

TRANSCO designs and manufactures:

antennas
antenna couplers
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REPRESENTATIVES IN MAJOR AREAS

CIRCLE 27 ON READER-SERVICE CARD

DESIGN

What new and improved designs will we see in 1958? The pages that follow give a decidedly better picture than the best of crystal balls. Our Design '58 report includes the answers of over seventy-five research and design engineers. We asked many questions about problems facing designers. Our answers are generally a composite of several replies rather than any one individual's.

'58

We Must Build a Bridge

There are many problems posed on the following pages. None seem more poignant or more crucial for our time than that stated by Mr. Shank below.

R. J. Shank
Vice President—Engineering
Hughes Aircraft Company

The problem which faces us in 1958, and, I expect for some years beyond 1958, can be stated in starkest simplicity as follows:

How can our system design capability catch up to our system conceptual capability as it responds to our very real and urgent system requirements?

Let me illustrate. In recent years we Americans have acquired the habit of believing that we need only to state a problem and science will be forthcoming with an invention and a solution. Thus, we have called upon our scientists to create the A-Bomb, the H-Bomb, the supersonic airplane, and coast-to-coast television.

Now secure in this experience of scientific achievement, we have handed science another set of requirements, such as:

- The intercontinental ballistic missile
- An air traffic control system
- The automation of our industry
- The automation of our business operations
- Space travel

Science has responded promptly and with great confidence. Solutions have indeed been proposed and systems to do these jobs have been conceived in principle. Our problem is that implementation of these concepts is requiring even vaster efforts involving more and more manpower and untold financial resources.

We are discovering that man can "dream" with great effectiveness and even with scientific accuracy, and then that the realization of those dreams comes only slowly and with great expenditure of effort and monies.

Our problem now is to manage and administer the development of the vast systems which our science has conceived with the same kind of scientific precision which has gone into the conceptual process.

The same boldness of thought and penetrating scientific analysis so successfully used to create new concepts must now be applied to the methods and the organizations needed to reduce these concepts to practice.

We have seen our objectives and visualized the course to reach them. We must now stop and build a bridge.

Missiles and Telemetry

What are the major problems facing missile and telemetry engineers?

We need to simplify airborne portions of telemetering systems. Most systems use an airborne sampler which presents analog signals from pickups to an encoder in sequence. The encoder produces pulse code modulation for the transmitter. The complexity lies in the multiplexing of the analog signals and in the encoder. One of these days, some clever designer will dream up a way of directly converting physical measurements to PCM. This will bypass intermediate transformation to an analog signal.

We already know how to encode directly using a code wheel with optical or magnetic pickups. This works fine for shafts, but not all data is available in shaft form.

Another formidable problem with today's high data rates and long tests is data reduction with the fm/fm system.

What about temperature, pressure, and strain? Can we convert these directly to PCM?

Unfortunately, no! The fellow who develops a design to do this will revolutionize telemetry and control.

What is being done to improve components?

Most companies in the field are increasing the reliability of components through increasingly rigid quality control specs. They are taking advantage of all advances in the state of the art provided by company sponsored and government sponsored research.

You spoke of improving reliability. Specifically, in what areas will this improvement manifest itself?

We are building devices with a much higher tolerance to vibration, acceleration and shock. New parts can take high temperatures better. We expect newer assemblies to be 50 to 100 per cent better in resistance to severe environments.

We are also learning better ways to use semiconductors and plastics. Upper temperature limits will be extended by 100 to 200 F.

Do you expect more progress in miniaturization?

It's hard to say. We are using miniaturization techniques wherever we can, providing they do not interfere with reliability and maintainability. These techniques have been applied successfully

Missiles (Cont.)

to several PCM systems but there is still lots of room for improvement.

What improvements do you expect in electrical characteristics?

Among other things, we are trying to improve maintenance and system signal-to-noise ratio. We're also trying to lower system power requirements.

What are today's important trends?

Transistors and semiconductor diodes are being used more extensively. Better potting techniques have improved shock resistance of many devices. There is also a trend toward new aerodynamic shapes and weights.

Is there any way suppliers can help solve some of your problems?

Yes. I should like to see them provide standard telemetry units, and especially, improved sensors. I'd like extremely tight delivery schedules and more quality control at the source. I'd like dependable components that withstand high vibration and acceleration loading in addition to being able to cope with humidity, temperature, and fungus. These improvements should start at the research and development stage.

What major developments are needed to overcome some of today's important limiting factors?

One of the big problems is with PCM systems. They've only recently been made available. They have the advantages of higher data rates, greater flexibility in multiplexing channels, no distortion in transmission, and usefulness in automatic systems for data processing without complex data reduction equipment. However, they are difficult to design and quite large.

On the positive side of the picture, there is the overall system approach.

Charles H. Doersam, Jr., Chairman Professional Group on Telemetry and Remote Control

"In telemetry, a major problem crying for solution is to accommodate increased data density within the existing standards. Data density has so increased over the years that extraordinary measures are being used. One method calls for the use of four or more separate rf carriers, each with its fm subcarriers."

Charles F. Carroll Program Engr. Missiles & Ord. General Electric Company

"We need telemetry systems that can work reliably in ionized air. Heat generated during reentry into the atmosphere makes ions which can damage vital parts."

Equipment Div. G. S. Humphrey Manager Government Raytheon Manufacturing Co.

"We are forced to use electronic components of 'today's' design in building 'tomorrow's' equipment. Component design and control of quality has not kept pace with the system manufacturers' design attainments."

Military Electronics

In what specific ways will the reliability of electronic equipment for the military be improved?

There will be continued and increased emphasis on evaluation of new components and materials. An analysis and follow-through on all component failures will be made. Also, we'll do more extensive prototype testing under simulated operational conditions.

To what extent will your products be miniaturized further?

We feel that future miniaturization beyond our present attainments will be increasingly difficult. Airborne miniaturization will continue to be emphasized. Products will be minified to the limit of the state of the art including transistorization and high density packaging with cooling.

What are some improvements in electrical characteristics to be expected?

You'll find higher transmitter/modulator pounds per cubic foot. You'll see satisfactory operation at frequencies above the K_u band. Higher efficiencies and frequency stability are to be expected of klystron, magnetron, and TWT oscillator/amplifiers.

Going back to reliability, how will you analyze components?

We want to obtain a clear statistical picture of the behavior of common electronic parts under the stress of load and environmental conditions. This statistical picture should be primarily concerned with the stability of these parts.

Since the probability of an excessive drift is the same as the probability of a circuit malfunction, proper accommodation of statistical drift will eliminate the drift mode of failure.

Just how do you use drift characteristics?

First, by defining the drift characteristics to be expected of normal parts in statistical terms, we are able to intelligently apply short-time culling tests to eliminate non-normal (outlaw) parts. Then, by the application of statistical descriptions of normal parts to circuit and system transfer function calculations, we hope to be able to predict the probability of any degree of instability.

Is the measurement of instability a completely adequate technique for achieving reliability?

The greatest single step that we need is a practical solution to the problem of actual designing

for a predetermined degree of equipment reliability. As I have said, we have learned how to use instability characteristic distributions of parts (the mean and variance) in designing, in culling potential failures, and in establishing circuit tolerances to drifts in parts.

The biggest problem that still remains is better, more complete calibration of accelerated tests in terms of application life, and more general publication of statistical expressions of the drift characteristics of parts.

Testing programs, such as are now being conducted by parts manufacturers in their quality control areas, will yield important engineering information when proper analysis of this data is made.

Component manufacturers are often blamed for not furnishing enough data. What is your experience?

We have been impressed by the splendid cooperation that our suppliers have given to us. We hope that this will continue.

Of course, we need not only the means and variances of new part characteristic distributions, but, in addition, the means and variances of the same characteristics after the parts have been subjected to stresses.

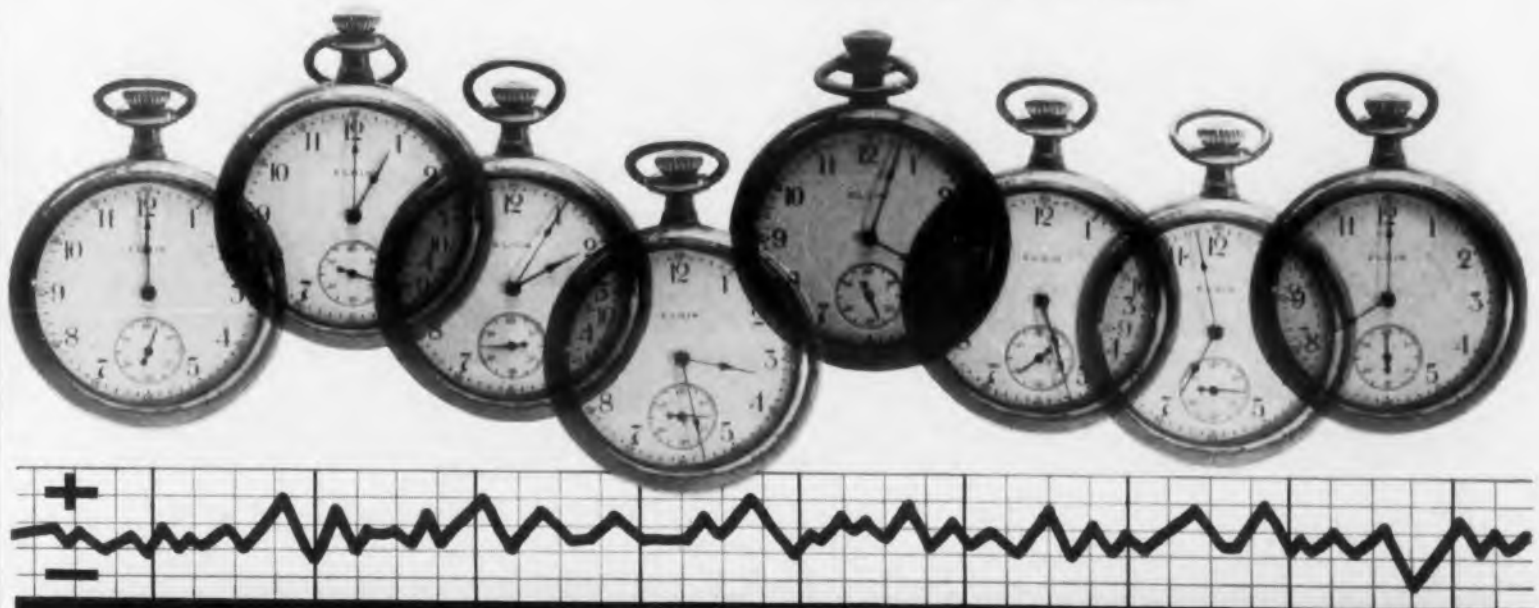
H. J. Wissemann
Assistant Vice President and Chief Engineer
Apparatus Div.
Texas Instruments Incorporated

"By obtaining the statistical pictures of the stability characteristics of each of the great multitude of parts which must be used . . . we can make more reliable equipments today. We are better able to define our future needs with this information than with the conventional (higher temperature, higher voltage, higher shock, etc.) statements of needed improvements."

Adm. W. E. Cleaves
Chairman
Professional Group on Military Electronics

"In 1958, designers should concentrate on maximum practical employment of recent research findings. To aid progress we need very careful and realistic scrutiny of equipment specifications, so that development costs and time may be cut, and reliability increased."

± SIX MICROVOLT INPUT DRIFT OVER AN EIGHT HOUR PERIOD



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represents the latest in the "state of the art" in instrumentation amplifiers. / Complete solid state circuitry / Transistorized / Low space requirement / Unique closed loop drift control

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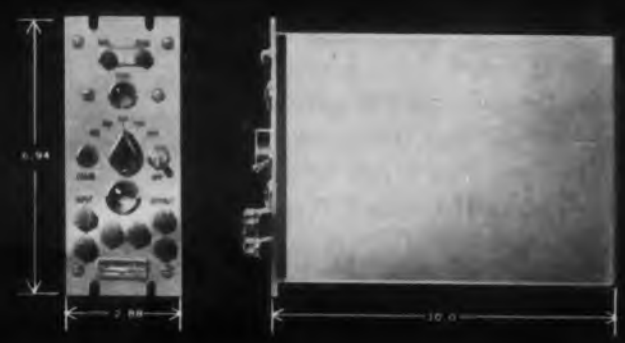

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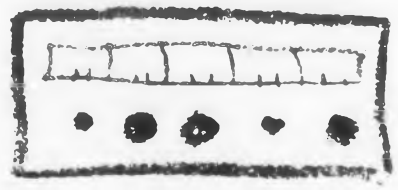
electronics division

CIRCLE 28 ON READER-SERVICE CARD

DESIGN '58

Industry and Military Needs



What would your department like to see in the way of component development?

First, better standardization of components and circuitry. Material improvement and the development of new materials must be undertaken to provide superior components. We also need improvement in the stability of characteristics of R, L, and C components and frequency.

We'd like to see work on new and novel means of cooling not requiring current types of heat sinks. We need more efficient methods of frequency and power generation for the various frequency values and power levels.

What is the Navy looking for that equipment designers can help solve?

There are five over-all areas that need attention:

- Measuring and improving life and reliability.
- Increased demands on accuracy, range, etc.
- Solution to temperature, size, weight problems.
- Improve compatibility of equipment by limiting radiation to specified regions.
- Higher temperature and nuclear radiation resistance.

Are there some specific things that designers should pay more attention to?

Yes. Designers should concern themselves with maintainability, value analysis, and simplicity.

They should attempt to arrive at standardized circuitry to maintain performance and improve standardization for simpler logistics. Regarding maintainability, designers should try to provide means of fault location without requiring an instruction book except for repair after functional trouble isolation. Of course, a lot of attention should be given to materials for components to improve performance under environment.

Col. J. S. Lambert
USAF
ARDC

"Temperatures above 500 C will be encountered . . . at high ambient temperatures, leakage currents will be higher than in conventional designs . . . ranges in impedance values will be much smaller, and the number of types of components will have to be considerably reduced. Ingenious circuit designers will have to work around these shortcomings."

Clure H. Owen
Chairman
Professional Group on Broadcast Transmission Systems

"Designers should check broadcasters more closely so that equipment will more nearly meet broadcasters' requirements."

W. H. Huggins
Chairman
Professional Group on Circuit Theory

"Our traditional education in mathematics, physics, and engineering has overemphasized analysis. Circuit theory, by illustrating the philosophy of synthesis, is a 'Sputnik' that shows the system designer that *it can be done* for a system of simple RLC structures. It points the direction for future work in system theory."

Capt. G. L. Countryman, USN
Assistant Chief of Bureau for Electronics
Bureau of Ships

"We'd like to see work on new and novel means of cooling not requiring current types of heat sinks. We need more efficient methods of frequency and power generation for the various frequency values and power levels."

E. R. Gamson
Chairman
Professional Group on Production Techniques

"Although the entire electronics industry in its quest for production maturity falls within the objectives of our Professional Group, we have placed the small business and its problems foremost in our immediate planning."

Dr. C. R. Burrows
Vice President for Engineering
Ford Instr. Co.
Chairman, PGEM

"We need a reduction of over-all costs. Designers must pay more attention to the ultimate cost of a project."

Henry Tulchin
President
Derivation And Tabulation Associates, Inc.

"Many more applications for the automatic capsulating of useful information for quick reference must still be found [DATA now compiles on punched cards specs on transistors, semiconductor diodes, and rectifiers], and as they are, the resultant time-saving benefits will indeed aid engineering progress . . . "

Dr. Victor Wouk
Chairman
Professional Group on Reliability and Quality Control

"Reliability and quality control progress will be materially aided if designers, and, more particularly, others who control the major paths that the designers are forced to follow, will realize reliable electronic equipment cannot be obtained cheaply."

J. M. Bridges
Director of Electronics
OASD

"We expect to see many of the ideas of the Report on Reliability put out by the Advisory Group on Reliability of Electronic Equipment adopted for their merit alone . . . [as contrasted to contractual enforcement]"

What is the military doing about reliability?

One of our latest actions is the publication of the report "Reliability of Electronic Equipment" prepared by the Advisory Group on Reliability of Electronic Equipment (AGREE). It was released several months ago and has been widely distributed throughout industry and the military departments.

Is action called for?

The three military departments have been requested by the ASD (R & E) to study this report carefully and to take certain specific actions with respect to the recommendations it contains.

Could you give us an idea of what is called for?

Among the actions requested are:

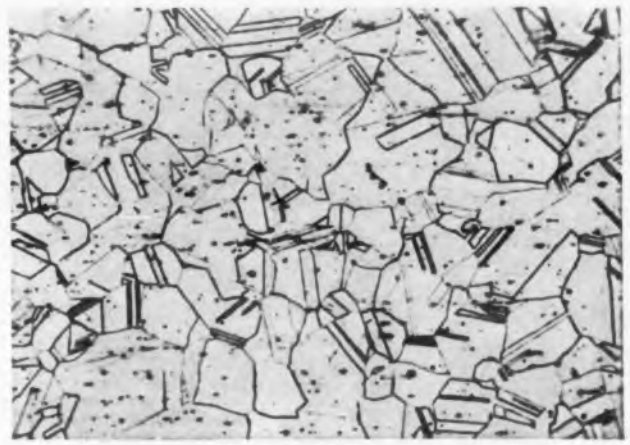
1. Assessment of the effect of implementing the recommendations of the report upon scheduling and fiscal aspects of contracts. Contracts involve equipment, weapons and weapons system development and production programs.
2. Suggestions concerning formal actions necessary to carry out the recommendations.
3. Selection of several equipments upon which will be applied the numerical requirements, design procedures and test methods established by Task Groups 1, 2, 3 and 4.

How far along is step 3?

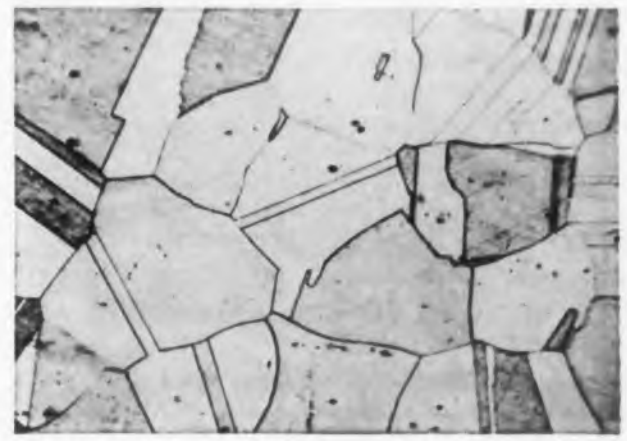
The equipments for trial application of the recommendations have been selected by the departments. This includes—8 equipments in the design stage and 9 equipments just entering production. These equipments have been selected to represent the application of electronics in the various military weapon and system categories. Some of these are communication equipments, others are portions of manned aircraft systems and still others are in the guided missile category.

The progress of the selected equipments in development and production will be monitored carefully by the Office of the Assistant Secretary of Defense for Research and Engineering in order to determine the effectiveness of applying the recommendations involved.

4 Improvements in NICKEL-CHROME ALLOYS Now Obtainable from Driver-Harris Vacuum Melting Service



Polished and etched sample of Air Melted NICHROME V in annealed condition.*



Vacuum melted NICHROME V, annealed. Note that reduced inclusions result in much larger grain size for the same annealing treatment.

After many years of experience with vacuum melting programs, Driver-Harris now offers a complete vacuum melting service for almost all of the 132 special purpose alloys made by this company.

The specific benefits gained by vacuum melting in the production of nickel-chrome alloys are today clearly established. They are:

1. Much closer control of analysis—particularly in alloying with the highly reactive elements, Titanium, Aluminum, Columbium, Calcium, and Zirconium. The normally high affinity for nitrogen and oxygen these elements have is completely eliminated in vacuum melting, thereby opening new avenues in alloy production.

2. Great reduction in inclusions, especially oxides and nitrides, results in higher ductility and tensile properties. In fine wires, the improvement in properties is frequently so great that wire sizes may be reduced without sacrifice of strength. An example of the greatly improved microstructure is illustrated in the metallographs shown.

3. Complete elimination of gas, not from the surface only but from the entire mass. Alloys so produced are therefore more desirable in the manufacture of electron tubes.

4. General improvement in electronic, electrical, and mechanical properties to meet specifications. Because closer control of analysis is a primary advantage of vacuum melting, we can now achieve these specific improvements with remarkable certainty.

Almost all of the Driver-Harris Alloys now vacuum melted and processed under close physical and analytical control show improvement in one or more of the above ways. If you are seeking further improvements in the D-H Alloys you use, inquire now for information on how Driver-Harris Vacuum Melting Service can help you. Address your inquiry to Dept. VMS.

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

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CIRCLE 29 ON READER-SERVICE CARD

DESIGN '58

Components

What problems face component designers?

The answer depends on whether we're talking about commercial components or military components. Problems are huge for both categories.

I presume you refer to the "squeeze" put on the component manufacturer?

Yes. The industry must, in 1958, reduce prices, reduce costs, and meet the need for increased quality levels. Equipment designers are talking about quality, quality control, and reliability. At the same time, increased competition, as well as rising labor and material costs is putting a considerable squeeze on the component manufacturers.

Is there any "out" for the component maker?

Part of the answer is that they improve their efficiency, utilize available materials, and develop new materials which can be worked into component designs, in order to meet the basic objectives of quality and cost.

What is the other part of the answer?

Frills which do not contribute to performance must be eliminated by the component engineer. This means the user, through his specifications and incoming inspection and quality control groups, must keep in mind the same objectives. He must not insist on nonessential requirements or tests beyond the quality level necessary to meet the performance requirements of his equipment. This is of especial importance in the entertainment field.

We have seen the introduction last year of components for ambients of 500 F. What can be expected in 1958?

Actually, some new materials and finishes have raised the temperature limits to 1000 F. Further improvements will be forthcoming. Innumerable design problems would be solved by the availability of 750 to 1000 F thermoplastic. For connectors, operation may be 1500 to 2000 F.

What special problems face capacitor manufacturers? What improvement will there be?

Lower costs. Improvement will not be outstanding except in a few items for the military. Materials having a higher resistivity, and higher saturation flux are needed.

And the resistor manufacturers?

Lower costs. Assembly will be simplified. Increased environmental ranges will be achieved for some military items. In general, there will be better conformity for longer periods. Closer tolerances will be held.

"The trend in relay manufacturing will be toward automatic assembly . . . new methods of joining parts will be worked out . . . sizes will be decreased as much as 50 per cent."

G. M. Hausler
Mgr., Relay Engineering
General Electric Co.

"The equipment design engineer must not expect to design into his equipment components which are, in themselves, inherently more costly, unless he can show that by so doing he can accomplish an over-all savings."

Louis Kahn
Technical Asst. to the President
Aerovox Corp.

"A major high temperature problem—one which intrudes against the concept of miniaturization by requiring compensating overdesign—is the thermal coefficient of electrical resistivity. Insulators become more conductive, and conductors become more resistive . . . conductors with the necessary corrosive resistance at very high temperatures, and capable of being hermetically sealed, usually have basically low conductivity at normal room temperature."

R. R. Rapier
Design Engineering Supervisor
Cannon Electric Co.

"The electronics system designer of today is pushing operational and environmental limits of the materials and components available to him. The gap between basic research and its application is narrowing. Some way must be found to extend the efforts in basic research in order to provide new materials and techniques. If this is not done, progress in the art will be reduced to a much lower rate than has been seen in the past few years."

Kenneth L. King
Director of Research
Norden-Ketay Corp.

"The problem for the equipment engineer is proper liaison with the components design engineer and intelligent choice of parts. For the component engineer knowledge of all environmental conditions is essential so that he can design parts of the highest quality and increased reliability in conformance with the over-all limits of size, packaging, and operating conditions."

R. M. Soria
Vice President, Engineering
Amphenol Electronics Corp.
Chairman
Professional Group on Component Parts

What are connector designers working on?

Designs for high temperature and/or radiation usage without sacrifice of moisture resistance, altitude flashover, electrical resistance, electrical conductivity, mechanical strength, durability, or miniaturization.

Can connectors be miniaturized further?

Seventy-two contacts per square inch of insulator surface appears to be the foreseeable practicable limitation.

Are radiation effects a serious problem?

Fortunately, materials which are resistant to high temperatures (above 500 F) are, for the most part, also resistant to radiation. Constituents in which excessive secondary radioactivity may be induced or retained must be avoided.

The connector is often said to be the most unreliable component. What is being done to improve the situation?

A major construction design problem is to provide adequate inherent orientation and guidance to prevent mating the wrong connector halves and to insure protection of the all important contacts and insulators during engagement of the plug to the receptacle. *This is important for remote control engagement.* An automatic indication should signal that engagement is complete.

What is the problem of sealing connectors?

The difficulty arises from lack of suitable elastomeric materials to provide compression seals, or suitably precise and durable "valve seat" type of rigid seal. Matched coefficients of expansion and constancy of pressure are supplementary problems.

What are relay problems and what can be expected in the way of improvement?

The problems are the need for better insulation, better cleaning methods, and better methods of joining.

As for improvement, temperature ratings will be increased (200 C), contamination removed, and vibration increased. Size will be lowered.

Although component manufacturers must do much research now for improved environmental ratings and reliability, can't future sales make up for this?

The potential sales for these highest reliability components in the foreseeable future is extremely small. The government has provided little or no subsidization for development or production of military items. The growing squeeze on profits from commercial business makes it difficult and even undesirable for most organizations to meet government requirements.

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TYPE

304-A

More Du Mont 304-A scopes have been sold than any other scope ever made.

The universal acceptance of the 304-A is no accident. It results from superb electrical design and manufacturing techniques which combine to produce an instrument of long-proved versatility and dependability.

The 304-A has been specified into so many processes and equipments that, faced with the cold facts of unrelenting market demand, we find ourselves forced to continue production, even though subsequent models with additional features are now available, and to announce that the ubiquitous 304-A is now again available from stock. (As is, of course, the rack-mounted version, 304-AR).

still only **$413.00**
F.O.B. Clifton, N. J.

P.S. Just in case you are not familiar with the 304-A, briefly...

The Du Mont 304-A is a true electronic voltmeter, offering speed and accuracy in measuring any portion of a 0 to 1000 volt signal from d-c to 100,000 cps. It offers sensitivity of 100 millivolts d-c full scale, equivalent to 25 p-p millivolts per inch, and high gain a-c or d-c amplification. Built-in, push-button amplitude calibration, high stability amplifiers, and other most-wanted features contribute toward the outstanding success of the 304-A.

WRITE FOR COMPLETE TECHNICAL DETAILS...

INSTRUMENT DIVISION, ALLEN B. DU MONT LABORATORIES, INC., CLIFTON, N.J., U.S.A.

CIRCLE 30 ON READER-SERVICE CARD

DESIGN '58

Microwave Techniques

What will microwave designers be working on in 1958?

The year 1957 saw the conception of solid state amplifiers for microwave signals. These devices promise the development of very low noise amplification, sources of extremely stable frequency, and sources of millimeter wavelengths. The conversion of laboratory models to production items will occupy designers in 1958.

Are there any areas which need special attention?

Increasing the frequency range in which these devices work, increasing the bandwidth, and increasing the gain are aspects of the devices which will require further development.

What kind of a "breakthrough" is needed to improve radar?

We need a major increase in transmitting tube efficiency, and longer life cathodes.

Also, basic development in tube research should concentrate on improved electron beam focusing techniques for klystrons and traveling wave tubes.

W. L. Pritchard
Chairman
Professional Group on Microwave Theory and Techniques

"Improved design of the r-f structures will be required to achieve and utilize the intrinsic low noise figure of some solid state amplifiers. Improved design will be necessary . . . to increase the bandwidth and gain of all of these devices."

What's being worked on in the way of microwave ferrite devices?

We're trying to get modulators that operate at high modulating frequencies. In general, ferrites will be designed to operate at higher power levels and lower frequencies, too.

What will environmental range be?

From −55 to +125 C operation will be routine.

Are ferrites being exploited to full advantage in microwave equipment?

There is a trend toward dielectric loading to improve isolator performance.

What are some instrument problems?

Extending the capabilities of microwave calorimetry to both much higher and much lower power levels—and to design loads related to the wavelength at frequencies so low that physical dimensions are awkwardly long.

What is the high power level?

We have extended the maximum power levels of our calorimeters to 50,000 watts power by using a flow rate greater than that possible from tap water. We are continuing further.

Dr. H. Scharfman
Special Microwave Device Group
Raytheon Mfg. Co.

"We'd like improved dielectric materials for microwaves. We also need high temperature (>250 C) bonding and adhesive materials."

Hugh E. Webber
Chief Engineer
Microwave Electronics Div.
Sperry Gyroscope Co.

"New ferrite techniques are already making possible the giant strides necessary to "uncomplicate" and make producible several vital system developments that must be available in quantity less than two years hence. This progress may soon be exceeded by still newer solid state devices that may even further compress the time required to achieve system readiness."

Ben R. Cole
Maynard Laboratory
Raytheon Manufacturing Co.

"It would be helpful for system engineers to have universal microwave component design data. We need reliability information in a more usable form for all components."

Sam Freedman
General Manager
Chemalloy Electronics Corp.

"The power measurement designer could use mediums which shorten the wavelength more for a particular frequency."

Where are instrument designers placing their emphasis in 1958?

On transistors. The use of transistors does not necessarily simplify design, as achieving a high frequency response and a high input impedance are problems. Transistors are being used because reliability will be better.

Instrument engineers are basically trying to improve performance and lower costs. Lower costs should encourage wider use.

Will vacuum tubes still be used?

Vacuum tubes will gradually be eliminated. Not only is maintenance reduced by using transistors, but instruments are made smaller and more portable. The need for 60 cycle power is removed.

Will 1958 instruments be easier to use?

Consideration of human engineering principles will make instruments easier to use and eliminate chance for error. More attention should be given to this aspect. More can be done to improve digital readout of measurements. However, the trend toward ease of operation may be at the expense of versatility.

What are factors limiting improvement in instruments?

Better transistors are needed—less noise, for example. Improved low-static transparent plastic and high coercivity magnets are desirable for better meters.

"The biggest problem facing the instrument designer is that of decreasing cost in the face of improving performance and reliability."

Dr. Robert C. Langford
Chief Engineer
Weston Electrical Inst. Corp.

"Human engineering, for ease of operation and elimination of errors, requires attention . . . Further developments in digital presentation are desirable. Packaging also requires attention—especially to facilitate maintenance and adjustment, as well as reliability, 'shipability', & operation."

F. C. Smith, Jr.
Chairman, P.G. on Instrumentation

It's *four* instruments in one...

1 dc null detector

2 micro-microammeter

3 microvolt level dc amplifier

4 microvoltmeter

...and can *really* take a beating

KIN TEL'S ELECTRO-GALVO SOLVES ALL YOUR LOW-LEVEL DC MEASUREMENT PROBLEMS

Sensitive

Functionally equivalent to suspension galvanometers, but with far greater versatility, the Model 204A is the ultimate for DC null detection in low level bridge and potentiometer circuits. KIN TEL's chopper stabilized, all transistor design provides extreme sensitivity and rugged durability superior to conventional moving coil or electronic galvanometers.

Rugged

Immune to overload and shock, the current sensitivity of the Model 204A is 20 times greater than the sensitivity of high quality, mechanical current galvanometers. As a voltage galvanometer, the extremely high power sensitivity of the Model 204A makes it superior to low impedance moving coil instruments.

Versatile

This reliable, general purpose unit is ideal for use as a direct reading indicator for strain gage, thermocouple and other current or voltage measurements in industry or laboratory. The 204A's simplicity of operation makes it the key to efficient production line testing. Its unequalled stability makes it ideal for low level DC amplification to extend the range of recording and other measurement instruments.

Representatives in all major cities.

Check these outstanding specifications

- 20 Micro Microamps Per Division Sensitivity
- ± 10 Microvolts to 10 Volts or ± 0.001 Microamp to 1 Milliamp Full Scale Sensitivity
- Withstands Extreme Overload with No Zero Offset
- Transistorized—Rugged—Insensitive to Shock, Microphonics, Position
- Floating Input
- 7 Voltage or Current Ranges
- 10,000 Ohm Input Resistance
- 10^{-14} Watts Full Scale Power Sensitivity
- Equivalent Built-in Ayrton Shunt—No Accessories to Buy
- Use as Stable DC Amplifier with 1 Volt at 1 ma Output
- Less than 2 Microvolts Drift
- Less than 1 Microvolt P-P Noise

Model 204A Price $325.00

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CIRCLE 31 ON READER-SERVICE CARD

BOWMAR

PRECISION COUNTING DEVICES

MINIATURE LATITUDE COUNTER 2417

Latitude indications from 00°00' North to 90°00' North or South. Reversible, but not continuous rotation. Speed: 1500 rpm max. int., 500 rpm cont. Torque: .3 in-oz. @ 20° C. Wgt.: 1.5 oz.

HEADING AND AZIMUTH DECIMAL LATITUDE-LONGITUDE IMPULSE AND CUSTOM COUNTING DEVICES

MINIATURE INTERNAL PINION COUNTER 2785

Decimal indications from 000 to 999. Reversible and continuous rotation. Speed: 600 rpm max. int., 350 rpm cont. Torque: .5 in-oz. approx.@ 20°C. Wgt.: .75 oz.

MIL COUNTER 1864

Mil indications from 0000 to 6399. Reversible and continuous rotation. Speed: 800 rpm max. int., 300 rpm cont. Torque: .75 in-oz. @ 20°C. Wgt.: 4.6 oz.

BOWMAR designs and produces all types of precision counting devices to customer specifications. Typical units illustrated are designed for general use in navigational, fire control, missile tracking and computing systems. They are available as shown, or can be redesigned to suit new applications. Counting devices can be produced from your prints or can be engineered to fill your performance requirements.

Precision Counting Devices

Reliability, high speed operation, miniature size and light weight are important features of precision electromechanical components and assemblies. BOWMAR produces units with these and other characteristics to all specifications and in all quantities.

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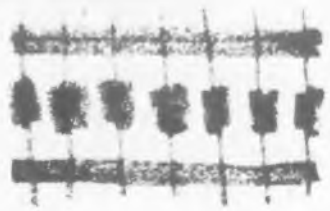
CIRCLE 32 ON READER-SERVICE CARD

DESIGN '58

Automatic Control



What will automatic control designers be working on in 1958?

The integration of structural design and the application of new materials to the design of electronic equipment. This effort will be directed toward achieving the microminiaturization, ruggedness, and reliability required by the more severe environments encountered by missiles and space vehicles.

Continued emphasis will be placed on mechanized fabrication methods and automatic quality control techniques to increase the reliability of the product.

What will be the trend in servos?

Incorporating improved components—designing miniaturized versions using transistors.

What do control engineers need to help improve reliability?

Better coordination of effort between equipment designers, materials specialists, physicists, and production engineers. This will help establish optimum design approaches and obtain better understanding of materials and parts. Such cooperation will help determine key characteristics governing breakdown mechanisms and further develop mechanized production and quality control methods.

What are the problems in magnetic amplifiers?

One of the most serious problems is posed by the limited predictability of core performance. The difference in magnetic properties of cores derived from different heats is still appreciable. Even when cores of the same heat are to be used for more critical applications such as low level amplifiers, a considerable effort is still needed in selecting one pair or one quadruplet of cores of acceptable similarity.

What is the trend in magnetic amplifiers?

There is a trend toward increased use of static switching elements, which are mainly magnetic amplifier types. Saturable core devices and transistors are also used successfully in increasing numbers in computers and other digital information handling equipment.

At the other end of the spectrum, the output power of magnetic amplifiers is constantly pushed to higher levels, and units for 100 kilowatt output are no longer a rarity.

Dr. H. F. Storm
Control Systems
General Electric
Co.

"Any improvement in the repeatability of core properties will be most welcome to designers and manufacturers of magnetic amplifiers."

L. K. Lee
Senior Staff Engr.
Space Tech. Labs
Ramo-Wooldridge

"The investigation of failure mechanisms for electronic parts and assemblies needs much attention so that key characteristics may be determined for use in mechanized quality control and improvement of electronic equipment reliability."

CIRCLE 33 ON READER-SERVICE CARD ➤

'SCOPE for VISUAL MICROWAVE ANALYSIS

Saves Engineering Manhours

Polarad Model TSA Spectrum Analyzer enables new visual techniques for checking and testing of microwave equipment with the same ease as standard oscilloscopes used in lower frequency work.

This instrument displays on a frequency base: pulse modulation components, frequency differences, attenuation and band width characteristics, leakage detection, radiation and interference signals, and VSWR information, with high sensitivity on a bright easily defined CRT.

Frequencies are read directly on the linear dial with 1% accuracy as the set is tuned. Maximum reliability and long life is assured through special, non-contacting oscillator choke sections. A stable frequency marker with both frequency and amplitude adjustment is provided.

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Model TSA

Write for your copy of the Polarad "Handbook of Spectrum Analyzer Techniques". It includes discussion of operation, applications and formulae for analysis techniques.

POLARAD ELECTRONICS CORPORATION

43-20 34th Street, Long Island City 1, New York

REPRESENTATIVES: Abington, Albany, Atlanta, Baltimore, Boeing Field, Chicago, Cleveland, Dayton, Denver, Detroit, Englewood, Fort Worth, Kansas City, Los Angeles, Portland, Rochester, St. Louis, Stamford, Sunnyvale, Syracuse, Washington, D. C., Westbury, Westwood, Wichita, Winston-Salem, Canada: Arnprior, Ontario. Resident Representatives in Principal Foreign Cities.

LEAKAGE AND INTERFERENCE MEASUREMENT

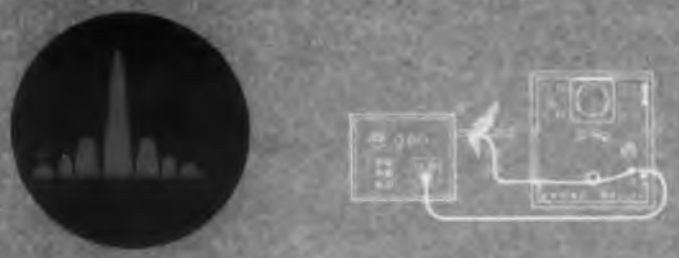
A simple, quick method of determining component leakage in microwave equipment is to watch the Spectrum Analyzer CRT while probing with a microwave test antenna. Because of high sensitivity of the TSA, CW signals will appear on the scope when the area of leakage has been found.

VISUAL FREQUENCY CALIBRATION

The Model TSA Spectrum Analyzer calibrates frequency by comparing the signal from a frequency standard as a reference, with that of an unknown. When signal coincidence occurs on the CRT, the unknown frequency is precisely shown. With a resolution of 25 kc, two 10 kmc signals can be compared with an error of less than 0.00025 percent.

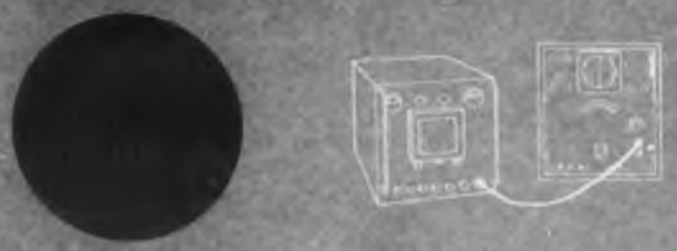
MEASUREMENT OF PULSE MODULATION

The output of a pulse modulated microwave system can be received and displayed, as shown, on the CRT of the Polarad Model TSA Spectrum Analyzer. The presentation is a measure of the quality of modulation and points up undesirable modulation components which can then be corrected by adjusting the modulator and observing the correction visually.



CHECKING AFC OF RADAR SYSTEMS

AFC can be checked readily by observing the manner in which the radar local oscillator signal tracks the transmitter spectrum on the spectrum analyzer.



CHECKING OUTPUT OF FM GENERATORS

Modulation index of frequency modulated signals can be checked.

POLARAD
PROVEN RELIABILITY

IN ACTION

A microwave receiver with large dynamic range; excellent gain stability for these applications:

- General communications.
- Field intensity meter.
- Frequency meter.
- Measurement of radiation and leakage of microwave devices.
- Measurement of bandwidth of microwave cavities.
- Measurement of relative power of fundamental and harmonic signal frequencies.
- Measurement of noise figure.
- Antenna field patterns.

AM, FM, CW, MCW
and PULSE RECEPTION

High video output —
low impedance
Trigger output
Special recorder output

Output level reading
directly in db
High sensitivity

Seven interchangeable plug-in r-f tuning units cover the entire frequency range:

*†RR-T	400- 1,000 mc
*†RL-T	950- 2,040 mc
*†RS-T	1,900- 4,340 mc
*†RM-T	4,200- 7,740 mc
*†RX-T	7,300-11,260 mc
†RKS-T	9,500-15,600 mc
†RKU-T	14,700-22,000 mc

*Microwave preselection, tracked and double-tuned
†U.S. Patent No. 2,774,243

Direct reading
UNI-DIAL control,
Broadband coverage

Audio output,
Audio output control
AFC switch

MULTI-PURPOSE BROADBAND MICROWAVE RECEIVER 400–22,000 mc

Four distinct receivers in one:

- **an AM-FM receiver**
- **a field intensity receiver**
- **a pulse, pulse time or pulse position demodulator**
- **a sensitive microwave power meter**

This receiver is designed for quantitative analysis of microwave signals and is ideal for the reception and monitoring of all types of radio and radar communications within the broad band 400 to 22,000 mc. It permits comparative power and frequency measurements, by means of its panel-mounted meter, of virtually every type of signal encountered in microwave work.

It is compact and functional, featuring 7 integrally designed plug-in, interchangeable RF microwave tuning units to cover 400 to 22,000 mc; non-contacting chokes in pre-selector and microwave oscillator to assure long life and reliability, and large scale indicating meter for ease of measurement.

Look at the front panel controls and see the versatility of this instrument – in every-day laboratory, production and field testing.

Call any Polarad representative or the factory for detailed specifications.

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43-20 34th Street, Long Island City 1, New York

REPRESENTATIVES: Abington, Albany, Atlanta, Baltimore, Boeing Field, Chicago, Cleveland, Dayton, Denver, Detroit, Englewood, Fort Worth, Kansas City, Los Angeles, Portland, Rochester, St. Louis, Stamford, Sunnyvale, Syracuse, Washington, D. C., Westbury, Westwood, Wichita, Winston-Salem, Canada: Arnprior, Ontario. Resident Representatives in Principal Foreign Cities.

SPECIFICATIONS:

Sensitivity:
(a) For Model RR-T: Minus 85 dbm
(b) For Models RL-T, RS-T, RM-T and RX-T: Minus 80 dbm
(c) For Models RKS-T and RKU-T: Minus 65 dbm

Frequency Accuracy: ±1%

IF Bandwidth: 3 mc

Image Rejection:
(a) For frequency ranges 400-11,260 mc: Greater than 60 db
(b) For frequency ranges 9,500-22,000 mc: (RKS-T and RKU-T tuning heads) Spurious response rejection obtained through the use of a bandpass filter

Gain Stability with AFC: ±2 db

Automatic Frequency Control: Pull-out range 10 mc off center

Recorder Output: 1 ma full scale (1,500 ohms)

Trigger Output: Positive 10-volt pulse across 100 ohms

Audio Output: 5 volts undistorted, across 500 ohms

FM Discriminator:
Deviation Sensitivity: .7 v./mc

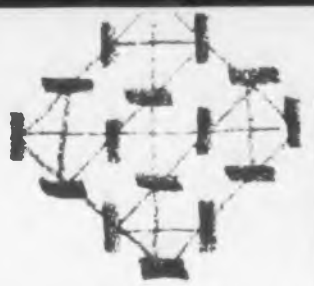
Skirt Selectivity:
60 db — 6 db bandwidth ratio less than 5:1

IF Rejection: 60 db

Maximum Acceptable Input Signal Amplitude: 0.1 volts rms, without external attenuation

Video Response: 30 cps to 2 mc

Network Synthesis



Is modern network synthesis catching on?

Increased emphasis will be placed on active network theory. The traditional restrictions imposed by classical RLC passive elements circuit design will be removed. Synthesis techniques for active networks should be readily generalized to more complicated systems.

What do you mean by generalizing synthesis techniques to apply to complicated systems?

I'm thinking of the value of synthesis techniques to system engineers. The philosophy of network synthesis makes one first decide upon the acceptable performance or behavior of the system and then find by exact procedures a network that will behave in the specified manner. Too often the system engineer starts with a system that is conjured up from somewhere and then analyzes it to see whether its performance is useful.

What aspects need much attention?

Systematic synthesis methods for incorporating tolerances of the component parameters at the outset so that the resulting network is least sensitive to errors in the component values.

F. B. MacLaren
President
F. B. MacLaren
and Co., Inc.

"We should see more and more the application of military digital electronic and servomechanism techniques to industrial applications."

John M. Wilson
Chief Engineer
Brown Inst. Div.
Minneapolis-
Honeywell

"One of our biggest problems in 1958 . . . will be to select proper materials. We are all aware of significant advances in synthetics, plastics, powdered metals, etc. In many cases the literature and advertising describes the advantages in glowing terms. Separating the facts so suitable selection can be made is a long, tedious job requiring much testing and laboratory analysis for each application."

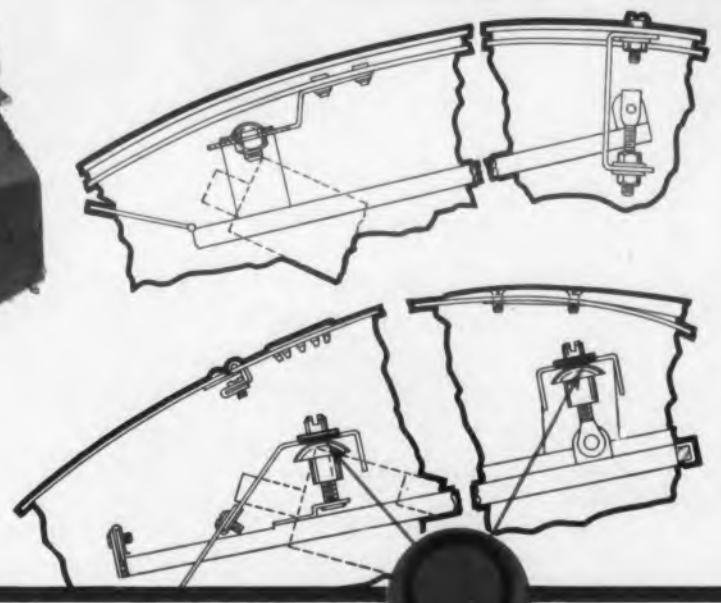
CIRCLE 33 ON READER-SERVICE CARD

Waldes Truarc Rings cut assembly costs, improve performance of precision photo-optics equipment

Charles Beseler Co., E. Orange, N. J. uses Waldes Truarc Retaining Rings in 3 applications shown.

REFLECTING MIRROR ASSEMBLY IN OPAQUE PROJECTOR

VU-LYTE II PROJECTOR



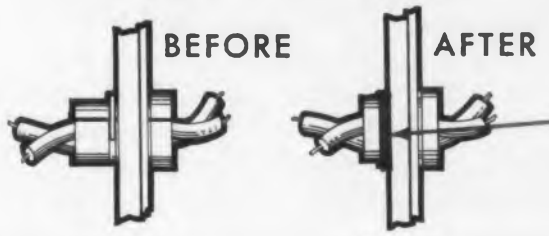
BEFORE

"The front surface mirror is the most precise optical element in a properly-functioning opaque projector," Beseler writes. "Previously we used this extremely cumbersome means of holding the mirror in position. As mirror adjustments are always required and the mirror is extremely delicate, our spoilage was terrific."

AFTER

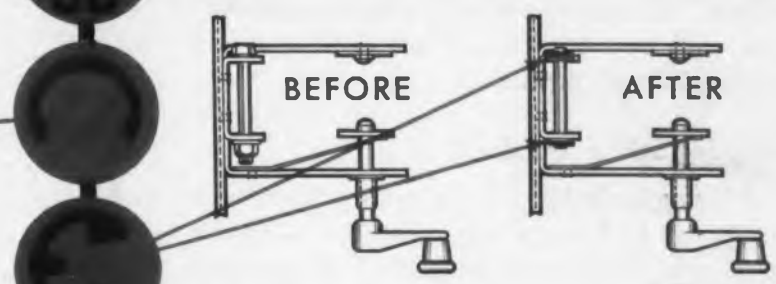
"Two Truarc Series 5100 Rings made possible complete redesign of the mirror assembly. Now mirrors can be adjusted from *outside* the projector. Rejects now are practically nil. More precise adjustment of the mirror is possible. And because of the greater ease in adjustment, we have cut labor costs $2.00 per unit."

HEAT ASSEMBLY IN PRINT DRIER



Here a Waldes Truarc crescent ring, Series 5103, replaced a split collar and clamping ring. Results: labor costs cut 50¢ per unit because of greater ease of assembly. Drier provides more uniform heating.

35 MM MICRO-FILM NEGATIVE CARRIER IN ENLARGER



2 Waldes Truarc Series 5133 E-Rings replaced 2 cap nuts—at a saving of 20¢ per unit in labor costs.

Whatever you make, there's a Waldes Truarc Ring designed to save you material, machining and labor costs, and to improve the functioning of your product.

In Truarc, you get

Complete Selection: 36 functionally different types. As many as 97 standard sizes within a ring type. 5 metal specifications and 14 different finishes. All types available quickly from leading OEM distributors in 90 stocking points throughout the U.S. and Canada.

Controlled Quality from engineering and raw materials through to the finished product. Every step in manufacture watched and checked in Waldes' own modern plant.

Field Engineering Service: More than 30 engineering-minded factory representatives and 700 field men are at your call.

Design and Engineering Service not only helps you select the proper type of ring for your purpose, but also helps you use it most efficiently. Send us your blueprints today...let our Truarc engineers help you solve design, assembly and production problems...without obligation.

WALDES
TRUARC®
RETAINING RINGS
WALDES KOHINOOR, INC.
47-16 AUSTEL PLACE, L. I. C. 1, N. Y.

Waldes Kohinoor, Inc., 47-16 Austel Place, L.I.C. 1, N.Y.
Please send new, descriptive catalog showing all types of Truarc rings and representative case history applications. *(Please print)*

Name _____
Title _____
Company _____
Business Address _____
City _____ Zone ____ State _____

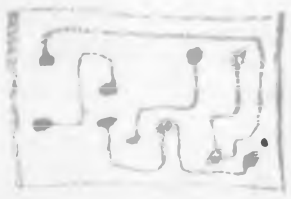
EDO10

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U.S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U.S. Patents pending. Equal patent protection established in foreign countries.

CIRCLE 34 ON READER-SERVICE CARD

DESIGN '58

Printed Circuits



Are there problems confronting printed circuit manufacturers?

The major problem facing the printed circuit industry is the lack of satisfactory base materials. However, we expect soon to produce printed circuits with improved insulation resistance and lower moisture absorption.

Is soldering still a problem?

Dip-soldering techniques have improved. A year or so ago we had a number of customers every week in our plant for dip-soldering demonstrations and training. This is not so any more. Most of them consider themselves to be experts now.

Another company reports: We have succeeded in eliminating oxides and chromates in our printed circuits, overcoming solder difficulties.

Will the reliability of printed circuits for the military be assured?

Insofar as our activities are concerned, we are trying to raise quality levels through more careful inspection of base materials and improved manufacturing techniques. We expect this to result in printed circuits with greater reliability.

In looking into the cases where unreliability was traceable to the use of printed circuits, it was found that 99 per cent of the trouble resulted from either too poor design of the printed wiring boards or too poor quality control over the manufacturing or assembly techniques. For instance, printed circuit boards used in portable radio receivers crack when the receiver is dropped. This is usually due to improper support of the board in the case. Improper use of eyelets as through connections in printed wiring boards has been an unreliability problem in the field.

In some of the extremely high reliability missile programs it has been found that a higher order of reliability has been obtained with printed wiring boards than was heretofore possible with any other method of assembly.

What about eyelets vs plated holes?

The eyelet vs plated hole controversy continues, although a great deal has been learned in the last year about the reliability problems inherent in both methods. Practically everyone realizes now that if eyelets are used as through connections, the design of the eyelet must be special and the way that it is soldered to the pattern must be very carefully controlled. There have also been certain conclusions reached with regard to plated holes as to what the minimum thickness of copper should be, etc.

We have noticed a distinct increase in the number of customers who are using, or are planning to use, plated holes instead of eyelets.

Are printed circuits practical for short runs?

Printed circuits are definitely proving practical for small runs. Many manufacturers of instruments and other devices where runs of 25 to 50 are normal have converted to printed wiring. They seem to be happy with their decision.

Charles Sabel
President
Precision Circuits, Inc.

"We expect to produce printed circuits with improved insulation resistance and lower moisture absorption."

Automation

Is there any one biggest problem facing designers of automatic assembly machinery in 1958?

The increased use of transistors points to the desirability of production machinery to automatically handle them. The problem is whether a degree of standardization of the physical shape can be achieved so that a simple mechanism can do the job. Our experience tells us that there should be a component form factor that requires minimum handling in the production cycle.

Is the promise of the automatic factory still around the corner? We don't hear much about the grandiose schemes revealed several years ago.

There hasn't been the first phase standardization between component designers and machine designers.

Will 1958 see a change?

Probably not a great deal. There isn't much progress in the necessary transition from components created for manual assembly to those compatible with machine assembly.

To be honest about it, we machinery suppliers must settle the problem of how the component should be prepared for automatic machinery. But we're dependent on both the assembler and the component manufacturer to standardize more on what the component should be.

Can we mechanize electronic parts assembly all the way?

Well, even if automation is technically feasible, there are some tasks which humans can probably do better. Not all operations need to be automated.

R. L. Swiggett
Vice President
Photocircuits Corp.

"Carefully controlled dip-soldering procedures seem to produce more reliable solder joints than hand-soldering, regardless . . . of training . . . of persons doing the hand-soldering."

What will some future trends be in automatic machinery?

There will probably be more automatic soldering and automatic printed circuit board fabricating machines.

Our company has announced for 1958 a new machine for handling the full range of axial lead components. This semi-automatic machine has no special requirements as to the lead straightness or lead concentricity.

Do you see any interesting trends developing?

The use of printed wiring is expanding into areas of smaller volume production where considerations other than economics are important. The ability of printed wiring to meet varying environmental conditions is apparently encouraging its growth.

There will be more automatic checking and automatic welding as well as automatic assembly.

E. J. Venaglia
Manager
Microwave Electronics Div.
Sperry Gyroscope Co.

"Another new technique for further compressing critical development and test time in complex weapon systems combines recent instrumentation, measuring, and computer developments for automatic checkout systems. Integration of this combination into a comprehensive system reduces weapon checkout time from days to minutes. This RACE (Rapid Automatic Checkout Equipment) technique is not only being applied effectively in production and development stage weapons but also in large data handling and computer systems necessary for evaluation of system test results. Newest of RACE applications lies in the field of weapon counter measures."

P. E. McGinness
Assistant Manager
Dynasert Dept.
United Shoe Machinery Corp.

"In addition to over-all industry cooperation needed for determining adequate component packaging, standardization of printed wiring board layout is a key for simpler mechanized assembly. Printed wiring designs that recognize characteristics of mechanized assembly can eliminate production and re-tooling problems. The design need not be compromised in any way."

when you have **ken** ✻ you can!

ESC **HAS THE KNOW-HOW AND EXPERIENCE REQUIRED TO PRODUCE CUSTOM-BUILT DELAY LINES TO YOUR EXACTING SPECIFICATIONS.**

1st in sales!

1st company devoted *exclusively* to the manufacture of delay lines!

1st in research, design and development of custom-built delay lines!

1st to submit the most definitive laboratory reports with all custom-built delay line prototypes!

✻ **ken**—vision, knowledge, perception... as, ESC has the ken to produce the finest custom-built delay lines in use today.

Exceptional employment opportunities for engineers experienced in pulse techniques.

ESC **CORPORATION**

534 Bergen Boulevard, Palisades Park, New Jersey

CIRCLE 35 ON READER-SERVICE CARD

DESIGN '58

Tubes

What will the improvements in tubes be in 1958?

It is difficult to estimate to what percentage improvements will be accomplished in 1958 in regards to design life and reliability. Improvements in design are a continuing process in that we are always trying to produce maximum outputs and the longest life possible from each device.

We are also trying to increase the operating temperature range of each device since this will make it possible to make a tube smaller and maintain its present ratings. Again, this is not expected to be completed in 1958.

What is the biggest stumbling block to the production of better tubes?

Improvements in the materials and the processing of materials used in electronic tubes are the areas which need the greatest attention. This may be done either by tube manufacturers cooperating with raw materials vendors to determine the best over-all specifications for materials, or by further development of various processing methods in each tube manufacturer's plant.

What problems will be overcome in the receiving tube field for industrial use?

Significant advances in receiving tube design in 1958 will take place in several fields. First, there will be improved performance of industrial and military ceramic tubes in vital uhf communications. Subminiatures will be made more reliable with respect to vibration and noise output to meet demands of severe operating conditions of guided missiles.

We should see development of new glass tubes with unique electrical characteristics to satisfy new requirements of specialized equipment in certain functions such as voltage regulation, electrostatic scanning, and high speed computation.

What about the tubes for entertainment-type equipment?

New materials and techniques will be utilized to provide entertainment types with increased power output for high fidelity amplifiers. Also in prospect are higher efficiency sweep tubes which will permit more compact television cabinetry by reducing heat dissipation.

What are some specific power tube problems?

Ground based tubes capable of producing higher pulsed and average power outputs without sacrificing reliability are needed for radar equipment.

We must extend the frequency and power capabilities of pulsed and cw klystrons, TWT's and power tubes.

How will these problems be solved?

As mentioned before, by the use of ceramics. The fact that such tubes can be processed at higher temperatures and that tolerances can be held closer improves the tube's reliability and high frequency performance. In particular, it is expected that high power traveling wave tubes will begin to compete with the klystron amplifier and magnetron oscillator tubes as the output tube for the more sophisticated high power radar systems.

What would you say is the biggest problem facing cathode ray tube designers?

Increasing presentation resolution without compromising light output for special purpose tubes.

T. R. Bristol
Manager
Application Engineering
Power Tube Department
General Electric Co.

"One area which must be investigated more thoroughly during the next few years is the effect of nuclear radiation on the performance of electron tubes. Very little data has been accumulated to date due to the limited access to nuclear facilities large enough to accommodate the average power tube."

C. E. Ramich
Manager
Power Tube Engineering Dept.
Electronic Tube Div.
Westinghouse Electric Corp.

"We . . . are working both with vendors of raw materials and within our own laboratories to determine the best specifications for materials and proper processing methods. Most gains for tube problems will probably be gradual . . . "

Transistors

What will transistor designers be working on most?

Achieving an understanding and effective control of semiconductor device surface problems. We will be doing continuing research on materials and processes of fabrication.

Can we expect increases in temperature ratings?

Germanium products maximum temperature ratings will progress toward 100 C. Silicon products maximum temperature ratings will progress toward 200 C. In other words, an increased fraction of the industry's production will be given the ratings mentioned or, in any event, increased temperature ratings.

Will transistors be improved in 1958?

The range of satisfactory electrical performance will be increased, reliability will be improved, and costs will be reduced. In general, efforts will be directed toward increased gain, higher breakdown voltages, reduced leakage currents, reduced saturation resistance, and improvements in the high frequency-high power area.

Reliability improvements will be due to increased effectiveness of process and fabrication control techniques, better understanding of surface problems and through the application of more complete and explicit specifications and ratings.

Can you specify any noteworthy trends?

The use of automatic and semiautomatic facilities will increase. Small-signal transistor designs are expected to follow the trend to small, short, welded cans with standard lead placement suitable for printed wiring board insertion.

Will auto radios be converted to transistors?

Although there is a growing trend towards all-transistor auto radios, this market as a large scale value will probably not open up until 1959 or later. 1958, however, should see better than three-fourths of the auto radios using transistors in some, but not all, sockets.

Do you think transistors will invade TV sets in 1958?

The largest single application of the future for transistors is their use in television circuits. However, transistors will not penetrate the TV circuit market until there is price equality with electron tube circuits. This probably won't be in 1958.

H. B. Fancher
General Manager
Semiconductor Products Dept.
General Electric Co.

"Unit sales of transistors will increase about 75 per cent to 48 million devices. The entertainment market will continue to take about two-thirds of the units and account for one-third of the dollars, while one-third of the units and two-thirds of the dollars will constitute the combined military and industrial market."

A. Easton
Vice President, Marketing
General Transistor Corp.

"In 1958 we will acquire greater detailed knowledge concerning the lifetime of transistors."

H. L. Owens
Chief Design Engr.
Semiconductor-Components Div.
Texas Instruments Incorporated

"We all have a common responsibility . . . to continue developmental and educational activity to the end that all users of semiconductor devices may use them more effectively, more reliably, and at reduced cost."

Arthur F. Dickerson
Manager, Product Planning
Receiving Tube Dept.
General Electric Co.

"New glass tubes with unique electrical characteristics to satisfy new requirements of specialized equipment in certain functions such as voltage regulation, electrostatic scanning, and high speed computation will be developed."

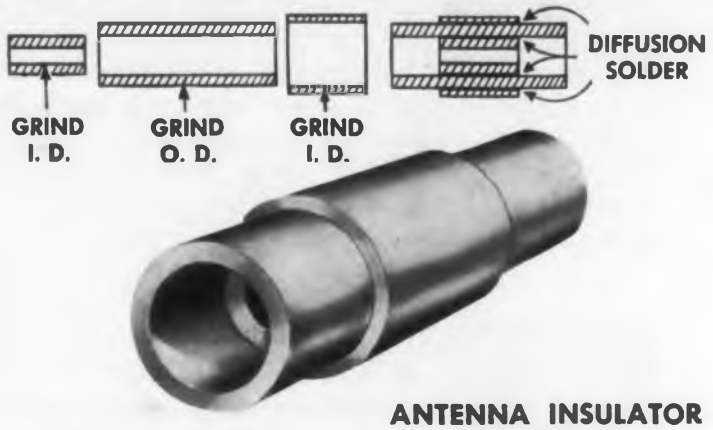
Walter A. Weiss
General Manager
Radio Tube Div.
Sylvania Electric Products, Inc.

"To increase the life span of military, entertainment, and industrial tube types, we will, in 1958, intensify our basic physical and chemical studies of materials such as heater and cathode metals and coatings used in vacuum tube manufacture . . . exploit opportunities to substitute ceramics for mica and other materials in new military tube types."

J. S. McCullough
Director of Research and Development
Eitel-McCullough

"All of our future planning is based on the elimination of glass from the vacuum tube envelope."

Three Standard
OFF-THE-SHELF
DIAMONITE
high alumina ceramic TUBES
SAVED TIME
FOR
Autonetics Division, North American Aviation, Inc.



ANTENNA INSULATOR
ASSEMBLED WITH DIAMONITE STANDARD TUBES

Saving time and eliminating expensive "short run" special parts manufacturing were just two of the reasons Diamonite standard off-the-shelf tubes met this customer's need. First, Diamonite characteristics and properties such as high dielectric strength, non-metallic, non-magnetic and a non-conductor of electricity made it the ideal insulator; it also withstands elevated temperatures, has great resistance to mechanical shock and is easily metallized for component assemblies. In this case, Autonetics engineers were able to quickly assemble their needs for testing and speed planning for regular production.

SPEED UP DESIGN AND TESTING OF HIGH ALUMINA CERAMICS WITH DIAMONITE OFF-THE-SHELF SERVICE

Perhap you have need for quick proof on the merits and use of high alumina ceramics. Send for Diamonite's off-the-shelf-service bulletin No. 357-R today listing standard tubes, cylinders, rings and rods ready for shipping the same day your order is received. Your inquiries will get immediate and interested attention.

EA158
DIAMONITE
products manufacturing company
pioneers in the development of high alumina ceramics
Canton 3, Ohio
Phone: GLendale 6-8195

CIRCLE 36 ON READER-SERVICE CARD

DESIGN '58

Antennas and Propagation

What new knowledge have we acquired regarding radio wave propagation?

The subject was reviewed comprehensively at the Twelfth General Assembly of the International Scientific Radio Union (Boulder, Colorado, August-September, 1957). Major progress has been made in the past year and a half on many topics.

- Communication by meteor trail scatter has passed the research phase, and is now proven to be a valuable adjunct to other kinds of scatter propagation.
- Air-to-ground tropospheric scatter measurements have been extended to in excess of 2000 miles, and new theories have been advanced to explain the long-ranges observed.
- Much data have been obtained on auroral and meteor back scatter in the vhf-uhf region, though the situation is not settled enough to permit an understanding of the scattering mechanisms. Meteor observations have given, however, valuable data on E-region winds.
- Several successful moon-echo communication circuits were put into operation.
- A careful study of the effects of the great solar flare of February 23, 1956 has yielded fresh and surprising information on solar-earth relationships, especially pertaining to the solar magnetic field and "corona" surrounding the earth.

Perhaps the most exciting development of all, however, was the demonstration that man-made low-frequency signals may travel *via* the "whistler mode" from one hemisphere to the other through paths reaching far beyond the normal ionosphere. Study of these "artificial sferics" has opened new chapters both in the exploration of the upper atmosphere and in long-distance communications.

Will our progress be as good in 1958?

All of the above active subjects will be continued in 1958, but with one important difference. Almost all the observations will be intensified and coordinated in accordance with the over-all International Geophysical Year program. There is every reason to expect that 1958 will see more worthwhile propagation data taken (and other geophysical data relating to propagation) than in any previous five year period! Of course, several years will be needed to analyze and interpret this mass of information completely.

Can you single out a few topics that will be studied closely?

Radar satellite tracking has, even in the single month which has elapsed at the time of writing, yielded information on ionospheric absorption and scintillation. Obviously this will be a prime concern in 1958. Solar control of ionospheric propagation (and also tropospheric: the correlation between meteor shower rate and rainfall) can be studied with the centralized IGY data to be

Charles H. Wilcox
Exploratory Studies Dept.
Physics Laboratory
Research Laboratories
Hughes Aircraft Co.

"From the military systems standpoint, the major area in wave propagation not adequately covered by IGY, which needs increased emphasis in 1958 and succeeding years, is outer space propagation effects, both detection and communication from ground-to-space and space-to-space. Reliable, accurate, and non-noisy propagation through the atmosphere is certainly the most immediate problem in this area."

made available. Radar echoes from the nearer planets probably will be achieved.

A major emphasis in theory will be to understand the role of turbulence in the atmosphere, especially with magnetic fields present (hydromagnetics), and to understand more fully meteoric and auroral ionization, and related effects. Further valuable work on the correlation and prediction of meteorological phenomena by radar will occur.

What will antenna and propagation experts be working on in 1958?

Even bigger aperture antennas than the giants built in 1957 for communication, radar, and radio astronomy. The design of large, high powered, wide angle, two-dimensional slot antennas will occupy the time of many engineers. Some will work on microwave progressive-wave antennas for use directly on curved surfaces.

Have you the proper theoretical and experimental knowledge to make the desired progress?

We need more. [See Bohnert quote.] Knowledge of effects of phase errors on very large aperture antennas are needed in order to relax mechanical tolerances and thereby reduce the astronomical cost of radio astronomy antennas. We need better phase-shifting schemes for antenna scanners, especially simplified scanning techniques (mechanical and electrical) for two-dimensional scanning. More information on scattering from objects both man-made and natural.

What could others do to aid progress?

Provide dielectric material with low loss (tan $\delta < 0.001$) and light weight (< 10 lb per cu ft) for variable index of refraction microwave lenses (e.g., the Luneberg lens).

J. I. Bohnert
Chairman
Professional
Group on
Antennas and
Propagation

"It would be helpful to have . . . , in particular, a more accurate and useful approximation to electromagnetic field theory than the first-order geometrical optics."

BRAND MULTI-CONDUCTOR CABLE GIVES RCA'S BIZMAC SYSTEMS . . .

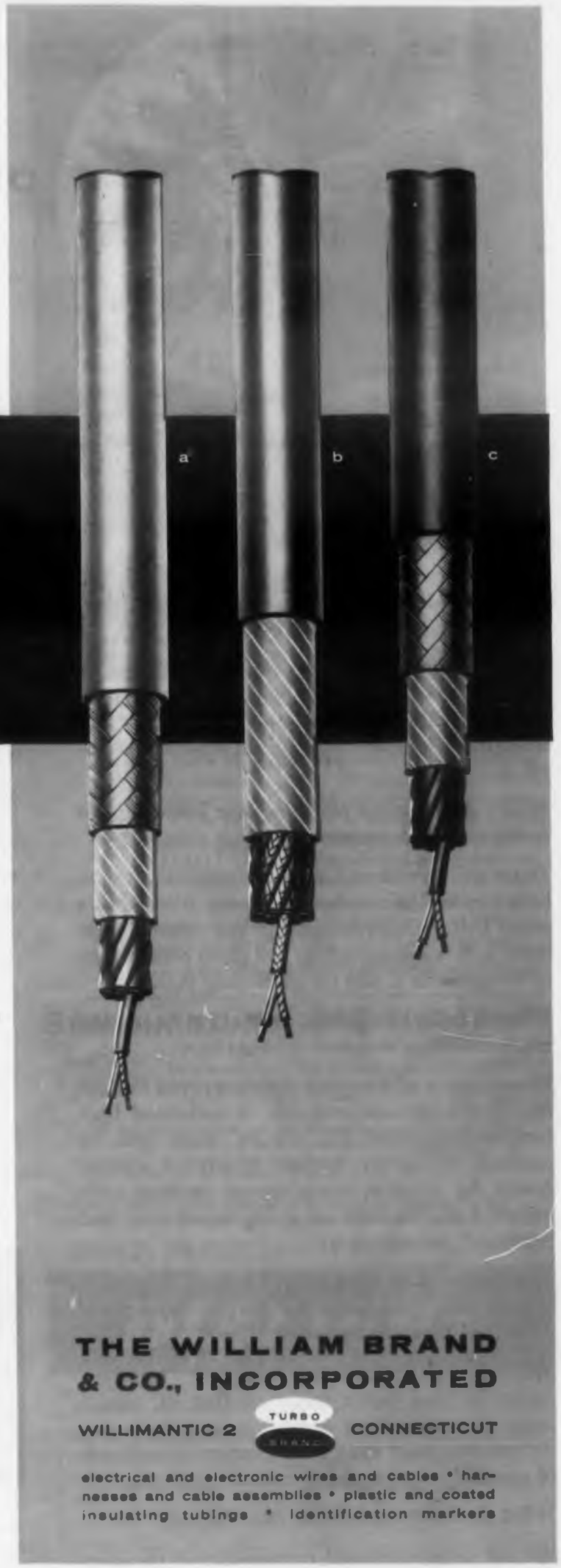
- top signal fidelity
- freedom from cross talk

RCA'S Bizmac Business System Units combine to perform foolproof results in business efficiency. Connecting these units are three extremely flexible, abrasion resistant, Turbo-Brand multi-conductor cables, custom manufactured for RCA.

RCA says, "Brand cables transmit signals between our Bizmac units with high fidelity and without disrupting cross talk between signal lines."

One Brand cable (a) transmits a five micro-second pulse "write signal." Low impedance drive allows transmission of signals through 400 feet of balanced lines. The cable has nine twisted pairs of AWG 22 color coded conductors. The shielding of #36 tinned copper wires is braided over the conductor assembly. The over-all jacket is of .030" brown plastic. Another cable (b) transmits "tape control" signals which have a five micro-second pulse with about a three micro-second rise time across the conductors. Each of the 12 pairs of conductors are shielded with a #36 tinned soft copper braid, and the over-all jacket is of .030" red polyvinyl chloride. The other cable (c) transmits "read signals" that resemble a full sine wave whose period is 70 micro-seconds. The 12 twisted pairs of AWG 22 conductors have a tinned copper over-all shielding braided over the conductor assembly. The over-all jacket is of .030" black vinyl plastic.

The accumulated experience of the William Brand & Co., Incorporated Engineering, Research and Production Departments is always available. You are invited to use these services in the solution of any of your wire and/or cable problems.



THE WILLIAM BRAND & CO., INCORPORATED

WILLIMANTIC 2 TURBO BRAND CONNECTICUT

electrical and electronic wires and cables • harnesses and cable assemblies • plastic and coated insulating tubings • identification markers

CIRCLE 37 ON READER-SERVICE CARD

DESIGN '58

Materials

What is this new miracle material "Unobtainium" that the Air Force thinks so highly of?

It is practically weightless; infinitely strong; resists any degree of heat; mills, machines, casts, extrudes, and forges with great ease; and the cost is negligible! Of course, it hasn't been discovered yet.

Where do we stand regarding our knowledge of radiation effects on materials?

There will be new materials for components with better radiation resistance coming. We have a much better understanding of the effects of radiation. It is not enough to just place components or materials in a pile for evaluating them.

What is being worked on, or likely to be worked on, in 1958?

Development of materials with improved nuclear radiation resistance and able to withstand high temperatures (500 C). Under study will be methods to obtain nuclear generated electric power by simpler, more direct methods. We expect improvements in space monitoring and personnel protection.

What areas need stepped up attention to provide a continuing foundation for the development of advanced weapons systems?

Methods of determining reliability. Improvements in, and better understanding of, metallurgy of materials as applied in radiation conditions. We must work for reproducible methods of assembly not requiring manual operations.

What do ceramics hold in store for us?

We are developing and manufacturing ceramics that withstand more rugged environmental conditions such as high nuclear radiation conditions, elevated temperatures of 500 C and above, shock, vibration, etc. Ceramics will operate well at vhf.

What has been recent progress in research in the field of solid state physics?

The major advances in the last 18 months have been in our understanding of superconductivity, exciting propagation in insulators, in methods of developing low temperatures below 1 degree kev, and in the investigation of double resonance with its interest for solid state Masers.

What specific aspects of solid state physics are being worked on, or likely to be worked on, in 1958?

The entire front of solid state research is continually active. The points of breakthrough are difficult to predict. All that can be said with certainty is that the area is far from static.

What is the progress with semiconductors for higher temperatures?

Although we are having some success with gallium arsenide, and indium phosphide, practical devices beyond the 200 C for silicon transistors are a long way off.

What can be said about general trends in plastics for military uses?

- Alkyd resins—Polycarbonate resin is tough and heat resistant. May replace metals and ceramics in some components.
- Epoxy resins—Much activity. High heat resistance to 600 F; self-hardeners; new lead cast types for shielding; improved adhesives. Heavy use in laminates, castings, foams, and tooling.
- Ethylenes—Irradiated polyethylenes for 350 C insulation for wire and cable.
- Fluoroethylenes—Teflon tapes in glass or cloth reinforced form are cementable and useful for component insulation. Thicknesses down to 0.002 inches. Many Teflon-like properties being reached without disadvantages of difficult workability. New fluorocarbon plastic for copper-clad laminates with no water absorption.
- Foams—Many foam types are developing for structural parts and core insulation in sandwiches.
- Inorganic plastics—Glass bonded mica molding and fabricating material is useful in the 650 to 700 F range.
- Silicones—Laminates withstand temperatures to 1200 F. Good insulation resistance for miniature connectors. Rubber silicones offer new opportunities.

Dr. F. Seitz
Professor of Physics
University of Illinois

"It is to be hoped that the recent trend stimulated by former Secretary of Defense Wilson to strangle research within the Department of Defense will be reversed quickly now that its disastrous consequences are generally understood by the thinking public."

C. M. Harris
Chairman
Professional Group on Ultrasonics Engineering

" . . . if the upper limit of ultrasonic waves that can be generated in the laboratory can be increased considerably, the uses of ultrasonics as a means of studying the physical properties of matter will be extended significantly."

What about the chemistry of plastics as a limiting factor?

Physical chemistry has defined the basic limitations of plastics. Non-uniformity of electrical performance in view of the very complex structure of plastics comes as no great surprise to the chemist. A minor breakthrough might be envisioned in the form of plastics manufacturers engaging to some degree in the manufacture of specific type polymers to supply to the electronics industry. However, the volume of materials utilized does not suggest a desirable economic picture for the large plastics producers.

What do you consider to be the biggest design problem facing designers of laminates?

Designing laminates that will withstand higher temperatures. Improved flame retardance is being worked on for industrial laminates. There is an increasing need for maximum uniformity of the quality of laminated plastics.

What improvements in electrical characteristics are expected?

Our laminated plastics are being made more water-resistant so as to be better electrically under high humidity.

What do you consider to be the biggest design problem facing designers of reinforced plastics?

The biggest design problem is for lightweight, reinforced plastic, high temperature airborne radomes and antennas that are dimensionally stable and reproducible. New techniques for reproducibility involve the cold layup process.

How much will the environmental ranges such as temperature, shock, etc., be extended for specific products?

In many cases, for high temperature requirements and severe shock problems, requirements will have to be met by complex structural materials other than high polymers in many instances. The high polymer manufacturers are presently hoping to push the high temperature barrier 50 degrees higher for prolonged operation of plastic components. This would put the shielding temperature in the range of 550 F.

Shock requirements are, in most cases, related to temperature requirements. As we increase our accelerations, hence Mach numbers, we can expect more severe shock problems. In the case of reinforced plastics commonly used in airborne radar reflectors and radomes, shock resistance is extremely good.

To what extent, if any, will your products be miniaturized further?

Basic economics is involved in miniaturization. A 50 per cent decrease in size can carry with it as much as a 500 per cent increase in cost as well as enormous engineering problems and, in many cases, poor reliability.

The nature of radar reflectors requires that they give certain radar patterns and the physical size is consequently dictated by the radar pattern requirement. New techniques involving lenses and polarizing windows are concepts that might change the whole picture.

R. L. Mondano
Plastics Group
Manager
Research Div.
Raytheon
Manufacturing
Co.

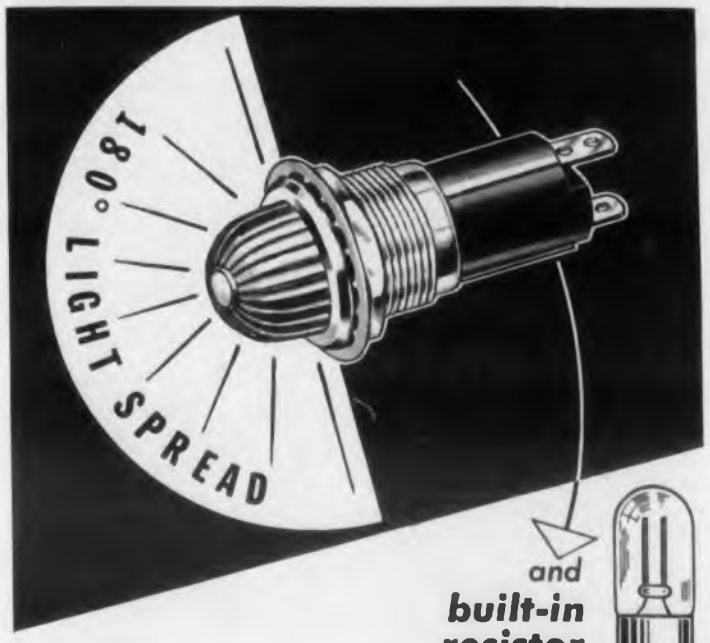
"Various national and local conferences related to specific problems such as radome conferences, airborne plastics or plastics for electronics conferences are valuable contributions in our efforts to overcome problems."

Dr. N. A. Skow
Director of
Research
Synthane Corp.

"Our laminated plastics are being made more water-resistant so as to be better electrically under high humidity."

C. L. Stec
Chief Civilian
Electronics
Design Div.
Bureau of Ships

"[We] need a major breakthrough in the materials area. It appears that 'designed' materials are needed which will be tailored to specific uses."



and
built-in resistor
for Neon lamp
. . . a patented
DIALCO feature

NE-51

. . . two of many special features obtainable in

DIALCO PILOT LIGHTS

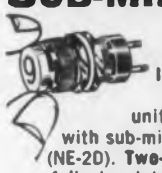
The DIALCO series of Pilot Lights, exemplified by the unit shown above, is designed to house the *NE-51 Neon Glow Lamp*, and for *direct use on 125 volt to 250 volt circuits.* Since Neon lamps require a current limiting (ballast) resistor, the necessary resistor is *"built-in"*— an integral part of the lamp socket. The resistor itself is *completely insulated in moulded bakelite* and sealed in metal (U.S. Pat. No. 2,421,321) . . . Small space is required—units are available for mounting in 9/16" or 11/16" clearance holes.

A wide choice of optional features includes metal finishes, terminal types, lens shapes and colors, etc. Meet Military *(MIL Spec)* and Civilian *(UL* and *CSA)* requirements.

All Assemblies Are Available Complete with Lamp.

ALSO

SUB-MINIATURE
Pilot Lights



For use with tiny Incandescent bulbs (T-1¾ . . . Many units available for use with sub-miniature **Neon** bulbs (NE-2D). **Two-Terminal** units are fully insulated. **Single-Terminal** units are for use on grounded circuits. Also **Dimming** and **Non-Dimming** sub-miniatures. Meet all applicable Military Specifications.

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CIRCLE 38 ON READER-SERVICE CARD

12 tips on resistors

Unusually versatile Vitrohm® resistor line simplifies design problems

Did you know that high reliability Vitrohm Resistors can take on more than 11 styles to fit almost every design requirement? All have outstanding Ward Leonard quality that protects your reputation as an equipment designer.

1 FIXED Vitrohm tubulars come in 5-to-200 watt sizes. **2** AXIOHM, standard in 3, 5, or 10 watts, with axial leads is ideal for compact electronic gear. **3** ADJUSTOHMS make it easy to get the right voltage, bleeder or bias current.

4 NON-INDUCTIVE Vitrohm tubulars, up to 160 watts in stock sizes. Famous flatted sides and 'Ayrton-Perry' winding keeps down inductance and capacitance. **5** DISCOHMS, at 24 watts, feature extra compact mounting and **6** PLAQOHMS, sizes to 150 watts, are also non-inductive. **7** STRIPOHMS, from 20 to 75 watts, are another way to save space—easy to stack mount. **8** RIBFLEX resistors (made to order), up to 550 watts, take terrific momentary overloads.

9 FERRULE TERMINAL resistors (made to order) feature fuse-clip-type mounting. **10** SCREW BASE resistors (also made to order) permit ready change of resistance values. **11** BRACKET TERMINAL resistors have leads silver-brazed to mounting brackets. Mounting completes electrical circuit. **12** MIL-R-26C Vitrohm Resistors available in all styles —sizes—characteristics and resistance values listed in spec.

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CIRCLE 39 ON READER-SERVICE CARD

DESIGN '58

Computers

What problems face digital computer designers?

Improving reliability, increasing memory, and standardizing problems so that general purpose computers can be used.

What is the trend in digital computers?

Towards transistors. Combination of analog and digital machines for special purpose uses.

What are you doing to improve the design of analog computers? What will the improvements in reliability be?

Reducing the failure rate gets priority. This is increasingly important due to both the increased size of the analog computer and its extension into new fields. Increased reliability will be accomplished primarily through more conservative circuit design, more efficient cooling, and the use of more modern techniques (where these techniques have proven themselves).

The nature of an analog computer requires that, if a failure exists, it must become immediately known to the operator. As a result, further reliability will be accomplished through the technique of built-in, self-check features.

Another major area for failure reduction lies in automating, where possible, the operation of the computer, thereby reducing human error.

What improvements in electrical characteristics are expected?

In the analog computer field, the non-linear equipment (i.e., multipliers, function generators, resolvers, etc.) still limits the over-all accuracy attainable, and hence limits the application or usability of these machines. 1958 will see considerable effort toward new techniques for the generation of an arbitrary function of a variable.

What about stability of such items as integrating capacitors due to temperature change?

Improvement in this area generally will be through the design of better temperature controlled ovens to house these components. Improvement by a factor of 10 or more may be expected in this area.

Are there any noteworthy trends taking place?

The improved reliability we talked about demands reduction of human, or operator, error as well as machine error. In line with this, the major trend in the field of general purpose analog computers will be to automate as much as possible of the presently accepted operator's activities.

Of equal importance will be the trend towards special purpose analog computers. These special purpose machines will be aimed not only at the field of controllers (process control), but also towards business in general. 1958 will see such machines developed, aimed at production control, inventory control, profit projections, etc., to be used as management tools.

What would you like in the way of better components?

The dc accuracy of R-C components must not only be improved, but so must their dynamic accuracy. These dynamic errors include such factors as internal heating, dielectric absorption, stray capacity, etc. In general, it can be stated that our industry requires ideal resistors and ideal capacitors (zero change in value for any reason—time, temperature, frequency, etc.).

Aeronautical and Navigational Electronics

What will aeronautical electronic equipment engineers be working on in 1958?

You know the answer: more reliable, smaller size, lighter weight, lower power consumption and higher ambient temperature equipment. Some new concepts should evolve to meet the challenge of "higher and faster flight."

What will be done to improve products?

More careful purchasing of parts and materials. More life testing.

What specific areas will receive the attention of aeronautical electronic engineers?

Attention should be focused on single side band utilization, doppler and storm avoidance radars, and new collision avoidance systems. There should be application of the Maser principles to microwave amplification and fuller utilization of infrared sensing. Further use of solid state devices should take place. Small computers for reduction of cockpit workload will be developed.

Joseph General
Chairman
Professional
Group on
Aeronautical
and
Navigational
Electronics

" . . . in addition, TPPD's (USAF Technical Program Planning Documents) should be studied to insure that R and D is channeled toward a common goal and that there are no voids in the state of the art of aeronautical electronics."

J. L. Hussey
Manager
Computer
Engineering
Berkeley Div.
Beckman Instruments, Inc.

"Our general problems for 1958 are to develop new and improved means of non-linear function generation, and to develop more ideal components—particularly resistors and capacitors."

TIP-N-DIP

Now . . . printed circuit component mounting
SECURELY — RAPIDLY

The A-MP Component Tip provides these new advantages to manufacturers using printed circuit techniques:

- eliminates the need for eyelets or thru-plating on two-sided boards
- prevents cold solder problems by eliminating any movement of the component during dipping cycle
- permits bridging or offsetting of components—for air circulation and elimination of temperature influence
- design promotes solder-wicking and uniform solder deposit
- protects fine semi-conductor leads from heat and assembly damage

AMP-engineered, high-speed, automatic tipping machines provide an easy and economical method for applying A-MP Component Tips to leads of single-piece or belted components.

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CIRCLE 40 ON READER-SERVICE CARD

DESIGN '58

Communications Equipment

What will TV and radio designers be working on in 1958?

Cost reduction of TV and transistor radios. High fidelity manufacturers are working for lower costs.

What are you shooting for as the cost for color TV receivers?

Fifty per cent over the cost of black and white sets.

Are any improvements in high fidelity equipment expected?

Greater sensitivity, wider frequency range.

What will designers of broadcasting equipment be working on in 1958?

Applying transistors and silicon rectifiers to audio and video circuits. They will also be striving for improvements in TV camera tubes, magnetic video recording, and TV antennas.

Wilbur Jackson
Engineering Service Manager
Motorola Inc.

"We need a further development in the art of packaged components and greater standardization of components."

What is the trend in TV

Designing to a shallower or thinner TV receiver.

What is the best system for mobile communications, AM, FM, or SSB?

There are many evaluation factors to be considered. It depends a lot on individual preference. For example, FM is superior where good readability is required; for rejecting undesirable signals at close frequency spacing, SSB is better. Maintenance and costs favor AM and FM.

Are you saying there is no need to arrive at a standard modulation system for vehicular communications?

Yes. SSB offers hams advantages that are not apparent to commercial users.

But does SSB offer the ultimate in spectrum conservation?

From a technical consideration only, yes. But from a practical point of view, not necessarily. The end objective in spectrum conservation should be a practical system that does not sacrifice performance, cost, and maintenance.

C. J. LeBel
Chief Engineer
Audio Instrument Co., Inc.

"Our current limiting factor is the designer's ingenuity; this can be overcome by abrasion and not by a 'breakthrough'."

Research in Acoustics

Last year we didn't know how to scientifically reduce high noise level in jets. What has the progress been?

Jet noise reduction has been studied by a phenomenological theory and by many measurements. More work is required.

With regard to boundary layer noise, some careful experiments on boundary layer pressure fluctuations are in progress.

I might add, the transition between flow around a cylinder and the concomitant acoustic field is now understood in detail at low Reynolds numbers.

What has been learned about sound transmission?

The particular problem of transmission of a spherical wave through a plate has been solved. More work is required on curved panels and shells, finite flat panels, and multiple panels.

The mechanism of damping material applied to plates is better understood. (Application to aircraft structures.) More work is required.

What items should receive much attention?

Fatigue of structures by noise and vibration is a big problem. We must investigate the failure of electronics and bearing surfaces.

There should be study of the influence of mean flow on the attenuation of sound in a muffler.

Dr. L. L. Beranek
President
Bolt Beranek and Newman Inc.
Associate Professor
Massachusetts Institute of Technology

"We need a small high frequency sound source to produce intense levels over the frequency range of 10 to 200 kilocycles. There should be developed a means of measuring vibration of small objects, such as a vacuum tube grid, without loading the object being measured."

CIRCLE 41 ON READER-SERVICE CARD ➤

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HYFEN
a big step toward automation of wiring harnesses

Crimped pins and sockets snap-locked in plug or receptacle. Individual circuit removal or gang disconnect.

Hyfen ends the need for time consuming solder operations — and the high rejection rate inherent with solder. Pins and sockets are speedily crimped on wire ends by automatic installation tooling — or where more convenient, by bench or hand tools. Dies control and provide a uniform depth of indent which can be inspected by depth micrometer assuring absolute unvarying reliability. Crimping may be done before or after harness is in place.

Hyfen meets or exceeds MIL specifications for voltage drop, dielectric strength, contact engaging force, and contact retention force. It provides high corrosion resistance since there are no fluxes or dissimilar metals involved. Floating contacts in both plug and receptacle make for uniform mating and disconnecting force by the alignment flexibility provided.

Hyfen principle is not limited as to size, shape of plug and receptacle nor to number or size of connections. Wire for bulletin.
Burndy, Norwalk, Connect.

CIRCLE 281 ON READER-SERVICE CARD

Medical Electronics

Is the medical electronics field increasing?

Much more electronic equipment was used in the biological and medical sciences in 1957 than in preceding years. The use of transistors made several types of medical electronic equipment more convenient to use.

Do engineers know what medical problems need solving?

The uses of electronics in medicine and biology have not yet begun to be fully explored. In the immediate future the most progress will have to come from the personal contact between medical scientist and engineer. Each needs to learn more about the field of the other.

In general, what is needed in the way of medical electronic equipment?

More medical electronic equipment should be miniaturized. Of great help in 1958 would be the availability of electronic computers small enough for the medical or biological research laboratory that the scientist can program himself.

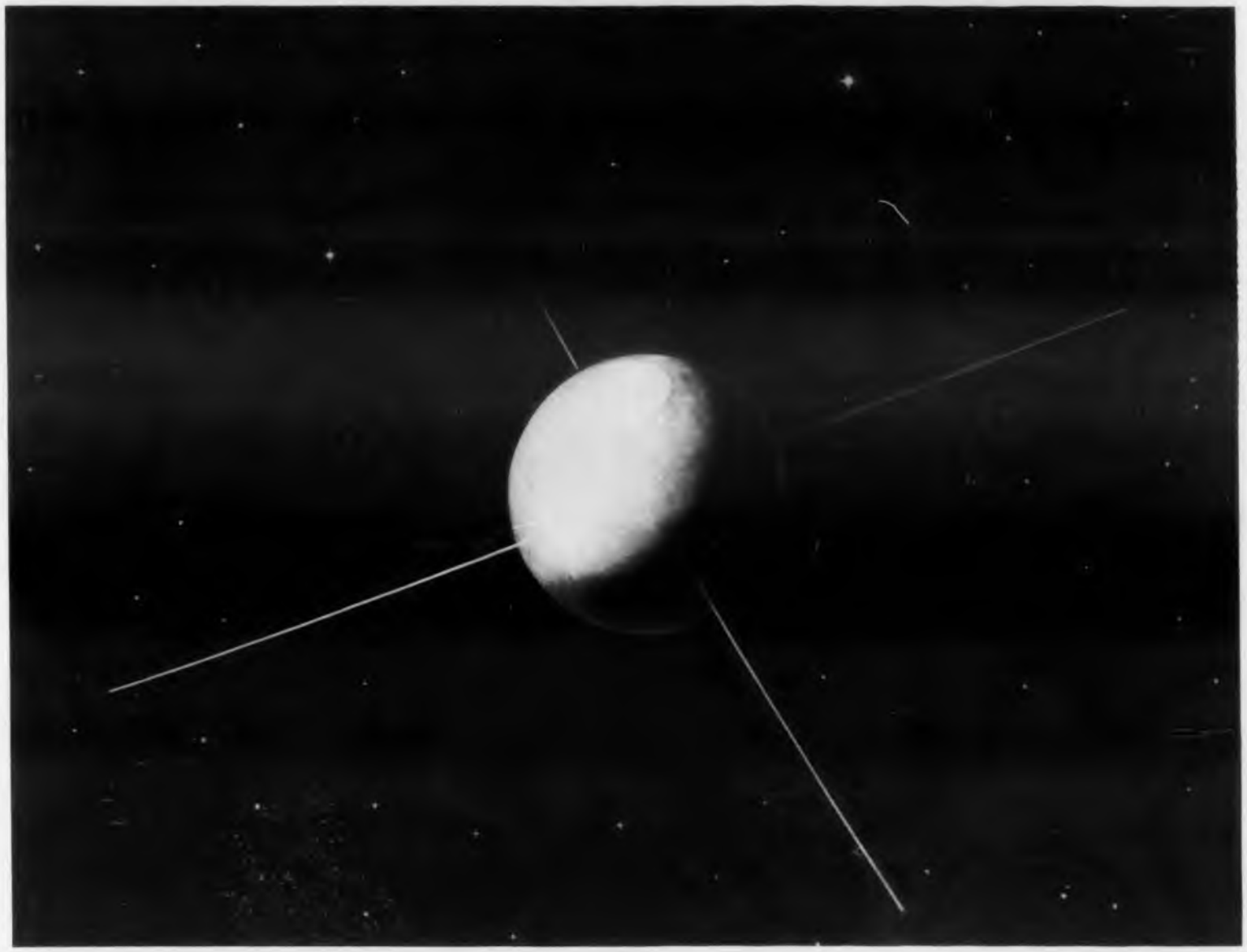
Is the use of ultrasonics promising?

Applications of ultrasonics will increase both in research and in clinical use. From a research standpoint the uses of ultrasonics in medicine have received considerable attention.

L. B. Lusted, M.D.
Chairman
Professional
Group on
Medical
Electronics

"Electronic engineers must become acquainted with medical problems . . . PGME is trying to increase the number of personal contacts of engineers with medical and biological scientists so that electronic techniques may be used more effectively in medicine and biology."

THE NATIONAL SCENE



WEATHER PREDICTIONS FROM OUTER SPACE. Far more accurate weather forecasts will be one of America's scientific achievements during the International Geophysical Year. They will begin when America's earth satellite hurtles into space. Present predictions are based on data covering only 5% of the earth's surface. But forecasters soon will draw clues from cloud patterns, radiation, thickness, types and moisture content—revealed by our satellite orbiting around the earth. National's PHENOLITE will help.

WEATHER EYES TO MEASURE CLOUD RADIATION. In the U.S. satellite, two "Weather Eyes" will peer from outer space at earth's cloud layer. Planned by the U.S. Army Signal Corps Engineering Laboratories and developed by the Perkin-Elmer Corp., Norwalk, Conn. to measure cloud radiation, these 4-ounce instruments are hardly larger than a pack of cigarettes. Each uses an f/0.7 mirror to pick up infrared cloud radiation and focus it on a tiny detector unit.

PHENOLITE WINS BERTH ON EARTH SATELLITE. In the "Weather Eyes" and in the satellite's silicon solar battery system, tiny but essential pieces of National PHENOLITE laminated plastic serve as printed circuit base and insulating spacers. To qualify for this job, PHENOLITE had to meet stringent specifications in dimensional stability, light weight and ability to withstand a wide range of operating temperatures. Perkin-Elmer selected PHENOLITE Grade G-10-865 because it meets all of these requirements.

CIRCLE 43 ON READER-SERVICE CARD

NATIONAL CAN HELP YOU...

reduce product cost or improve product performance at no added cost. Here's why . . . you can select "the one best material" from over 100 grades of PHENOLITE®, Vulcanized Fibre and National Nylon—without compromise in properties or cost. You can simplify production and purchasing with the timed delivery of 100% usable parts — from a single reliable source. You gain competitively with National's new materials and grades —the direct results of programmed materials research.

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- More timely presentation of new products, materials, and processes.
- Better coverage of important electronic events, conventions, meetings, etc.
- More balanced editorial—some departments will be expanded.
- Improved delivery schedules, more efficient production and handling—copies will reach you faster.

Studies conducted among *Electronic Design* readers have shown an unusually heavy "habit readership". 26 time scheduling should help to regularize this reading routine even more. Next year you can expect *Electronic Design*—more timely and more complete than ever before—on a regular basis, *every other Wednesday.*

ELECTRONIC DESIGN

New York · Chicago · Los Angeles

from USSR

"Reds'" Problems for 1958

RECENTLY, an East German government official enunciated what the goals of electronic engineers in that part of the world should be. The occasion was an electrical engineers' convention at Weimar. Over 1600, mostly East German engineers, were present. Ministry for Heavy Machinery spokesman K. Friedel stressed automation and nuclear power plant developments. Highlights of his speech are presented below. What is asked for by the Communists is not unlike our own demands, as reflected in "Design '58."

■ The continued progress of automation requires the development of reliable switching and control devices. The interruption of production due to equipment failure must be avoided. Consequently, automatic equipment must be designed so that not only parts but entire subassemblies can be replaced easily and quickly. In connection

with this task, the development of new materials, as for example, new magnetic materials, is called for.

- Automation of production must be expanded to include the programming of machines with the eventual goal of completely automatic production.
- The capacity of generating plants can be increased if automation is applied to that industry. Larger installations with higher efficiency are consequently envisioned. (In the field of nuclear power plants the speaker reported that a 70 mw installation in East Germany is under construction and that by 1962 it is expected that 140 mw capacity will be established.)
- Long time lags between development and production must be avoided. All development should be carried out with eventual production in mind. The developmental model should not lead to new models which need further development but to the final version of the device.
- All future development must be carried out with "international cooperation" between the "socialist countries" for the sake of economy and efficiency, and to avoid duplication.
- The requirements of equipment for export purposes must be kept in mind and domestic specifications should be compatible.
- All projects must be carried out under a master plan which has as its goal the increase of productivity in the country generally.

Citing the achievements of the electrical industry in East Germany, the following were among the items specifically mentioned.

East German equipment has been improved to where, "for the most part," the products satisfy the requirements of international standards.

Automation has progressed rapidly. The development of new insulating materials both for export purposes and for use of equipment at higher operating temperatures has taken place. In this connection, the development of materials for tropical climates is stressed.

The use of aluminum as a substitute for copper in machinery has proved to be satisfactory and copper substitutes (aluminum and aluminum alloys) should be developed for use in electronic equipment.

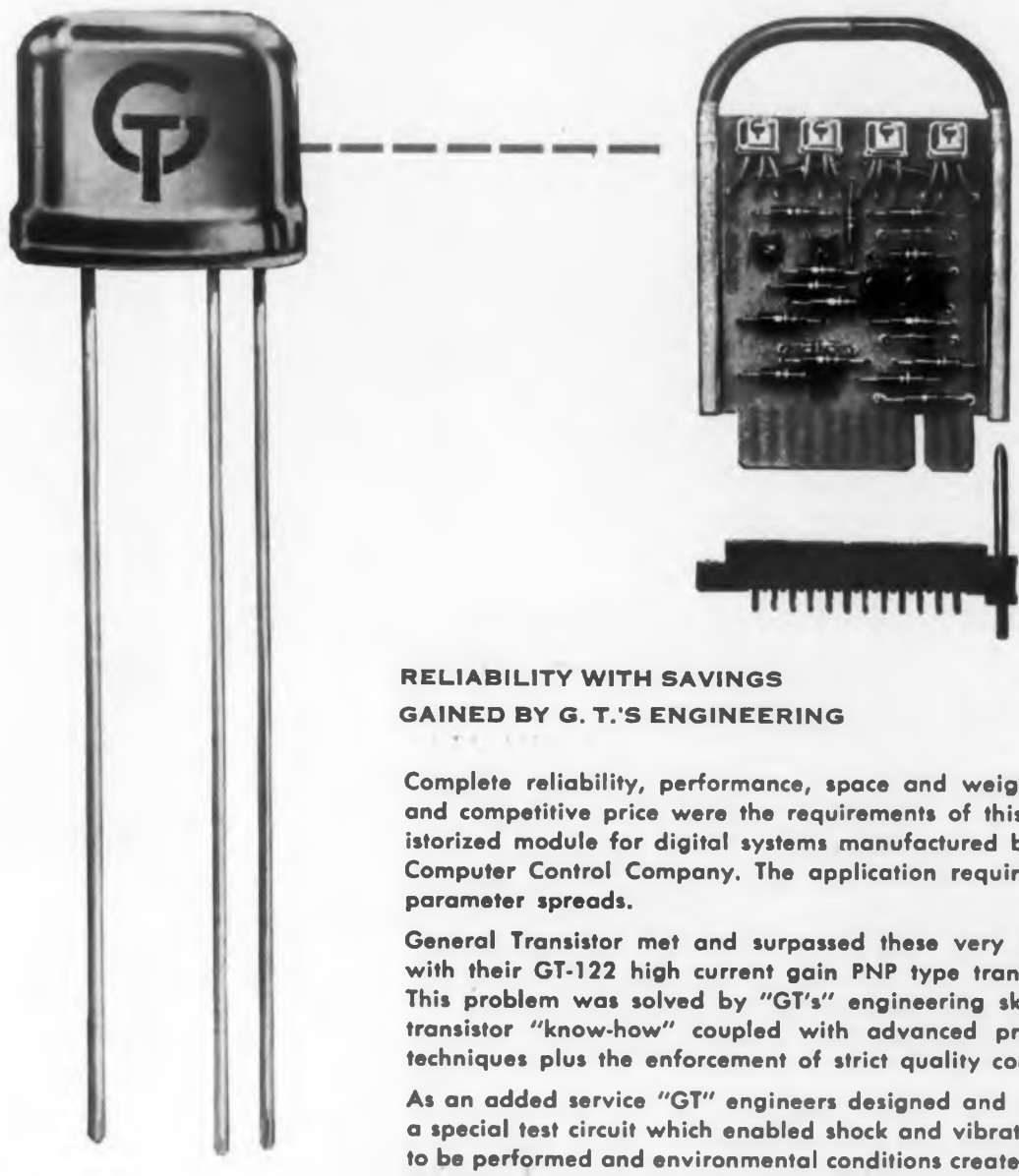
The telephone system has been improved, and it is expected that intercity dial systems will be developed in the foreseeable future. Telegraph and radio equipment development has progressed, but there is a need for increased TV receiver production and for transistorized radio equipment.

The over-all plan calls for doubling of production in the five year period between 1955 and 1960.

Source: Magazine *Nachrichtentechnik*. Vol. 7, No. 9, September 1957, pp 373-376.

GENERAL TRANSISTOR

MEETS NARROW PARAMETER SPECS FOR COMPUTER CONTROL COMPANY'S ONE SHOT MULTIVIBRATOR



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General Transistor met and surpassed these very tight specs with their GT-122 high current gain PNP type transistor. This problem was solved by "GT's" engineering skill and transistor "know-how" coupled with advanced production techniques plus the enforcement of strict quality controls.

As an added service "GT" engineers designed and constructed a special test circuit which enabled shock and vibration tests to be performed and environmental conditions created to assure the customer complete reliability under extreme conditions.

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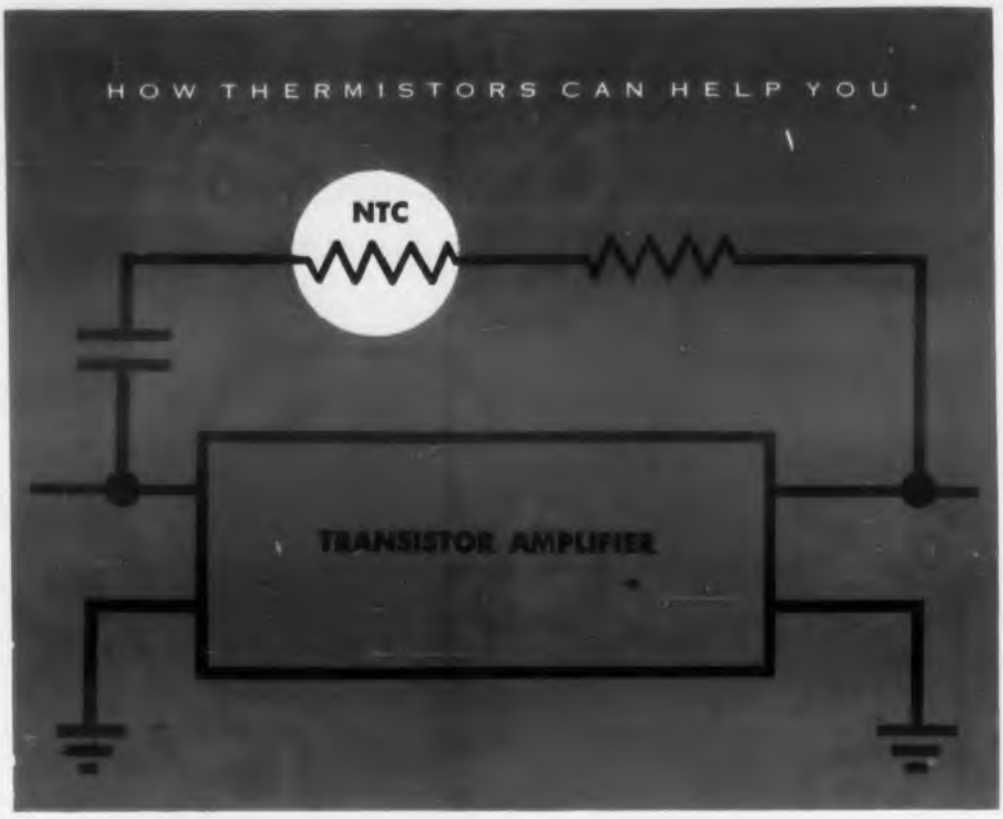

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A temperature increase in the transistor amplifier circuit shown above causes an increase in power gain. To maintain constant gain, a Glennite wafer thermistor is placed in the feedback circuit. Negative temperature coefficient of the thermistor causes a decrease in resistance as the temperature increases. The resultant feedback degeneration compensates for the gain.

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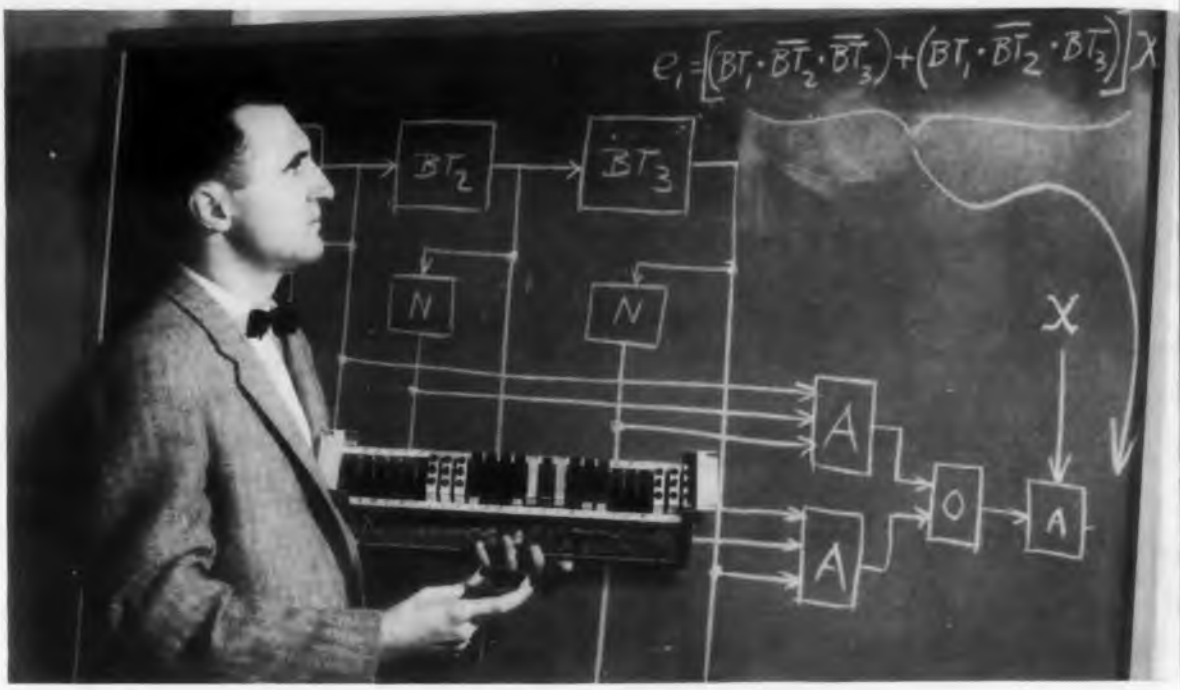
from logic to computer with

Transistorized Logical Building Blocks



A COMPLETE set of miniaturized, low-cost, packaged circuits make up "transistorized logical building blocks" for use in computer design. They enable the computer engineer to use ready-made, completely compatible, logical elements in system design in the same manner that circuit engineers employ resistors and capacitors. With the building blocks, it is possible to jump from symbolic logic or Boolean algebra to finished equipment without an intermediate electronic development stage. Room-size computers can be designed to desk dimensions with the building blocks. No air conditioning is needed, and each logical element occupies only 2-1/2 cubic inches.

The eight basic building blocks, made by the Avco Research and Advanced Development Division, 20 South Union St., Lawrence, Mass., all measure 2-1/2 in. x 2 in. x 1/2 in. to comprise the complete series. Long life and trouble-free operation are incorporated in the circuits, since the electronic elements operate well within the performance limits of their transistors.

The eight types of building block are the bistable trigger element, monostable element, gated amplifier element, complementer amplifier element, "or" gate package, "and" gate package, "and-or" gate package, and emitter follower package. These basic units can be combined to produce virtually any logical system desired.

The bistable trigger element, incorporates two stable output levels: *0v*, which normally represents a binary *1;* and *—10v*, which represents *0*. The element has two separated inputs, *0* and *1*, which

Fig. 2. Transistorized logical building blocks, 2½ x 2 x ½-in., simplify design and greatly reduce size of high-speed computers.

Fig. 1. Transistorized logical building blocks enable electronics engineer to move directly from Boolean algebra or symbolic logic to final circuit design without intermediate steps. The electronic elements are plugged into test rack (above), completing computer circuit design illustrated by equation.

may be joined externally to provide a "scale of two" circuit; a grated amplifier element, providing current gain and used when required after gating elements to give standard output pulses. Pulse retiming is possible by introducing a clock pulse to one input and the two-input "and" gate in front of this amplifier; complementer amplifier element, providing a "not" or inhibit function, this element produces an output which is the complement of its input. Thus, a *1* input produces a *0* output, and vice versa; monostable element, which is essentially a one-shot pulse generator. Output voltage is at *0* in its quiescent condition, but then a negative pulse or step is provided at the input, a negative output pulse of fixed width is generated.

The elements operate over a temperature range of −50 to +85 degrees Centigrade. At temperatures above 25 C., some derating of load current and switching speed is necessary. Two types of mounting sockets are available: solder lugs or dual-output taper pins. Rack mounting chassis can be supplied using either type socket for flush, recessed or enclosed mounting with interconnecting terminals located either front or back. Each rack is 3-1/2 in. high, holds 25 building blocks, and fits a standard relay rack. Transistorized power unit is available, capable of supplying up to 150 logical building blocks with six dc voltage outputs. The 7-in. high unit fits a standard relay rack.

For more information about these "transistorized building blocks," turn to the Reader Service Card and circle number **47.**

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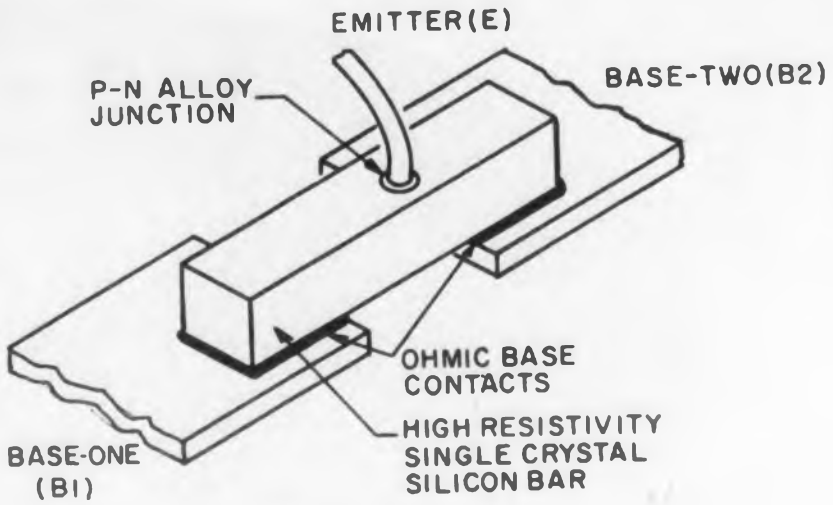

Fig. 1a. Construction of unijunction transistor.

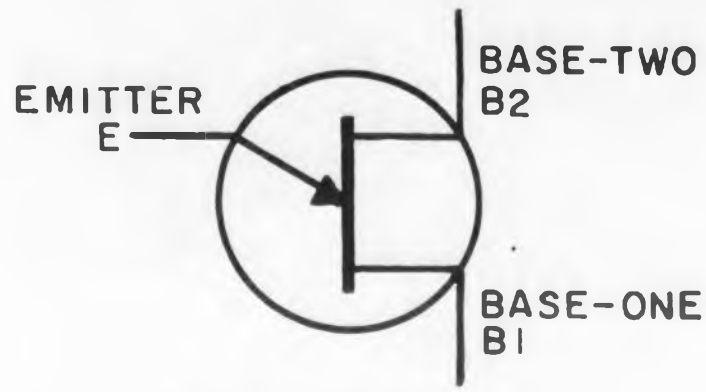

Fig. 1b. Standard symbol for p-n unijunction transistor.

more circuits transistorized with the Silicon Unijunction Transistor

S. R. Brown—T. P. Sylvan

General Electric Co.
Semiconductor Products Dept.
Syracuse, N.Y.

Part I

The silicon unijunction transistor is a three-terminal semi-conductor device different from the conventional two-junction transistor. Six standard types are now available having regular JETEC numbers. Part I of this two-part article deals with the structure and basic characteristics of the unijunction transistor. Part II will deal with practical characteristics and circuitry.

THE SILICON unijunction transistor is the first three-terminal semiconductor device other than the conventional two-junction transistor to achieve complete commercial acceptance. Six standard types of this transistor are now available having regular JETEC numbers.

In contrast to the conventional junction transistor, the unijunction transistor is a device exhibiting open-circuit stable negative resistance characteristics and is primarily useful in switching and oscillator applications. The unijunction transistor can be operated in a number of different circuit configurations such that any of the three terminals can serve as a signal input or a load output. In addition its unique ability to sense voltage levels makes it the nearest solid state equivalent to the gas thyratron.

The essential features of a pn unijunction transistor are indicated in Fig. 1a. Fig. 1b shows the standard symbol for this transistor.

Physical Structure

The silicon bar has an average length of 35 mils. It is cut from a high resistivity, doped-n-type, single crystal having a low total impurity concentration.

The operation of the unijunction transistor is dependent upon modulation of the conductivity of this single-crystal bar between the emitter and base-one terminals. The conductivity of this region is given by the relation;

$$\sigma = q\ (\mu_p\ p + \mu_n\ n)$$

where

σ = conductivity (ohm-cm)$^{-1}$
q = electronic charge (coulombs)
μ_p = hole mobility (cm^2/volt sec.)
μ_n = electron mobility (cm^2/volt sec.)
p = hole concentration no./cm^3)
n = electron concentration (no./cm^3)

The first term of this expression may be neglected in the absence of any injected carriers since the bar is doped n-type and the holes are the minority carriers. If, however, the emitter junction is biased in the forward direction and holes are injected into the bar, there will be a region within the bar in which the conductivity will be greatly increased. This conductivity increase will be due to the increase of the hole concentration, p, in the region where the injected holes appear, and to the corresponding increase in electron concentration, n, which occurs to maintain space charge neutrality.

Representative Circuit

A simplified explanation of the principles by which the unijunction transistor operates may be made by referring to the "representative" circuit of the unijunction transistor given in Fig. 2.

Here it is assumed that; (1) the diode is a conventional junction diode, (2) R_{B1} varies as a function of the current through the diode as shown in Fig. 3, and (3) R_{B2} remains constant. The first assumption typifies the conditions which exist immediately through and across the emitter junction boundaries. The second assumption illustrates the change in bar conductivity as the hole concentration is increased in the emitter to base-one region. The third assumption implies

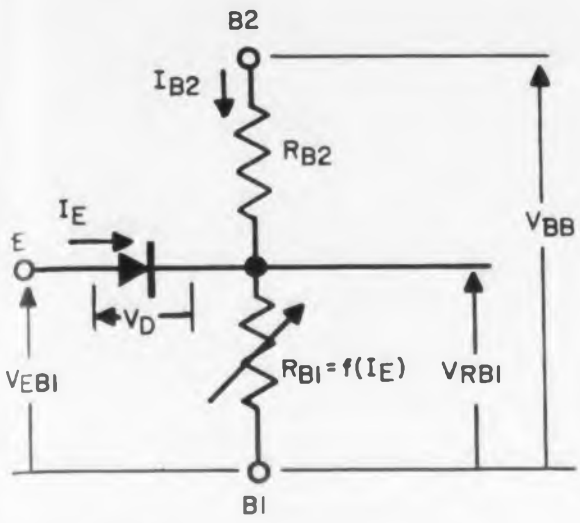

Fig. 2. "Representative" circuit of unijunction transistor.

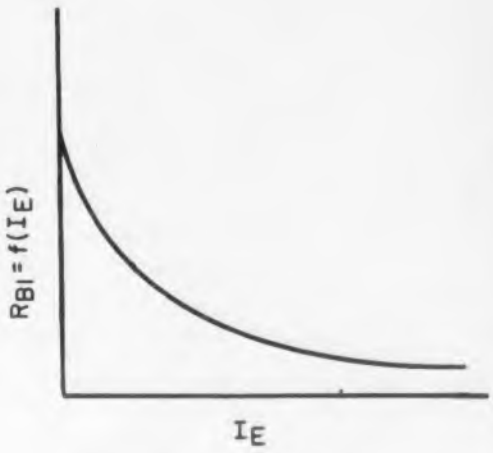

Fig. 3. Variation of R_{B1} with emitter current.

that base-two is open-circuited (in which case R_{B2} has no significance) or that a sufficient positive potential is placed at base-two to prevent any holes from entering the emitter to base-two region. This "representative" circuit leads to a reasonable prediction of the characteristics between the emitter and base-one.

Assume initially that base-two is open-circuited. If a variable voltage V_{EB1} is applied between the emitter and base-one an I_E—V_{EB1} characteristic will be obtained as shown in Fig. 4, curve *c*.

The characteristic shown by curve *c* may be considered to have two primary components indicated by curves *a* and *b* in the same figure. Curve *a* represents the drop across the equivalent emitter diode, that is, once the diode forward voltage has exceeded the band-gap voltage the diode current rises with little increase in voltage. Curve *c* differs from that of a conventional diode by an amount indicated by curve *b*. This is primarily due to the unique requirement of the unijunction transistor that there be a high-resistance region (as indicated by R_{B1} of Fig. 2) between the emitter and base-one prior to conduction. Establishing the value of this resistance is one of the design problems associated with the manufacture of unijunction transistors.

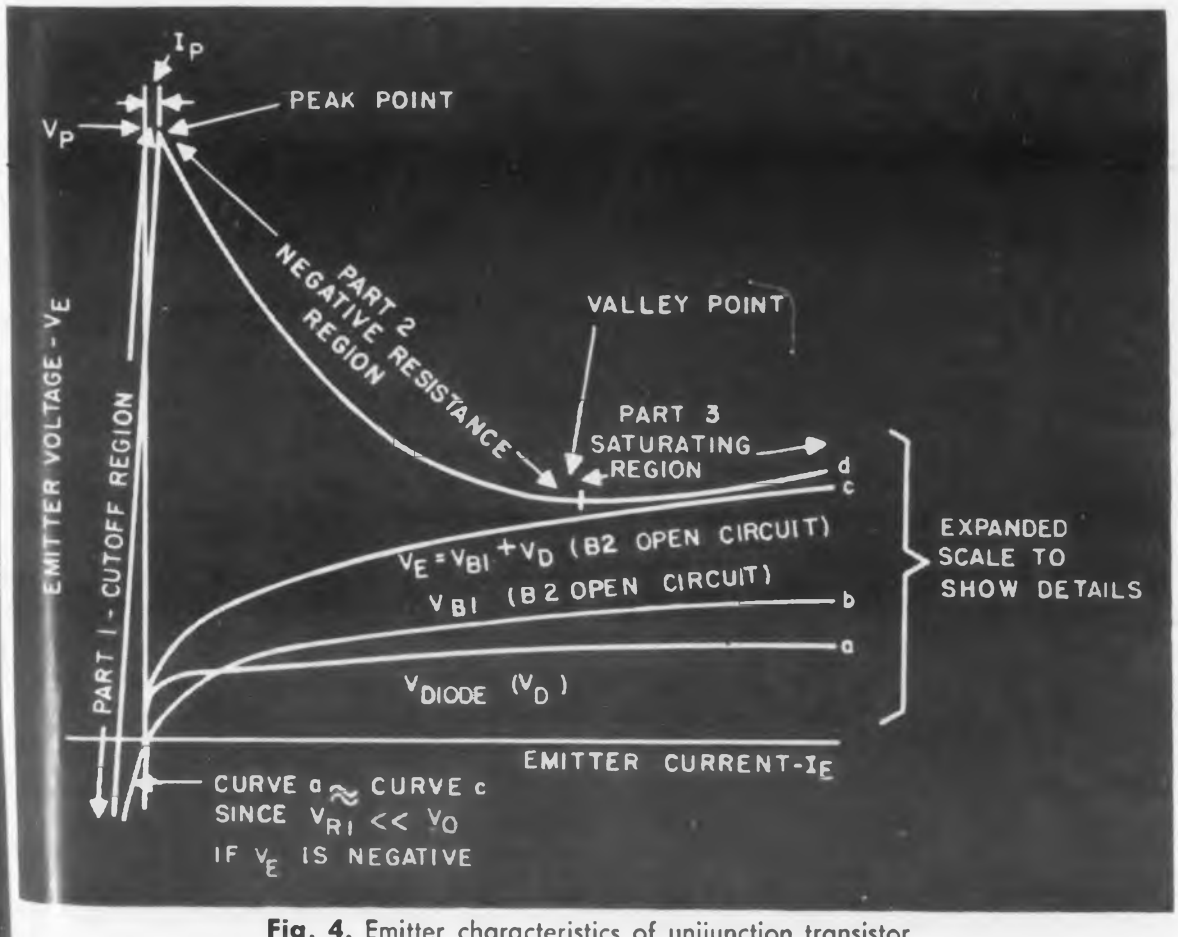

Fig. 4. Emitter characteristics of unijunction transistor.

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This resistance is primarily dependent upon the geometry and the resistivity of the bar. The relationship between this resistance and the emitter current is even more complex, depending upon geometry, semiconductor metal parameters, and process control. Because of the necessity of providing for this resistance the dc forward emitter voltage drop of the unijunction transistor will always be somewhat greater than the corresponding forward drops in conventional transistors or diodes. The dynamic resistance at the higher current levels can be quite low however, a value of 5 ohms is typical for most units.

Let us now assume that a constant potential V_{BB} is applied between base-one and base-two in our representative circuit. If the emitter is open circuited a current I_{B2} will flow between the base terminals. The ratio of the interbase voltage, V_{BB}, to interbase current, I_{B2}, under these conditions is referred to as the emitter open-circuit interbase resistance or more simply as the interbase resistance, R_{BB}. This resistance is equivalent to the sum of R_{B1} and R_{B2} of Fig. 2 evaluated at zero emitter current.

Temperature Sensitivity

The interbase resistance is a function of the bar temperature and to a lesser extent the internal field intensity. When the interbase resistance is measured at a low value of interbase voltage (1.5 v or less) and at a bar temperature of 25 C it is given the symbol R_{BB_o}. The interbase resistance increases with temperature at approximately 0.8 percent of R_{BB_o} per degree C as shown in Fig. 5. The high predictability of the variation of R_{BB} with temperature can be utilized to provide effective temperature compensation in many circuit applications. It is also very useful in the design of temperature indicating circuits.

When base-two is biased positive with respect to base-one there will be a positive potential (*B1* as reference) established at the common point of R_{B2} and R_{B1} when no emitter current is flowing. If a variable voltage is then applied between the emitter and base-one, part 1 of curve *d*, Fig. 4 will be traced out as this voltage is increased from some negative value. Note that for a given negative emitter to base-one voltage the emitter current is more negative than it is with base-two open circuited. This increase in the back current is caused by the additional back bias produced by that portion of V_{BB} appearing at the common point of R_{B1} and R_{B2}. A further increase in emitter voltage causes emitter current to flow through R_{B1}. R_{B1} therefore decreases, which in turn decreases the percentage of V_{BB} back biasing the diode, and effectively results in more forward voltage being applied across the diode. There is a condition, at very low emitter currents, (approximately 10 μa or less) at which the static resistance of the diode is large enough to stabilize the circuit against the effective decrease of R_{B1}. As the emitter current increases, however, it reaches a value called the peak point emitter current, I_p, at which value the total effective emitter to base-one resistance becomes negative, as illustrated in portion of curve *d*, Fig. 4.

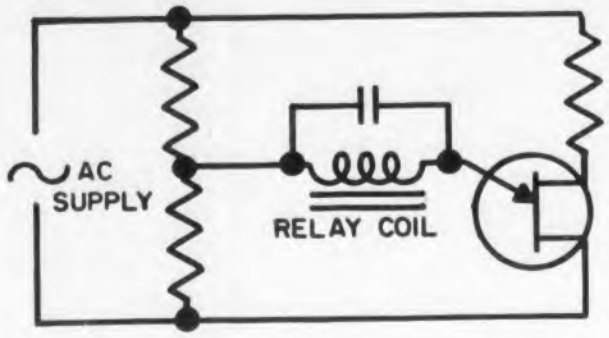


Fig. 6. Temperature control element. A decrease in temperature will decrease bar resistance. This will lower interbase voltage and hence peak voltage causing unit to fire and energize relay. Thermal delays and hold times may be designed in or largely compensated for. Circuit is also sensitive to changes in any of the resistors and could fire on temperature differences existing at two resistors.

Peak Emitter Voltage

The highest value of emitter voltage reached just before entering the negative resistance region is called the peak point emitter voltage, V_p. The peak point voltage is related to the interbase voltage and to a lesser extent the emitter junction temperature. The relationship is given by,

$$V_p = \eta V_{BB} + V_p\big|_{I_E=I_p}$$

where η is an invariant device parameter called the intrinsic stand-off ratio. $V_D\big|_{I_E=I_p}$ is the forward voltage drop across the equivalent emitter diode with a current I_P flowing. $V_E\big|_{I_E=I_p}$ is approximately equal to 200 divided by the emitter junction temperature in degrees Kelvin. Its value at room temperature is approximately 0.7 v.

Portion 2 of curve *d*, Fig. 4 is the single most important characteristic of the unijunction transistor, for it is on the basis of this negative resistance region that almost all of the applications of the unijunction transistor are devised. In practice it is possible to trace out the exact shape of this portion of the emitter static characteristics only if a generator of sufficiently high internal

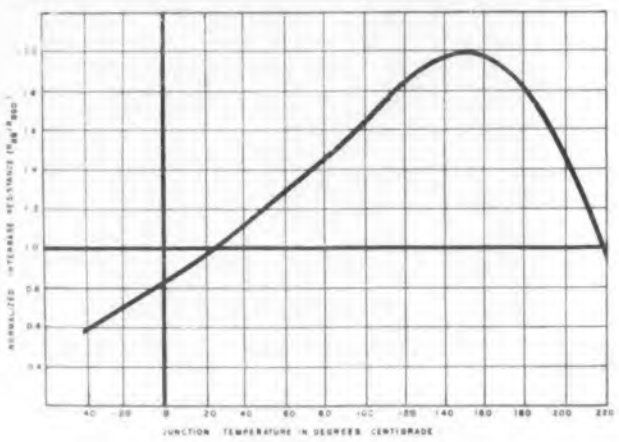


Fig. 5. Variation of inter-base resistance with temperature.

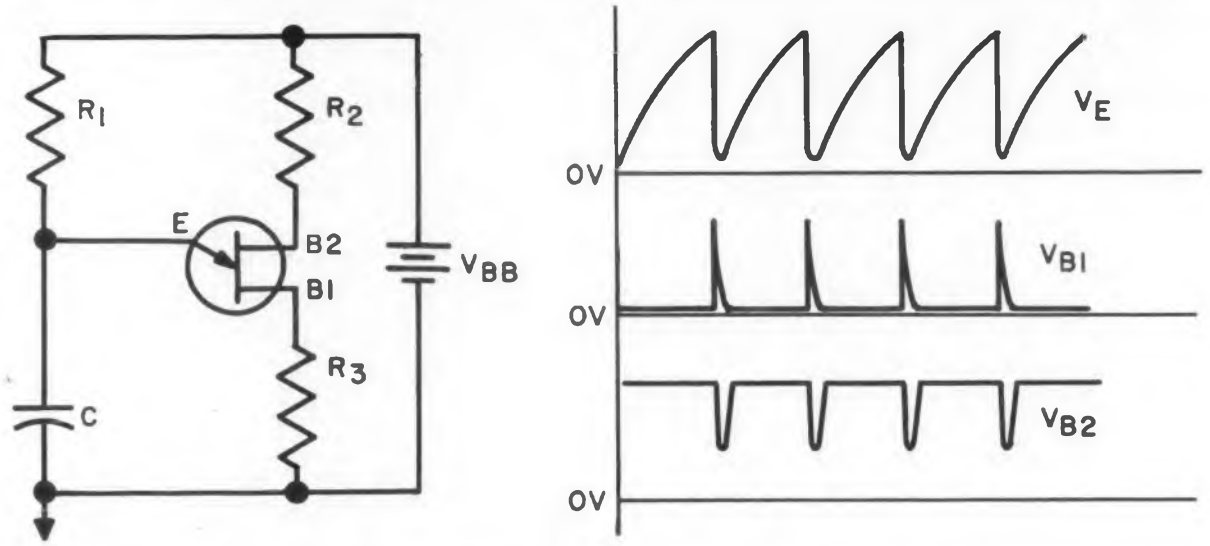


Fig. 7. Relaxation oscillator. The frequency is determined by *R*, *C* when $R_2 = 0$. For large values of R_2 (>5K) output frequency will indicate temperature variations. Frequency will increase with decreasing temperature. For low values of R_2 (200-500 ohms) frequency can be stabilized to <1 per cent over V_{BB} range of 10-40 v and temperature range of greater than 100 deg C. Pulse width at B_1 largely dependent on R_3 and C. Current pulses of up to 2 amp from C of 10μf can be obtained.

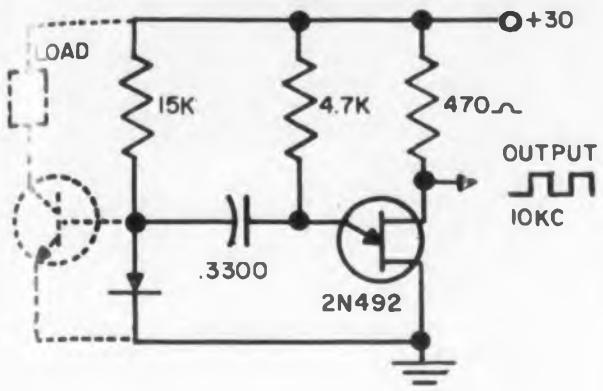


Fig. 8. Multivibrator circuit. This circuit may be used as a triangular wave generator by taking the output across the capacitor. It may also be used to drive a transistor by using an NPN transistor in place of the diode as indicated by the dotted lines.

impedance is used in the emitter circuit.

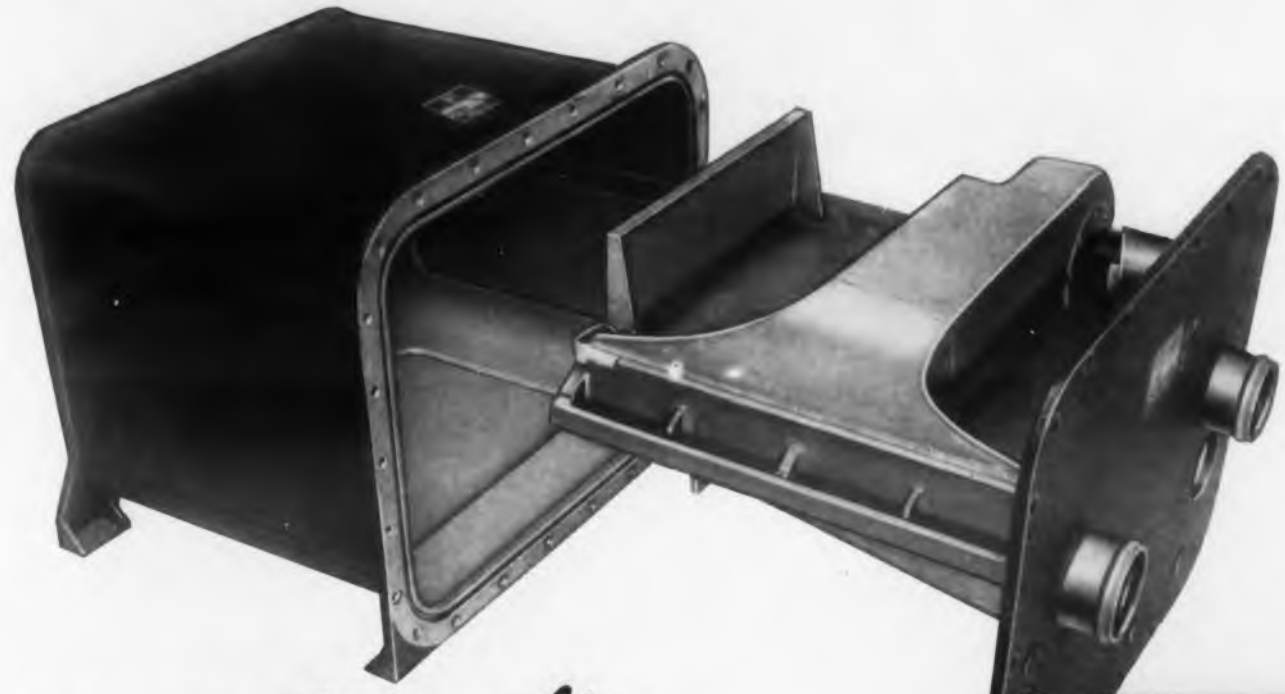
The remaining portion 3 of curve *d*, Fig. 4 occurs when the magnitude of the rate of change of the resistance from emitter to base-one, R_{EB1}, (diode resistance plus R_{B1} in Fig. 2) with respect to the emitter current becomes less than the ratio of the static resistance between emitter and base-one to I_E, or when

$$\left.\frac{\Delta R_{EB1}}{\Delta I_E}\right|_{I_E} \leq \left.\frac{R_{EB1}}{I_E}\right|_{I_E}$$

The value of I_E for which the equality holds is called the valley current I_V. The corresponding emitter voltage at this point is called the valley voltage, V_V. If this valley point falls within the triangle formed by a given emitter circuit load line and the emitter characteristic axes a stable, high-current, low-voltage state will exist in the emitter circuit. If the peak point described previously falls outside of this triangle a stable, high-voltage, low-current state will exist in the emitter circuit.

Curve *d* of Fig. 4 approaches curve *c* as a limit but is always somewhat above curve *c* due to the increased voltage drop across R_{B1} caused by the base-two current. Thus, for any unijunction transistor a curve comparable to *c* will establish the absolute lower limit of emitter to base one voltage, V_{EB1}. Some sort of indication of the value of this voltage is desirable. This is specified on the unijunction transistor data sheets as the emitter saturation voltage, $V_E(SAT)$ which is measured at an emitter current of 50 ma and an interbase voltage of 10 v.

(This is the first of two articles on the silicon unijunction transistor.)



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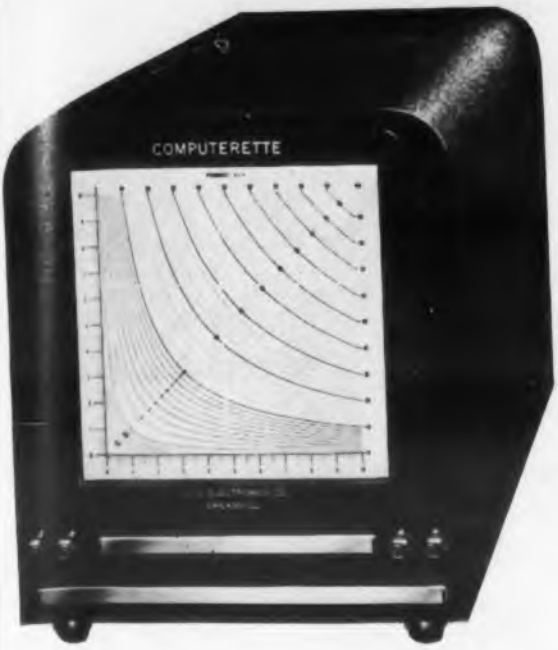
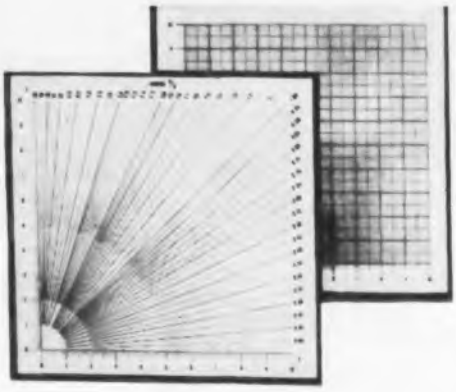
The indicator, made by Aero Electronics Co., 1512 N. Wells Street, Chicago 10, Illinois, consists of two direct current reflecting galvanometers which, together with their associated optical systems, project light lines on to a ground glass screen located on the front of the instrument. These lines extend across the entire screen. One of them is horizontal and moves vertically a distance proportional to the galvanometer current. A scale along the left edge of the screen indicates the magnitude of this current or the desired quantity proportional to this current. The other line is vertical and moves in the horizontal direction a distance proportional to its galvanometer current. A scale located along the lower edge of the screen indicates magnitude of the galvanometer current or some quantity proportional to this current.

In addition to the two scales, the screen contains a family of curves representing the third quantity which is a function of the first two. The point where the two light lines intersect, together with the family of curves, indicates the third, or derived quantity.

It can be readily used to indicate quantities which can otherwise be determined only by laborious computation or with the aid of more complex computers.

In inspection and gaging frequently the allowable tolerances on a certain dimension of a component are dependent upon some other dimen-





Two reflecting galvanometers projecting on a ground glass screen allows this indicator to compute a third quantity from a family of curves.

sion of the same component. Often a moderate tolerance is selected for one dimension, and a corresponding permissible tolerance is specified for the other dimension. This results in unnecessarily restrictive tolerances and large rejection. "Computerette" permits preparation of chart showing maximum allowable tolerances and their inter-dependence.

In non-linear and complex systems it is frequently desirable to be able to determine at a glance the region in which operation is maintained. For example, a power system employing very large power transistors could be monitored quite readily by employing a "Computerette" having the power transistor collector voltage and current as indicator parameters.

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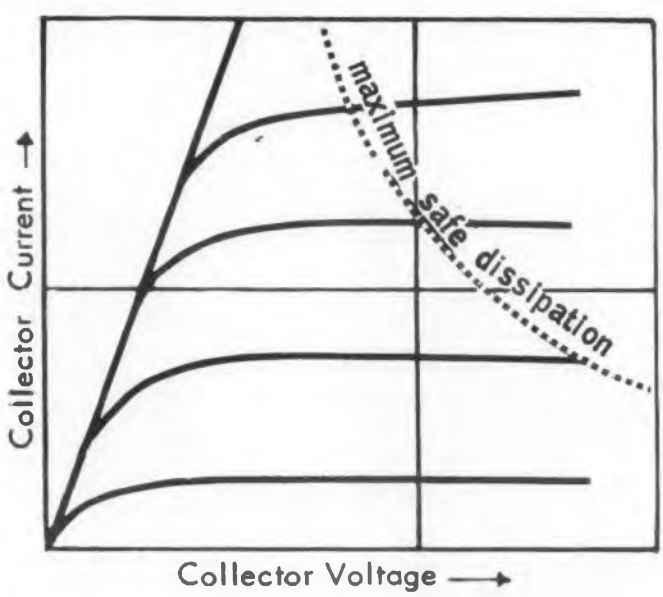
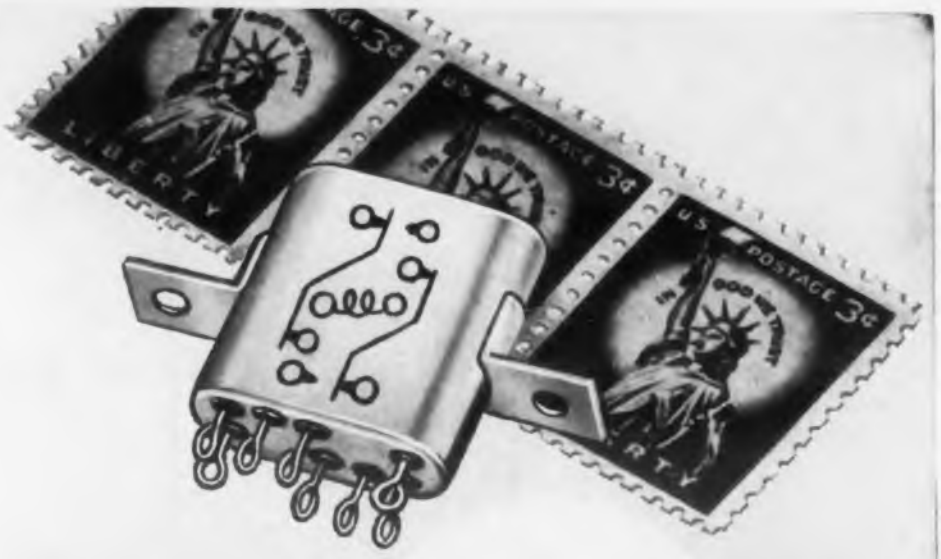
For more information, turn to the Reader Service Card and circle **52.**



The computing-indicator can be used to monitor the area of operation of a transistor, if collector voltage and current are used as parameters.



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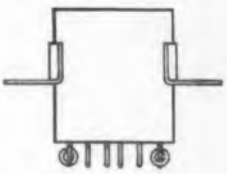

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OPERATING POWER	Nominal 1.2 watts at ambient temperature
CONTACT ARRANGEMENT	DPDT (2 Form C)
CONTACT RATING	2 amps resistive at 32VDC or 115VAC
CONTACT MATERIAL	Silver-Magnesium-Nickel, Gold-plated
CONTACT RESISTANCE	0.05 ohms
OPERATING TIME	5 milliseconds maximum at nominal power
RELEASE TIME	5 milliseconds maximum
ALTITUDE	Voltage breakdown of relay is 1000 volts AC at sea level—450 volts AC to 70,000 feet
DIELECTRIC STRENGTH	1000 volts RMS
INSULATION RESISTANCE	100 megohms minimum at 125° C
STANDARD COIL RESISTANCES	30, 120, 600, 1000, 2500, 5000, 10,000 ohms; others available
SIZE	0.875 high x .797 wide x .359 thick maximum
WEIGHT	0.45 ounces (maximum)
MOUNTING ARRANGEMENT	Angle bracket (as shown), strap bracket or plug-in
TERMINAL ARRANGEMENT	Solder-hook (as shown), or plug-in

ADVANCE RELAYS

ADVANCE RELAYS

ELGIN

A DEPARTMENT OF ELGIN NATIONAL WATCH COMPANY
ELGIN, ILLINOIS AND BURBANK, CALIFORNIA

CIRCLE 53 ON READER-SERVICE CARD

NEW LOW-NOISE CHOPPER

Bristol's Syncroverter† chopper is now available in a low-noise, external-coil model for critical dry circuit applications.

This new external-coil chopper virtually eliminates capacitive coupling between signal-circuit contacts and driving coil leads. Peak-to-peak noise levels are usually *less than 100 microvolts* across a 1 megohm impedance (rms noise, in the order of 10 microvolts).

LONG LIFE and immunity to severe shock and vibration are outstanding characteristics of the new Syncroverter chopper. Withstands vibration, 5 to 2000 cps, up to 30G, and up to five 30G impacts on any major axis. SPDT switch action. Nominal contact ratings: up to 10 V, 1 ma.

Write for complete data on this latest addition to the Bristol Syncroverter line. The Bristol Company, 151 Bristol Road, Waterbury 20, Conn. 7.31

†T. M. Reg. U. S. Pat. Off.

TYPICAL CHARACTERISTICS

Driving Frequency Range:	0—1800 cps
Coil Voltage:	6.3 V sine, square, pulse wave
***Coil Current:**	70 milliamperes
Coil Resistance:	52 ohms
***Phase Lag:**	60° ± 10°
***Dissymmetry:**	15° max.
***Switching Time:**	15° ± 5°
Temperature Ranges:	—55°C to 100°C or —65°C to 125°C
Operating Position:	Any
Mounting:	Flange; 2-hole or 4-hole Plug-in; fits 7-pin miniature socket

*These characteristics based on sine-wave excitation, 400 cps.

BRISTOL FINE PRECISION INSTRUMENTS FOR OVER 68 YEARS

CIRCLE 54 ON READER-SERVICE CARD

TWT Oscilloscope Detects Microwaves

SIGNAL frequencies to 2000 mc can be detected on this microwave oscilloscope which incorporates a traveling-wave cathode-ray tube. High sensitivity permits millimicrosecond observations of transient and repetitive phenomena at signal voltages as low as 60 mv. The oscilloscope faithfully displays pulse rise times on the order of a tenth of a millimicrosecond and records at writing speeds on the order of 10^{11} trace widths per second.

Developed by Edgerton, Germeshausen and Grier, Inc. of 160 Brookline Ave., Boston, Mass., the E G & G Type 2236 Traveling-Wave Oscilloscope uses no amplifiers. The traveling wave deflection system, in a sealed-off tube, provides a band width of 2000 mc combined with a sensibility of 0.030 v per trace width at an impedance level of 120 ohms. This high sensibility makes possible recording of signal amplitudes from 10-100 times smaller than could be recorded with oscilloscopes of conventional design.

An important contributing factor to the per-

Fig. 1. Traveling-wave tube microwave oscilloscope.

Fig. 2. Camera for recording images on CRT screen.

CIRCLE 55 ON READER-SERVICE CARD ➤

Electron Tube News
—from SYLVANIA

Engineering New Developments—Everywhere in Electronics

IN MOBILE COMMUNICATIONS...

Sylvania designs the 12EK6, an RF-IF pentode for auto radio and two-way radio applications

Type 12EK6, a Sylvania-originated T-5½ RF-IF pentode, is available for wide application in vehicular radio. Originally intended for use in 12-volt AM or FM service, the type is finding growing application in two-way radio service for commercial, industrial, amateur and experimental mobile communications.

The new 12EK6 features high gain in IF and RF applications. It is controlled for operation at both 10.0 v and 15.9 v. These maximum ratings provide an increased safety factor for the wide voltage variations possible in mobile power supply systems. The 12EK6 is life-tested at the maximum rating of 15.9 v. to insure top performance.

The new 12DY8 is a triode-tetrode designed for relay service in signal-seeker 12-volt hybrid auto radios

Sylvania introduces the 12DY8, a triode-tetrode specifically controlled for operating relays in signal-seeking hybrid auto radio. The new tube combines in one T-6½ package all of the requirements for signal-seeking operations, including cutoff controls at high supply voltage and zero bias plate control at low supply conditions.

Type 12DY8 can also be used as an audio amplifier-transistor driver in hybrid auto radios. Although primarily intended for automotive service, the new audio power tetrode is applicable wherever a 5 ma. relay on a 12 v system is used.

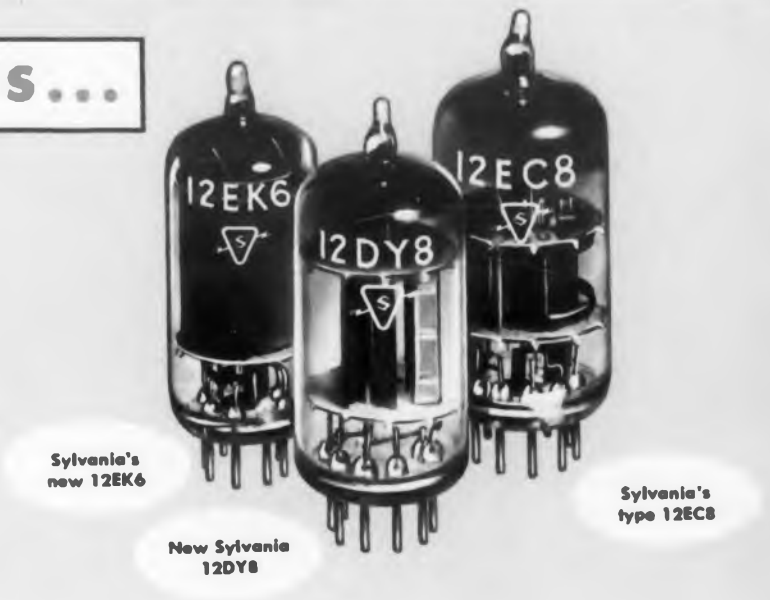
As in the new 12EK6, the heater ratings of the 12DY8 span the entire 10.0 volts- 15.9 volts range to provide a greater safety factor for possible wide variations in fluctuating battery system supply voltages.

Type 12EC8, Sylvania's first mixer for FM service in hybrid communications receivers

New triode-pentode, type 12EC8, is now in production for broad application wherever 12-volt or 26-volt systems are in use. The 12EC8 is particularly well suited for good mixing action through the 100 MC FM band.

By superimposing even higher quality controls on its already exacting tube manufacturing processes, Sylvania has been able to insure steady long-life operation for the 12EC8.

As with Sylvania's other new tubes for vehicular communications, the heater ratings of the 12EC8 have been extended to cover the range from 10.0 volts to 15.9 volts—for an added safety factor in battery system operation.



Type 12EK6
Typical Operating Conditions & Characteristics

Plate voltage	12.6 volts
Grid #1 voltage	0
Grid #2 voltage	12.6 volts
Grid #1 resistor	2.2 megohms
Transconductance	4200 umhos
Plate resistance (approx.)	40,000 ohms
Plate current	4.4 ma.
Screen current	2.0 ma.
Grid #1 voltage for I_b=10 ua.	−4.2 volts
Direct Interelectrode Capacitances	**Without Shield**
Grid to plate: (gl to p) max.	0.032 uuf max.
Input: gl to ($h+K+g^2+g^3$)	10.0 uuf
Output: p to ($h+k+g^2+g^3$)	5.5 uuf

Type 12DY8
Typical operating conditions and characteristics

	Triode	Tetrode
Plate Voltage	12.6	12.6 volts
Grid #1 voltage	0	0
Grid #2 voltage	—	12.6 volts
Grid #1 Resistor	—	2.2 megohms
Grid #1 resistor bypass condenser	—	1.0 uf
Transconductance	1,500	5,400 umhos
Amplification Factor	20	—
Plate resistance (approx.)	15,000	4,000 ohms
Zero Signal Plate Current	1.0	14 ma
Zero Signal Screen Current	—	3 ma
Relay Pull-In Plate Current		5 ma. min.
E_b-E_c2-E_f-10 volts; E_c1-O; R_p-1500 ohms; R_g-10 meg.		
Relay Drop Out Plate Current		3 ma. max.
E_b-E_c2-E_f-15 volts; E_c1- -5.5 volts; R_g1-O; R_p-1500 ohms.		

Type 12EC8
Typical Operating Conditions and Characteristics

	Triode	Pentode
Plate Voltage	12.6	12.6 volts
Grid #2 voltage	—	12.6 volts
Grid #1 voltage	0	0
Grid #1 Resistor	4,700	33,000 ohms
Amplification Factor	25	—
Plate resistance (approx.)	6,000	750,000 ohms
Transconductance	4,700	2,000 umhos
Plate current	2.4	0.66 ma
Grid #2 current	—	0.28 ma
Grid #1 voltage for Ib-10 ua (approx.)	−2.2	−1.6 volts

Engineering New Developments

IN TELEVISION...

Sylvania upgrades the 10DE7 for a better safety factor in 110° deflection circuits

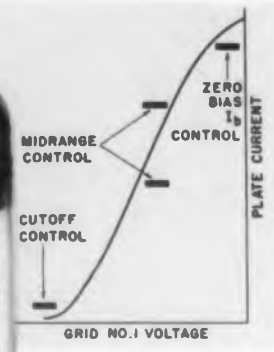
A new 10DE7 to give a better safety factor in 110° vertical deflection circuits has been designed by Sylvania. Most important upgrading in the new tube is:

• **Peak pulse plate voltage**—raised from 1,000 to 1,500 volts.

The reserve power of the 10DE7 is achieved through use of a newly designed plate which has been increased in size to provide greater power handling capacity.

Special care in manufacturing and extensive tests have paved the way for the increased peak pulse plate voltage in Sylvania's 10DE7.

Sylvania's improved 10DE7



The transfer characteristics in the new 10DE7 are rigidly controlled for proper vertical deflection operation.

Average Characteristics	Triode No. 1	Triode No. 2
Plate Voltage	250	150 volts
Grid No. 1 Voltage	-11	-17.5 volts
Plate Current	5.5	35 ma
Transconductance	2,000	6,500 umhos
Amplification Factor	17.5	6.0
Plate Resistance (approx.)	8,750	925 ohms
Grid Voltage for I_b-10 ua	-20	— volts
Grid Voltage for I_b-50 ua	—	-44 volts
Zero Bias Plate Current E_b-60 V/Ec-0 (Inst. Values)	—	80 ma

Nine types are added to Sylvania's extensive line of receiving tubes for complete coverage of TV set requirements

Sylvania expands its broad line of TV receiving tubes with the addition of nine new types:

• **Types 6CX8 and 8CX8,** triode and sharp cutoff video pentodes. The pentode section of these types is designed for use as a video amplifier. The triode section is adaptable to a wide range of low frequency amplifier and oscillator applications.

• **Types 6DT5 and 12DT5,** miniature beam power pentodes featuring high zero bias plate current for 110° vertical deflection service. They are designed for superior performance with both plate and screen operating at the B power supply potential.

• **Types 6CU5 and 12CU5,** miniature beam power pentodes for TV audio output in low B+ TV receivers. Both the 6CU5 and 12CU5 exhibit characteristics similar to those of the 5OC5.

• **Type 6CQ8,** medium mu triode and sharp cutoff pentode for use in series string TV receivers. It is intended as a combined vhf oscillator and mixer tube.

• **Types 1J3 and 1K3,** high voltage rectifiers. The 1K3 is the short bulb version of the 1J3 and has identical characteristics.

These timely new additions indicate why more manufacturers contact Sylvania for complete tube service from one convenient source.

IN GUIDED MISSILE TYPES...

Full line of guided missile types is now in factory production to meet expanding military needs

Sylvania expands production of its Guided Missile line to meet growing military requirements as the U. S. missile program moves into high gear.

The entire line of Sylvania Guided Missile tubes from type 6943 to 6948 is designed specifically to meet and surpass the most stringent military specifications. The Guided Missile line passes Sylvania's many exacting quality tests such as the White Noise Tests, flicker shorts tests and fatigue tests.

Type No.	Description
6788	Pentode audio voltage amplifier
6943	Sharp cutoff RF pentode
6944	Semi-remote cutoff RF pentode
6945	Audio beam power pentode
6946	Medium mu single triode
6947	Double, medium mu triode
6948	Double, high mu triode

Sylvania's Guided Missile tube line goes into mass production

Everywhere in Electronics

IN RELIABLE TUBES...

Sylvania's New Gold Brand booklet

New engineering booklet tells the story behind the Gold Brand lines

Sylvania offers a new booklet on its Gold Brand lines with a full run-down on the characteristics, specifications, ratings and production techniques for the reliable tubes. The booklet tells why the Gold Brand has become the sign of premium dependability in reliable receiving tubes. It shows the extra critical specifications that are met throughout the entire manufacturing process. It illustrates how the Gold Brand has become the industry's assurance of military and industrial tubes with extra reliability and excellent performance.

For full information on Sylvania reliable tubes send for your copy of the new Gold Brand booklet.

IN VIDEO AMPLIFIERS...

Sylvania introduces type 6EB8, a high mu triode—sharp cutoff pentode in a T-6½ envelope

Type 6EB8 is a high mu triode, sharp cutoff video pentode. The pentode section is controlled for low knee characteristics and high zero bias plate current. It provides substantially higher video output than its predecessors.

Sylvania's new 6EB8 may also be used to excellent advantage in oscilloscopes and other visual presentation instruments.

New Sylvania type 6EB8

Typical Operating Conditions and Characteristics, Class A1 Amplifier

	Triode	Pentode
Plate voltage	250	200 volts
Grid #2 voltage	—	125 volts
Grid #1 voltage	-2	0 volts
Cathode bias resistor	—	68 ohms
Amplification factor	100	—
Plate resistance (approx.)	34,000	75,000 ohms
Transconductance	2,700	12,500 umhos
Plate current	2	25 ma
Grid #2 current	—	7.0 ma
Grid #1 voltage (approx.) for Ib=100 ua	—	-9 Vdc
Grid #1 voltage (approx.) for Ib=20 ua	-5	— Vdc
Zero Bias: With Eb=40 V; and Ec2=125 V; (instantaneous values)		
Plate Current		40 ma
Grid #2 current		15 ma

IN INDUSTRIAL AND MILITARY C-R TUBES...

New multi-gun tube development nears completion as Sylvania pushes military and commercial designs

Out of Sylvania's broad basic experience in color TV picture tubes come new developments in multi-gun cathode-ray tubes for commercial and military applications. Sylvania engineers are now completing development of the type 6DP7 shown, an intricate triple gun C-R-T designed for special military purposes. Other multi-gun developmental types incorporating as many as five separate guns are in development.

For airborne use, Sylvania is developing the 5BCP7, a miniaturized lightweight C-R-T that meets the stringent requirements of today's aircraft.

Whatever the need in special cathode-ray tubes—from multi-gun types to wide-angle special-phosphor tubes—Sylvania's engineering know-how and unsurpassed manufacturing facilities can meet it. Discuss your special C-R tube problem with Sylvania's Industrial and Military Cathode-Ray Tube Department.

Developmental model of multi-gun 6DP7

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(First Class Permit No. 46687, New York 19, N.Y.)

SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway
New York 19, N. Y.

Engineering New Developments *Everywhere in Electronics*

IN 110° PICTURE TUBES . . .

Sylvania replaces hand tipping with a new automatic exhaust tip sealing process that increases 110° picture tube reliability

Sylvania adds new and greater uniformity and reliability to its 110° picture tube line with an automatic tipping process. Now all Sylvania 110° types incorporate the rugged squared seal shown.

The extreme rigidity of the new ruggedized exhaust tip seal virtually eliminates cracking or breakage possibilities. By automating the old hand tipping process, uniform reliability is assured for complete tube runs.

The new automatic sealing process allows greater control of tip length as well as shape. This is of particular benefit where rigid pin bases are used. It results in more highly uniform base fitting and pin alignment.

Improvements such as the new tipping process indicate why Sylvania continues to lead the way in 110° picture tubes. All Sylvania 110° types, from the 14's and 17's to the newest 24's now incorporate the squared exhaust tip seal. In 110° picture tubes, it pays to specify Sylvania.

1. "Old" Hand-Tip—Cross section of earlier style base showing seal obtained employing previously used hand tipping

2. "New" Automatic Tip—Cross section of conventional base used on 110° picture tubes

3. "New" Automatic Tip—Cross section of rigid pin base used on 110° picture tubes

IN NEW HEATER DESIGN . . .

Sylvania now offers the design engineer a broader horizon within which to explore, with the development of a sound and proven 300 ma., 6.3 volt heater for picture tubes.

Originally developed for export markets, the 300 ma., 6.3 volt heater can be made available in sample 90° and 110° tubes for the design engineer's evaluation.

SYLVANIA

Sylvania Electric Products Inc.
1740 Broadway, New York 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd.
Shell Tower Bldg., Montreal

LIGHTING • TELEVISION • RADIO • ELECTRONICS • PHOTOGRAPHY • ATOMIC ENERGY • CHEMISTRY-METALLURGY

Please send additional information on the items checked below:

- ☐ Type 10DE7
- ☐ Type 12EK6
- ☐ Type 12DY8
- ☐ Type 12EC8
- ☐ Type 6EB8
- ☐ Types 6/8CX8
- ☐ Types 6/12DT5
- ☐ Types 6/12CU5
- ☐ Type 6CQ8
- ☐ Types 1J3, 1K3
- ☐ Gold Brand Brochure
- ☐ Guided Missile Line
- ☐ 110° Picture Tubes
- ☐ Industrial and Military C-R Tubes
- ☐ The 300 ma., 6.3 volt heater

Name_____

Address_____

Company_____

Use this handy business reply card to request additional information on these important new Sylvania developments

formance is the spot size of approximately 2 mils compared with 10 to 30 mils for conventional five-inch cathode-ray tubes. Although the useful display is but 0.4 by 0.6 in., it contains as much information as a standard 5-inch tube, and its resolution is fully as good.

For full realization of the unit's capabilities, a recording camera is available. It uses two $f/1.4$ lenses placed front to front, the resultant aperture being $f/0.7$ and the magnification 1:1. A built-in 5-power lens provides a means of viewing the display when the film holder is removed.

Traveling Wave Deflection System

High frequency response of the oscilloscope is achieved by using a traveling-wave type of deflection system instead of the conventional high voltage plate deflection system. With a plate deflection system, frequency response is limited by the transit time of the electron beam between the plates. This limitation is removed with a traveling-wave deflection system by propagating the signal pulse along a helix lying parallel to the beam axis. The helix pitch and dimensions are adjusted to make signal propagation speed down the tube match the beam velocity.

Input Trigger Characteristics

Minimum trigger amplitude for single shot operation depends on the pulse duration. For example, the minimum amplitude is only 50 mv for trigger pulses of more than 40 mμs duration, but increases to approximately 300 mv for a 10 mμs pulse. Sweep delay time depends on the pulse amplitude and, below 1 v, also depends on the trigger duration. For trigger amplitudes greater than 3 v, sweep delay time is approximately 50 mμs. For an amplitude of 0.4 v, the delay time may be as much as 80 mμs.

When the sweep circuit is free-running to display repetitive signals, the signal amplitude required for proper synchronization depends on signal frequency. With a 50 mc signal, an amplitude greater than 0.3 v will produce satisfactory synchronization. At lower frequencies the amplitude may be less. The maximum sweep repetition rate of 300 kc is obtained when the fastest (25 mμs) sweep is used. With the slowest (5 μs) sweep, the repetition rate is reduced to approximately 2 kc.

Positioning and Focus

Conventional controls for vertical and horizontal positioning, focus, and intensity are provided. Astigmatism adjustments on the electromagnetic lens are mechanical and are pre-set at the factory.

For further information on the Traveling Wave Oscilloscope, turn to the Reader's Service Card and circle 56.

CIRCLE 55 ON READER-SERVICE CARD

Fig. 3. Traveling-wave Cathode-ray tube.

.05% ACCURACY

D. C. VOLTMETER

Model 801

This instrument is a four-range, true potentiometer of .05% accuracy. EMF is measured by comparison with a portion of an extremely stable, 500 volt source, referenced by a standard cell.

The difference is read on a self-contained, calibrated, four-range, chopper-stabilized VTVM. At null, the input resistance is infinite and the unknown voltage is observed directly from the windows above each dial of the 5-dial Kelvin-Varley divider. An illuminated decimal point correctly punctuates the reading.

To facilitate the nulling process, four "search" VTVM ranges of 10 megohms input resistance are provided for rapid approximation of the unknown voltage.

VOLTAGE RANGES—0 to 500, 0 to 50, 0 to 5, 0 to .5 volts.

NULL RANGES—10-0-10, 1-0-1, .1-0-.1, .01-0-.01 volts.

ACCURACY—±.05% of input voltage from .1 volt to 500 volts; below .1 volt ±.1% or 50 microvolts.

INPUT RESISTANCE—Infinite at null; 1000 megohms per volt of input when 1% off null.

SEARCH RANGES—500-0-500, 50-0-50, 5-0-5, .5-0-.5.

SIZE AND WEIGHT—Cabinet, 13" H x 9¾" W x 14" D—25 lbs.; Rack, 8¾" H x 19" W x 16¾" D—28 lbs.

PRICE—Cabinet, $465.00; Rack, $485.00 f.o.b. Seattle.

.05% ACCURACY

D. C. VOLTMETER

Model 800

The Model 800 is a single-range version of the Model 801 described above. It, too, is rugged, simple to operate, burn-out proof, and features .05% accuracy and infinite input resistance at null.

VOLTAGE RANGE—0 to 500 volts.

NULL RANGES—10-0-10, 1-0-1 volts.

ACCURACY—±.05% of input voltage from 10 volts to 500 volts; below 10 volts. ±.1% or 5 millivolts.

INPUT RESISTANCE—Infinite at null; 1000 megohms per volt of input when 1% off null.

SEARCH RANGE—500-0-500 volts.

SIZE AND WEIGHT—Cabinet, 13" H x 9¾" W x 14" D—21 lbs.; Rack, 8¾" H x 19" W x 16¾" D—23 lbs.

PRICE—Cabinet, $335.00; Rack, $355.00 f.o.b. Seattle.

JOHN FLUKE MANUFACTURING CO., INC.

1111 W. NICKERSON ST., SEATTLE 99, WASH.

CIRCLE 57 ON READER-SERVICE CARD

NEW PRODUCTS

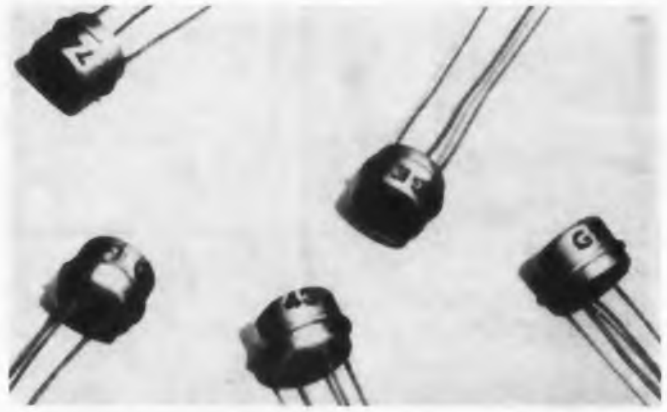
To provide a complete coverage of ALL new products generally specified when designing electronic original equipment, the New Product section has been extended. To include the larger number of items, products which are best suited to a brief description have been noted at the end of the section.

CRYSTAL OVEN

Proportional Control holds oven temperature within 1/1000 of the ambient temperature change in crystal oven type RD-130. The unit consists of two assemblies — a thermo-oven, which accommodates an HC-6/U crystal holder, and an oven control amplifier—both mounted on a 3-1/2 in. high standard 19-in. relay-rack panel. A temperature-sensitive resistance bridge is used both for oven heating and for sensing change in temperature. The oven temperature is normally provided set at 75 C, but is also available preset at any temperature from 10 to 100 C above ambient. Vernier temperature adjustments are possible.

Manson Laboratories, Inc., Dept. ED, 207 Greenwich Ave., Stamford, Conn.

CIRCLE 58 ON READER-SERVICE CARD



UNIJUNCTION TRANSISTORS

Close Parameter Tolerances are featured in these unijunction transistors designated type 2N489 through 2N494. The transistors are specified primarily in three ranges of intrinsic stand-off ratio and two ranges of interbase resistance. Each range of intrinsic standoff ratio has limits of ±10 per cent from center value and each interbase resistance has limits of ±20 per cent. Types 2N489, 2N491 and 2N493 have a nominal interbase resistance rating of 5.6 k and types 2N490, 2N492 and 2N494 have ratings of 7.5 k, all at 25 C junction temperature. Nominal intrinsic standoff ratio ranges from 0.56 to 0.68. All have a maximum power dissipation of 250 mw at 25 C. Operating temperature range is —65 to +150 C, and peak emitter current rating at 150 C is 2 amp. Maximum emitter reverse voltage rating is 60 v. Two nomograms are included with each specification sheet.

General Electric Semiconductor Products, Dept. ED, Electronics Park, Syracuse, N.Y.

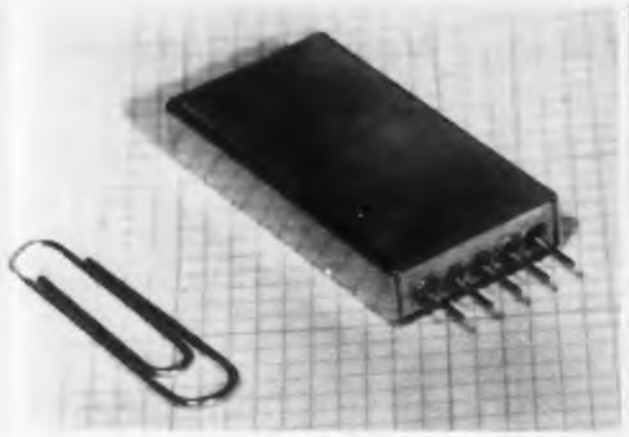
CIRCLE 59 ON READER-SERVICE CARD

E-1-R METER

Having An Input Resistance of 111 Meg, model 110 E-1-R meter is a battery powered unit with 9 voltage ranges, 100 mv to 1000 v full scale, and 18 current ranges, 1 mμa to 300 ma full scale. The input resistance for voltage measurements is 111 megohms; an 11 megohm isolation resistor is in the pencil probe provided. The voltage drop in current measurements is 100 mv. Zero drift is less than 1 mv per hour after a five-minute stabilization period. Six direct reading resistance scales provide center readings of 10 ohms to 100 meg.

Belleville-Hexem Corp., Dept. ED, 638 University Ave., Los Gatos, Calif.

CIRCLE 60 ON READER-SERVICE CARD



PLUG-IN SERIES

Four Miniature Circuits are available as plug-in units, each of identical appearance as shown. Model 7-1004 trigger is a high input, low output impedance switch which triggers at approximately +1 v and produces an output voltage which switches from +5 to +25 v. Model 7-1002 preamplifier flip-flop consists of a squaring amplifier and an Eccles-Jordan circuit. Model 7-1201 is a collector coupled one shot multivibrator utilizing 3 npn transistors. Model 5-1501 preamplifier is a high sensitivity transistorized unit for amplifying low level ac signals from 40 to 20 kc. It has a high input and low output impedance and will drive model 7-1002 or 7-1004.

Dynalysis Development Laboratories, Inc., Dept. ED, 11941 Wilshire Blvd., Los Angeles 25, Calif.

CIRCLE 61 ON READER-SERVICE CARD

HIGH TEMPERATURE FILTER

Continuous Operation At 225 C is made possible in these filters by utilizing a high percentage of inorganic materials. The filters have an overall temperature range of −55 to +225 C. Voltage ratings are 150 and 125 wv dc; current ratings are 1, 2, 5 and 10 amp. The size of the filter is described as only slightly larger than low temperature filters.

San Fernando Electric Mfg. Co., Dept. ED, 1509 First St., San Fernando, Calif.

CIRCLE 62 ON READER-SERVICE CARD

first in Performance Reliability and Quality

epco

TRANSISTORIZED V.R.P.S.*

- **REGULATION** (for line or load) 0.03% or 0.003 Volts (whichever is greater)
- **RIPPLE** 3 mv. rms
- **RECOVERY TIME** 50 microseconds
- **STABILITY** (for 8 hours) 0.03% or 0.003 Volts (whichever is greater)
- 0.005% resolution with 10 turn voltage control.
- Continuously variably output voltage without switching.
- External overload and short circuit protection included.
- Either positive or negative can be grounded.
- Units can be series connected.
- Suitable for square wave pulsed loading.
- Power requirements: 105-125 volts, 50-400 cycle.
- Terminations on front and rear of unit.
- High efficiency.
- Low heat dissipation.
- Compact, light weight.
- Color: grey hammer tone.
- Suitable for bench or rack use.
- Voltmeter and ammeter provided.

the most complete line of POWER SUPPLIES

*** VOLTAGE REGULATED POWER SUPPLIES**

Model	Output Volts	Output Amps.	Output Impedance Ohms DC-1 KC	Output Impedance Ohms 1 KC-100 KC	Rack Mount W	Rack Mount H	Rack Mount D
SC-32-0.5	0-32	0-0.5	0.02	0.2	19"	3½"	11"
SC-32-1	0-32	0-1	0.01	0.1	19"	3½"	11"
SC-32-1.5	0-32	0-1.5	0.01	0.1	19"	3½"	11"
2SC-32-1.5 DUAL OUTPUT	0-32 0-32	0-1.5 0-1.5	0.01 0.01	0.1 0.1	19"	7"	11"
SC-32-2.5	0-32	0-2.5	0.01	0.1	19"	3½"	11"
SC-32-5	0-32	0-5	0.005	0.05	19"	5¼"	13"
SC-32-10	0-32	0-10	0.001	0.01	19"	8¾"	13"
SC-32-15	0-32	0-15	0.001	0.01	19"	10½"	13"
2SC-100-0.2 DUAL OUTPUT	0-100 0-100	0-0.2 0-0.2	0.1 0.1	1.0 1.0	19"	5¼"	11"
SC-150-1	0-150	0-1	0.05	0.5	19"	5¼"	13"
SC-300-1	0-300	0-1	0.1	1.0	19"	8¾"	13"

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

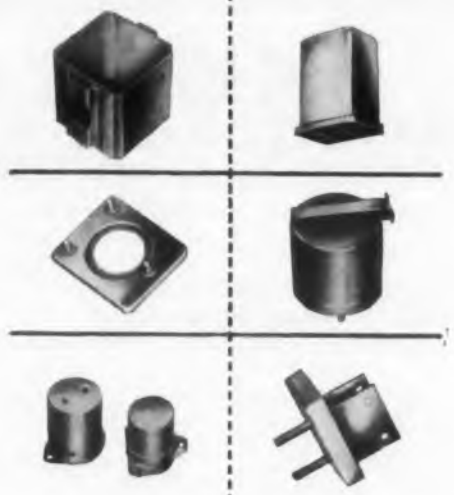
KEPCO OFFERS MORE THAN 120 STANDARD VOLTAGE REGULATED POWER SUPPLIES COVERING A WIDE RANGE OF MAGNETIC, TRANSISTOR AND TUBE TYPES. MOST MODELS AVAILABLE FROM STOCK. SEND FOR BROCHURE B-581

Model
SC-32-0.5
SC-32-1
SC-32-1.5
SC-32-2.5

CIRCLE 63 ON READER-SERVICE CARD

Do-it-yourself or hire an expert?

Check these facts on Hudson closure quality and costs!



PRECISION — Hudson accuracy in metal forming is assured by the closest adherence to critical tolerances. Standard design or custom components, you can be sure of metal products that meet requirements.

UNIFORMITY — Whether you order sample quantities or large products runs, Hudson closures are of true uniform quality . . . eliminate rejects, speed assembly all along the line.

ECONOMY — Hudson's standardized methods of design and manufacture produce custom quality parts at commercial prices. Thousands of economical standard closures are available to solve your problem.

HUDSON TOOL & DIE CO • INC

18-38 MALVERN ST., NEWARK 5, N. J. — Tel. MArket 3-7584

New Products

Ion Gauge

Measures 10^{-4} to 10^{-8} mm Hg

Model 710 ion gauge, and thermocouple amplifier includes a high-voltage R-F power supply, a vtvm with appropriate resistors for measuring ionization current, and a regulated low-voltage power supply. A power supply and switch provides the necessary current for outgassing the heater in the Phillips gauge. There are five ranges in the unit making vacuum measurements possible from 10^{-4} to 10^{-8} mm Hg.

Wave/Particle Corp., Dept. ED, P.O. Box 252, Menlo Park, Calif.

CIRCLE 65 ON READER-SERVICE CARD

Transformer Kits

Plug-In Pulse Type

Each of these three kits contains six different pulse transformers. All transformers are supplied with a 7-pin base, to fit standard miniature tube sockets. Contents of the kits respectively: blocking oscillator transformers, coupling transformers, and coupling and blocking oscillator transformers.

ESC Corp., Electronic Components Div., Dept. ED, 534 Bergen Blvd., Palisades Park, N.J.

CIRCLE 66 ON READER-SERVICE CARD

◀ CIRCLE 64 ON READER-SERVICE CARD

Ku-Band Rotary Joint

High Power

The MA-651 rotary joint will handle rf peak powers close to the maximum power capability of RG-91/U waveguide. The unit may be pressurized up to 60 psig for increased rf power handling capability. Type UG-419/U military standard choke flanges are used. General characteristics include a frequency range of 16.3 to 16.7 kmc, vswr of 1.25 max, power rating (unpressurized) of 60 kw, and a phase shift with rotation of less than 3 deg. Other high power rotary joints are available in the 35 kmc range.

Microwave Associates, Inc., Dept. ED, Burlington, Mass.

CIRCLE 67 ON READER-SERVICE CARD

Power Diodes

Peak Inverse of 40-80 Kv

The XD series of power diodes operates in the range of peak inverse voltages of 40-80 kv at average plate currents of 3 amp in rectifier service, and 5 amp rms in clipper diode service. A 600 w cathode permits operation peak emissions of 150 amp. External anode construction allows cooling by either forced air or liquid.

Central Electronic Manufacturers, Inc., Dept. ED, 2 Richwood Pl, Denville, N.J.

CIRCLE 68 ON READER-SERVICE CARD

CIRCLE 69 ON READER-SERVICE CARD ➤

More materials: Rugged, versatile compositions to resist impact, stress, vibration, pressure, heat, thermal shock, wear, chemical reactions. Superior electrical characteristics for higher temperatures and frequencies.

More equipment: Complete and separate production facilities devoted exclusively to finer quality AlSiMag Aluminas.

More "know how": Years of experience in formulating and fabricating Aluminas. The wider range of exacting designs produced have led to new, improved techniques. Precision tolerances. Dependable uniformity. Constant research.

Bring your problem to the source most apt to supply the right answer! Send blueprint with details of operating procedure for complete information.

AlSiMag

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A Subsidiary of Minnesota Mining and Manufacturing Company

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56TH 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.

YOUR PERFECT PARTNERS

for top performance at high temperatures

150°C characteristic B* molded TI resistors
150°C silicon TI transistors

You assure the stability of your high temperature circuits with TI silicon transistors. You can doubly insure long service life under rugged conditions using their temperature team-mates — the TI ¼-watt and ½-watt molded resistors — *another precision line of Texas Instruments components.*

You design with confidence because these resistors always hold electrical tolerances in specified extremes. When specifications require resistors meeting characteristic B of MIL-R-10905B, you can use TI molded type for fixed film high stability resistors . . . to give you lower cost, lighter weight, compact equipment.

You save critically needed space by snugly fitting these resistors side by side and against the chassis — without sleeving, potting or special hermetic enclosure — because of the high dielectric strength of their insulation.

You cut installation and assembly costs. Full mechanical protection allows normal production-line handling . . . close dimensional tolerances ($\pm 0.008''$ length; $+0.015''$, $-0.005''$ diameter) allow snug fit in tight circuitry . . . easy readability of markings helps avoid installation and stockroom errors.

T/I

electrical value	CDM ¼ (MIL Type RN65B)	CDM ½ (MIL Type RN70B)	unit
Wattage Rating	¼	½	Watt
Resistance Range — Low	40	25	Ohm
High	1	2	Megohm
Resistance Tolerances (to order)	½, 1, 2, 5	½, 1, 2, 5	%
Maximum Rated Voltage	300	350	V

*Specification for Fixed Film High Stability Resistors

Write today for Bulletin DL-C 787!

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 312 · DALLAS, TEXAS

New Products

High Voltage Power Supply

Air-Insulated Selenium-Rectified

Model 4250-2 power supply is an air-insulated selenium-rectified 250 kv, 2 ma unit. Input voltage is 105 to 125 v, 50 to 60 cps single phase, and input power is approximately 1 kva. Output voltage is continuously variable, with manually reversible polarity, approximately 2.5 per cent ripple at maximum rated power, and internal impedance of 11 meg.

Sorensen & Co., Inc., Beta Electric Div., Dept. ED, 333 E. 103 St., New York 29, N.Y.

CIRCLE 71 ON READER-SERVICE CARD

Scintillation Transducer

High Resolution

With the objective of maximizing pulse height and resolution, this scintillation transducer combines a high-clarity thallium-activated sodium-iodide crystal integrally packaged with a standard 5-in. photomultiplier tube. Available in any crystal length up to 4 in., the packaged detection units are supplied housed in overall mu-metal magnetic shields and complete with preamplifiers. Integral mounting of the crystal and photomultiplier avoids an interface of glass otherwise necessary, and therefore provides optimum optical contact between the two.

Levinthal Electronic Products, Inc., Dept. ED, Stanford Industrial Park, Palo Alto, Calif.

CIRCLE 72 ON READER-SERVICE CARD

◀ CIRCLE 70 ON READER-SERVICE CARD

Aircraft Power Supply

Extended Range

The output range of the Models KM75 and KM81 power supplies has been extended to cover 0-32 v dc at 5 and 10 amp respectively. Maximum rms ripple for both ratings has been reduced to 0.5 per cent at full load.

Opad Electric Company, Dept. ED, 69 Murray St., New York 7, N.Y.

CIRCLE 73 ON READER-SERVICE CARD

Ultrasonic Generator

500 VA Capacity

Model 1432-U ultrasonic generator has a 500 va capacity, and is one of a group which cover an output range of 25 va to 2 kva. All units in this line can be supplied to cover discrete portions of the 5 to 50 kc range with a frequency spread ratio of 3.6 to 1.

Communication Measurements Lab. Inc., Dept. ED, 350 Leland Ave., Plainfield, N.J.

CIRCLE 74 ON READER-SERVICE CARD

Numerical Data Printers

for Data Reduction Systems

Parallel entry numerical data printers for computers and data-reduction systems are available in three models with 5, 8 and 11 decades input capacity.

Clary Corp., Dept. ED, 408 Junipero St., San Gabriel, Calif.

CIRCLE 75 ON READER-SERVICE CARD

CIRCLE 76 ON READER-SERVICE CARD ➤

the new

miniature rechargeable nickel cadmium

BUTTON·CELL

BATTERY

Gulton Button·Cell batteries are available in capacities of 250 and 500 milliampere hours. Each Button·Cell has a nominal capacity of 1.2 volts. Multiple cells are packaged in any desired voltage combination to meet your specifications.

The Button Cell is only one of a complete line of nickel cadmium, nickel iron and battery and charger units from a new source — Gulton Industries Alkaline Battery Division.

Write today for complete technical information — please mention your application.

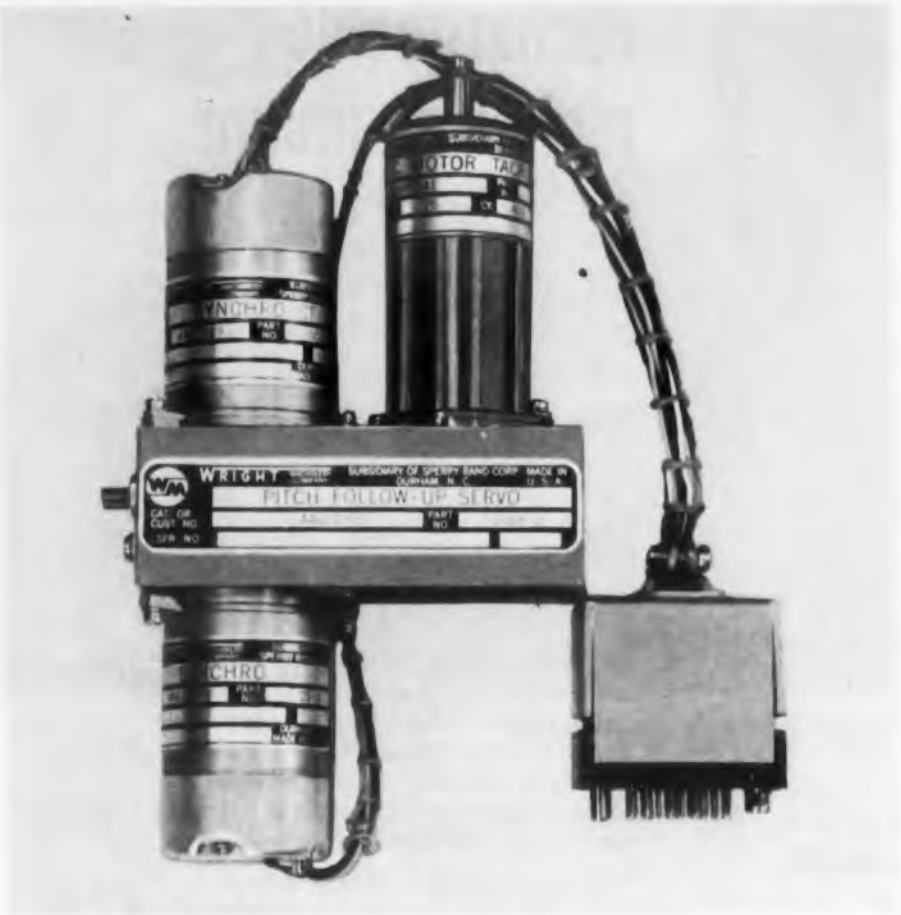
Gulton ALKALINE BATTERIES

Alkaline Battery Division

Gulton Industries, Inc.

METUCHEN, NEW JERSEY

PRECISION
CONTROL ASSEMBLIES
. . . a WRIGHT specialty



MAJOR SUB-ASSEMBLIES: Size 9 motor tachometer generator, 7/8" in diameter; two Size 11 high accuracy synchros; precision gear reduction unit with 6000 to 1 ratio.

This servo illustrates Wright's exceptional capability for production of special small precision components and assemblies. You are invited to consult us on your next requirement for . . .

A.C. and D.C. Motors • Servo Tach Units
Synchros In All Categories
Gyro Motors • Tachometer Generators
And Related Components or Assemblies

MOTOR DIVISION

WRIGHT MACHINERY COMPANY
EST. 1893 • DURHAM, N. C.
DIVISION OF SPERRY RAND CORPORATION

CIRCLE 279 ON READER-SERVICE CARD

New Products

Equipment Mount

Low Natural Frequency

Designed to mount airborne resolvers, computers, and radar search equipment, Model 1459 equipment mount has a low natural frequency of 5 to 9 cps for vibration protection. Vibration isolation response at 30 cps, for example, is as high as 90 per cent and improves at higher frequencies. Resilient elements provide environmental control of shock impacts and superimposed vibratory forces. The unit is designed to accommodate loads of 16 to 23 lb per mounting.

Robinson Aviation, Inc., Dept. ED, Teterboro Air Terminal, Teterboro, N.J.

CIRCLE 77 ON READER-SERVICE CARD

Ceramic Capacitor Line

Eight Materials for Varied Ratings

These subminiature ceramic capacitors are available in eight different ceramic materials to obtain the minimum size for the specific temperature characteristics required. For example, a capacitor of 2.5 μμf measures 1/8-in. sq when made with NPO ceramic which has a zero temperature coefficient; at the other extreme, a 1/8-in. sq capacitor made with Super-K ceramic measures 1000 μμf, but is usable only over a limited temperature range. Capacitors come with radial, axial, or ribbon lead, and as standoffs.

Mucon Corporation, Dept. ED, 9 St. Francis St., Newark 5, N.J.

CIRCLE 78 ON READER-SERVICE CARD

PHILLIPS OR SLOTTED

TAPPING SCREWS BY Southern

in STEEL, ALUMINUM, OR STAINLESS

FLAT, ROUND, OVAL, PAN, TRUSS, HEX

Types: A, B, C & F

Southern makes the tapping screws you need for faster, more profitable production... Rigid quality-controlled manufacturing methods in our own plant, employing only U.S.A. workers and materials, means that you can safely place full confidence in Southern as your one source for fasteners.

Over one billion Southern screws in stock. Four Southern warehouses mean service with a capital S!

Wire or phone your requirements, or write Southern Screw Co., P. O. Box 1360, Statesville, N.C.

A. B. C & F TAPPING SCREWS
DOWEL SCREWS • MACHINE SCREWS & NUTS • CARRIAGE BOLTS • STOVE BOLTS • WOOD SCREWS • SPEAKER SCREWS
HANGER BOLTS • WOOD KNOB SCREWS • DRIVE SCREWS

WAREHOUSES: NEW YORK, CHICAGO, DALLAS, LOS ANGELES

Southern SCREW COMPANY
STATESVILLE • NORTH CAROLINA

CIRCLE 280 ON READER-SERVICE CARD

STROMBERG-CARLSON

"BB" Series Relays

For your automation ...computing...control circuit applications... "Telephone Quality" at an ordinary price

To meet your needs for precision and durability in automation, computing and control circuitry, this relay provides *telephone quality* at an ordinary price.

The "BB" Series Relay accommodates up to 100 Form A spring combinations. It incorporates such important advantages as twin contacts, knife-edge pivot and special frame-armature construction. Like all Stromberg-Carlson relays, it is built to operate under extreme ranges of temperature and humidity. *Prompt delivery is available on all orders.*

This catalogue will give you complete technical details and specifications. We will gladly send you a free copy on request. Please ask for Catalogue T-5000R.

S-C STROMBERG-CARLSON

STROMBERG-CARLSON

A DIVISION OF GENERAL DYNAMICS CORPORATION

TELECOMMUNICATION INDUSTRIAL SALES

1 6 CARLSON ROAD, ROCHESTER 3, N. Y.

CIRCLE 79 ON READER-SERVICE CARD

Transistor Power Supply

60 V, 3 Amp Capacity

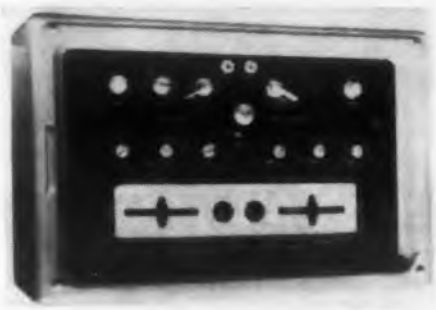
Model .6-3MB dc power supply offers the highest current capacity of the company's transistor power supply line. Output is 0 to 60 v dc, continuously variable, at 3 amp max. No derating of output current or of regulation and ripple specifications is necessary over this range. Regulation is 20 mv change no load to full load, or for line voltage change of 105 to 125 v ac. Ripple and internal noise are below 1.5 mv rms. Unit is designed for very low output impedance and fast recovery time. One per cent meters are supplied.

Dressen-Barnes Corp., Dept. ED, 250 N. Vinedo Ave., Pasadena, Calif.

CIRCLE 80 ON READER-SERVICE CARD

Universal Bridge

Seven Direct Reading Ranges



This instrument, type B221, is a highly accurate transformer ratio arm type bridge. It provides facilities for two, three or four terminal measurements of impedance or transfer admittance at an operating frequency of 1592 cps. Ranges covered are 0.0002 μμf to 11 μf, 10^{-1} to 10^{-8} mhos, and 1 mh to infinity, all in 7 ranges with ± 0.25 per cent accuracy. Measurement is unaffected by the impedance of the test leads, which can therefore be of any length. Cyphers, decimals and units of measurement are given in direct digital readout. A low impedance adapter type Q221 also is available, which provides an additional four ranges.

Robertshaw-Fulton Controls Co., Dept. ED, 2920 N. Fourth St., Philadelphia 33, Pa.

CIRCLE 81 ON READER-SERVICE CARD

SUPER-TEMP makes teflon insulated wires and cables perform to all kinds of tricky specifications...with wide margins of reliability. But the performance our customers like best is the SUPER-FAST DELIVERY. Need it fast . . . see us first . . . SUPER-TEMP'S management team will take personal interest in your problems.

HIGH QUALITY TEFLON* INSULATED

Magnet Wires
Hook-up Wires
Miniature Cables
Jumbo Cables
Lead Wires
Lacing Cords
Tubing
Specialty Wires

TEFLON TAPE PRODUCTION FACILITIES

FREE

36 Page Catalog
Contains Valuable Data and Specifications

*Du Pont's Polytetrafluoroethylene

Super-Temp

American Super-Temperature Wires, Inc.

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Agents in principal electronic manufacturing areas

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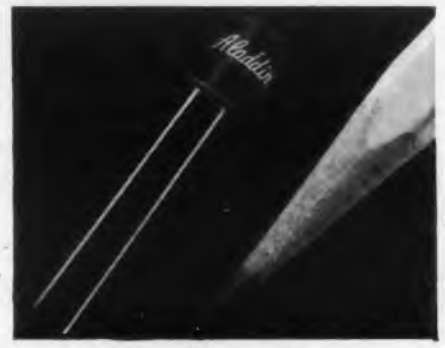
STATE _____

CIRCLE 82 ON READER-SERVICE CARD

WHERE RELIABILITY COUNTS...

Aladdin® ELECTRONICS

MICRO-MINIATURE COMPONENTS ARE BEING USED TO MINIMIZE MASS and VOLUME IN MODERN EQUIPMENT



Aladdin

INDUCTORS

Standard increments of inductance up to ONE HENRY... Operating temperatures up to 125° C.
Size: ..... .285" dia. .300 to 350" long
Weight: ..... .73 gram

Write for Bulletin 54.

Aladdin

PULSE TRANSFORMERS

Described in a new supplement to the Aladdin Pulse Transformer Encyclopedia.

189 standard catalog units, ideal for transistor circuit applications.

Write for the complete encyclopedia (Bulletin 55).

Aladdin® ELECTRONICS

A Division of Aladdin Industries, Inc.
715 Murfreesboro Road
Nashville, Tennessee
Tarrytown, N.Y.; Pasadena, Calif.

New Products

Hydraulic Vibrator

20,000 Lb at 600 CPS

This vibrator, designated type F-20, employs a simple hydraulic-mechanical system to produce forces up to 20,000 lb at frequencies up to 600 cps. Smoothness of wave form is achieved by a piston design making possible acceleration levels up to 50 g. The piston is designed to carry loads up to 100 lb.

L. A. B. Corp., Dept. ED, P.O. Box 278, Skaneateles, N.Y.

CIRCLE 84 ON READER-SERVICE CARD

Silicon Power Rectifiers

Four Types Cover 200-1000 Ma

Silicon Rectifiers type 1N253, 1N254, 1N255, and 1N256 are designed for use in the temperature range —65 to 150 C. The 135 C case temperature ratings of the rectifiers are as follows: average forward currents and maximum rms voltages are respectively 1000 ma and 65 v, 400 ma and 135 v, 400 ma and 270 v, and 200 ma and 400 v. A glass-metal hermetically sealed package with a solid copper base combines a high thermal conductivity with small size.

Microwave Associates, Inc., Dept. ED, Burlington, Mass.

CIRCLE 85 ON READER-SERVICE CARD

◀ CIRCLE 83 ON READER-SERVICE CARD

500-v Test Megohmmeter

Battery Operated

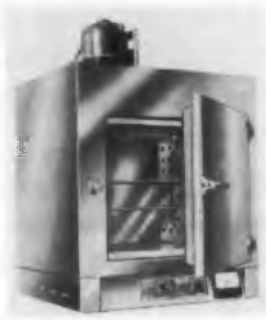
Utilizing a 500-v dc test potential, model 2030 portable megohmmeter is a battery operated transistorized instrument. It is especially suited for measuring leakage of transformers, motors, cables, condensers and insulating materials. Low resistance in series with component under test provides very short charging time for large condensers. A calibration position is provided to check accuracy of the regulated 500-v test potential. Resistance range is 5 meg to 10 million meg. Accuracy is ±3 per cent to 100,000 meg, and ±5 per cent to 10 million meg.

Freed Transformer Company, Inc., Dept. ED, 1787 Weirfield Street, Brooklyn, N.Y.

CIRCLE 86 ON READER-SERVICE CARD

Convection Oven

Horizontal Airflow



A series of bench model Stabil-Therm mechanical convection ovens have horizontal airflow for air temperature uniformity. The ovens have a temperature range to 500 or 650 F. Inside volume unit is 3.5 cu. ft.

Blue M. Electric Co., Dept. ED, 138th & Chatham, Blue Island, Ill.

CIRCLE 87 ON READER-SERVICE CARD

CIRCLE 88 ON READER-SERVICE CARD ➤

how large is small?

DAVEN'S NEW MINIATURE WIRE WOUND RESISTORS PROVIDE AS MUCH AS 400K RESISTANCE IN 1/4" x 5/16" SPACE

DAVEN's fully encapsulated, miniature, precision wire wound resistors offer the design and development engineer the solution to critical space limitation problems. DAVEN's advanced techniques provide the needed resistance value in a minimum of space, without sacrificing reliability. Where space conservation is a prime factor in your design, specify DAVEN miniature wire wounds.

Types and Specifications

Type	Dia.	Length	Max. Ohms	Max. Watts
1274	3/16	3/8	100K	0.25
1273	1/4	5/16	400K	0.25
1283	1/4	5/16	400K	0.25
1284	1/4	27/64	.5 Meg.	0.25
1250	1/4	1/2	900K	0.33
1170A	7/16	1/2	1.2 Meg.	0.50
1170	1/2	1/2	1.8 Meg.	0.50

• Fully encapsulated • Meet and exceed all humidity, salt water immersion and cycling tests as specified in MIL-R-93A, Amendment 3 • Operate at 125°C continuous power without de-rating • Can be obtained in tolerances as close as ±0.02% • Standard temperature coefficient is ±20PPM/°C.

THE DAVEN CO.
Livingston, N. J.

Special temperature coefficients can be supplied on request.

Write for our new resistor catalog.

Pioneering Specialists in

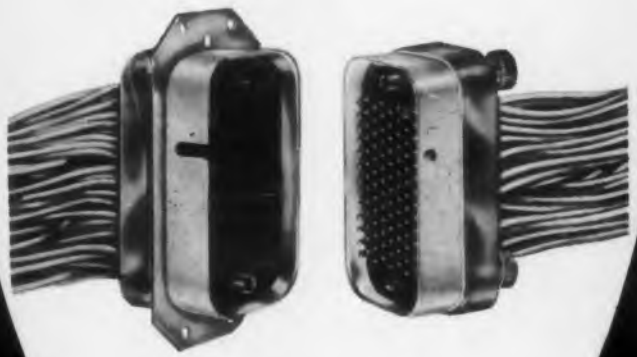
CONNECTORS

CONTROLLED HIGH QUALITY SINCE 1941

QUALITY Control in the manufacture of electrical and electronic Connectors is an original concept rigidly adhered to by Winchester Electronics since this company received the first of many patents honoring its "original" art.

This Quality Control, from design inception to final assembly of all its critical parts, assures you of the unqualified reliability of every Winchester Electronics Connector delivered to you.

Specializing *exclusively* in Connectors, Winchester Electronics' many patents . . . and numerous other original designs . . . are the product of continuous research, development of sound ideas . . . *and broad experience!*



Illustrated here is a typical Series "EMRA" Environmental Connector shown fully wired and potted.

WINCHESTER ELECTRONICS
INCORPORATED

West Coast Branch: 1218 Fifth Street, Santa Monica, Calif.

CIRCLE 89 ON READER-SERVICE CARD

New Products

10 Turn Potentiometer

350-450,000 Ohm Range

Designed for servo mounting, model 7603 is 1-13/16 in. in diam, with a total resistance range of 350 to 450,000 ohms. Power rating is 5 w at 40 C, and the ambient range is −55 to +80 C.

Beckman-Helipot Corp., Dept. ED, Newport Beach, Calif.

CIRCLE 90 ON READER-SERVICE CARD

Miniature Connectors

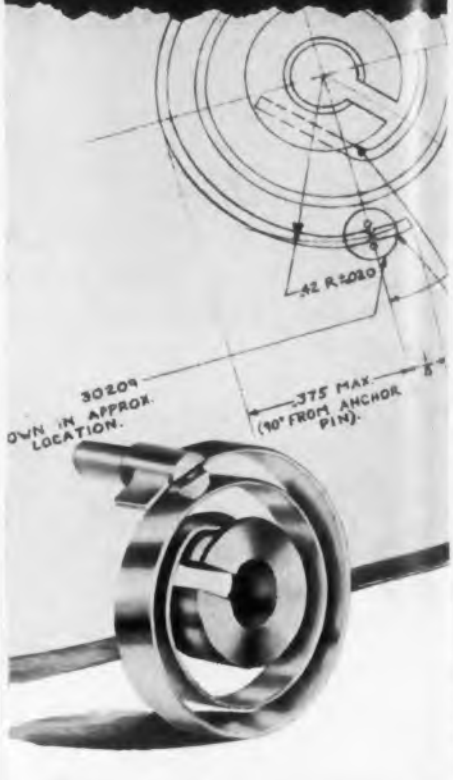
Visual-Check Locking Device

This series of miniature connectors feature a quick dis-connect locking device which locks automatically when engaged. The connector has an orange colored band which is visible only when connector is dis-engaged and is covered when engaged. Good environmental characteristics are achieved by a resilient inter-facial gasket between the plug and receptacle mating faces which is compressed when connector is locked. The connector has been tested under water at 16 psig pressure for 1 hr and has been found completely waterproof. They are available in 1 through 13 no. 20 contacts with a choice of mounting styles or as a cable connector with hermetic insulation.

Viking Industries, Inc., Dept. ED, 21343 Roscoe Blvd., Canoga Pk. 1, Calif.

CIRCLE 91 ON READER-SERVICE CARD

RIGID SPRING SPECS?



We're used to them here at John Chatillon & Sons. Specifications calling for incredibly close tolerances and little-known alloys are capably met by experienced hands and brains.

When the machinery you design calls for precision springs seemingly not available, consult with the Spring Engineers at John Chatillon & Sons. You'll save time, and get springs designed for your most exacting needs.

Over 120 years of experience and training await your call. Get into the habit of contacting Chatillon . . . Write Department D-3.

JOHN CHATILLON & SONS

85 CLIFF STREET, NEW YORK, N. Y.

Manufacturers of Precision Springs and Force Measuring Instruments Since 1835.

CIRCLE 92 ON READER-SERVICE CARD

Miniature Accelerometers

Weigh 0.5 Gram

The 600 series of accelerometers have been developed for shock and vibration measurements of small components and systems. The transducers employ barium titanate in compression for the sensing element attaining a high natural frequency of 150 kc and a sensitivity of 1 mv per g. The acceleration range extends from 1 g to 40,000 g with a frequency coverage from 5 cps to 50 kc. The units are equipped with 6 ft lengths of a miniature low-noise cable designed for extreme flexibility to minimize spurious response of the test system resulting from whipping effects and cable loading.

Columbia Research Labs., Dept. ED, MacDade Blvd. and Bullens Lane, Woodlyn, Pa.

CIRCLE 93 ON READER-SERVICE CARD

Tape Recording Heads

Long Wear

This line of high output magnetic tape recording heads includes monaural and stereophonic record, playback, record-playback and erase models, and stacked heads for computer work. The heads are made of a hard material which contains a special lubricant to reduce tape friction and head wear to a minimum.

Crest Electronic Corp., Dept. TD, Chelsea, Mich.

CIRCLE 94 ON READER-SERVICE CARD

CIRCLE 95 ON READER-SERVICE CARD ➤

ALLIED'S MHJ RELAY
Built for Shock and Vibration

10-55 cps at 0.125 inch double-amplitude • 55-2000 cps at 20g

Here are the facts:

Contact Ratings:
Low level up to 2 amperes non-inductive or 1 ampere inductive at 29 volts d-c or 115 volts a-c

Contact Arrangement:
MHJ-12D: 4 PDT
MHJ-18D: 6 PDT

Temperature:
Minus 65°C to plus 125°C

Vibration:
10-55 cps at 0.125 inch double-amplitude
55-2000 cps at 20g

Operating Shock: 100g

Weight:
MHJ-12D: 3.0 ounces
MHJ-18D: 4.2 ounces

Insulation:
1000 megohms minimum

Dielectric Stress:
1000 volts rms at sea level;
500 volts rms at 70,000 feet

Initial Contact Resistance:
.03 ohms maximum at .01 to 2 amps

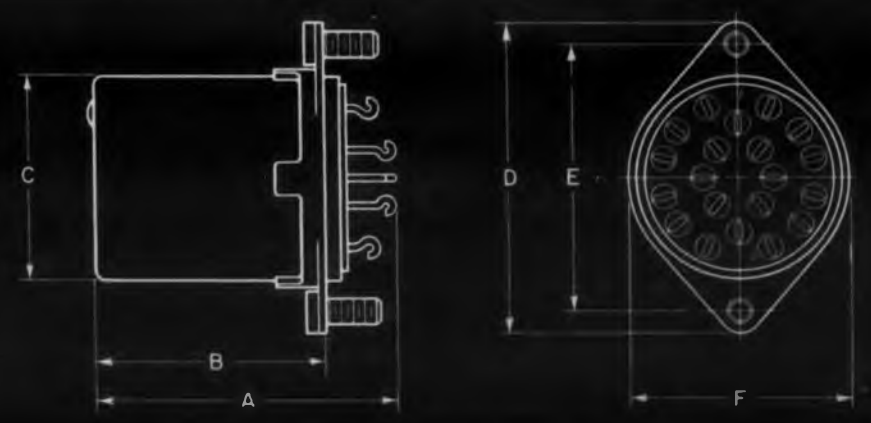
Operate Time:
10 milliseconds or less at rated voltage at 25°C

Release Time:
5 milliseconds or less at rated voltage at 25°C

Now with Stabilized Construction*

TYPE MHJ
ACTUAL SIZE

*Includes materials and processing necessary to minimize contact resistance variations and dielectric deterioration during life due to contact contamination, mechanical wear and shift of adjustments with temperature.

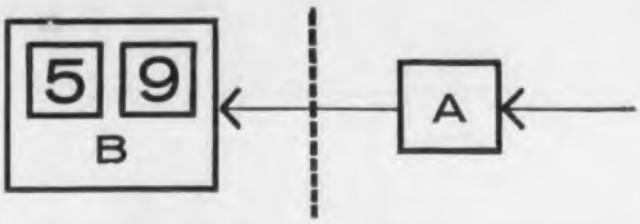


MOUNTING #6-32 NC-2A THD. (2) STUDS

	A	B	C	D	E	F
MHJ-12D (4 Pole)	1 3/4 max.	1 5/16	1 3/64	1 21/32	1.406	1 1/8
MHJ-18D (6 Pole)	1 3/4 max.	1 5/16	1 3/16	1 13/16	1.562	1 1/16

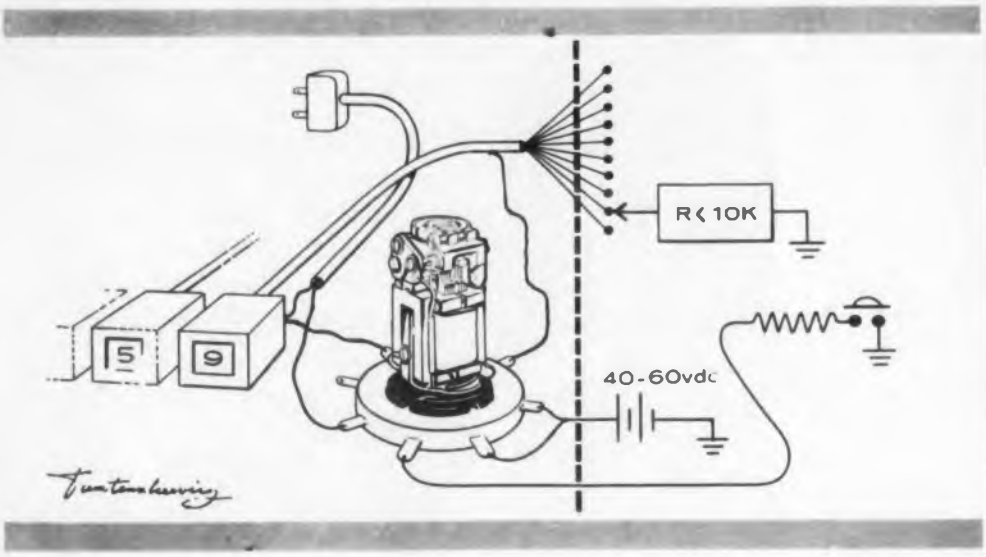
ALLIED CONTROL

ALLIED CONTROL COMPANY, INC., 2 EAST END AVENUE, NEW YORK 21, N. Y.



fast switch ON THE NUMBERS

Taking coded information, translating it into decimal form (A) and displaying it on the wall (B) seems to be a matter of concern to a fair number of people these days. Part "B"—making the right number come up — offers an opportunity to demonstrate the virtues of a Sigma Series 72 polar relay. As explained below, halting of display devices can be accomplished in a variety of ways. But because of the 72's combination of high speed, precision and sensitivity, the problem of consistently keeping up with a high speed number drive on very little signal power is solved all at once.



The breadboard diagram to the left of the dashed line has been drawn by our artist, who feels that schematic symbols can never do justice to a Sigma Type 72AOZ-1000-TS High Speed Polar Relay. Of course this may be an expensive way to run a cycledec, but if you are in a hurry you don't want to have to dish up nine separate pulses from the info department (right of the dashed line). Besides, what if it missed counting one of them? To be sure, the relay could be eliminated and the cycledec run directly through its own internal switch contacts. But then AC supply voltage would have to be put on all switch points except the designated one. This would make it rough for any little solid state peanut you tried to put in that box marked R < 10K.

As it is, the 72 will remove the supply from the cycledec .0005 seconds after it lands on the right number, and restore the supply .0008 seconds after you move the ground to another switch point and "push" the reset button. Incidentally, completion of selection puts power on the other contact of the 72, which can then run lights, bells or some other success signal.

Some of the virtues of a Type 72AOZ-1000-TS TCP* SPDT polar relay are:

Contacts rated 500,000,000 operations 60 ma. 120VDC

Coils, two, 1000 ohms each

Either-side stable, operate 0.56 ma. either way either coil

**Armature tungsten, fixed contacts copper-palladium*

You can get one such 72 relay with removable dust cover for $30.00, or for less money in quantity. Samples are available on order, or a bulletin simply on request.

SIGMA INSTRUMENTS, INC.

91 Pearl Street, So. Braintree 85, Mass.

CIRCLE 96 ON READER-SERVICE CARD

New Products

Antenna Positioners

Support 800 Lb

Series 41 remotely controlled antenna positioning tables are designed to support loads up to 800 lb with a maximum unbalance of 2000 ft-lb. Synchro output signals are provided for driving remote indicators and antenna pattern recorders. Other models include azimuth over elevation rotation and elevation over azimuth.

Scientific-Atlanta, Inc., Dept. ED, 2162 Piedmont Rd. N. E., Atlanta, Ga.

CIRCLE 97 ON READER-SERVICE CARD

10 W Resistor

Measures 3/4 In. Sq.

Measuring 3/4 in. sq, not including terminals, the RH-10 will dissipate 10 w, derating to 0 at 275 C when panel mounted on aluminum. Conservative wattage rating in free air is 6 w. The wire wound resistor is available in tolerances of ± 0.05 to ± 3 per cent with a resistance range from 0.05 to 30,000 ohms, depending on tolerance specified. The wound element is suspended in a shock absorbing compound, which also completely seals it from extreme environmental conditions. The unit is permanently inserted into the black anodized aluminum housing.

Dale Products, Inc., Dept. ED, Box 136, Columbus, Neb.

CIRCLE 98 ON READER-SERVICE CARD

GIVE GREATER PERFORMANCE . . . SAVE MONEY

Any combination of precious metals over precious metals . . . precious metals over base metals . . . base metals over precious metals . . . base metal combinations . . . from commercial purity to thermocouple purity, in sizes down to .001" diameter.

Before you order your next wire requirements consult BISHOP experts. Depend on BISHOP skills. BISHOP is now serving the aircraft, electronic, atomic and power industries . . . fulfilling their special wire needs.

BISHOP, pioneers in precious and base metal fabrications for over a century can serve you better and save you money.

MANUFACTURERS OF

Foils

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Clad Metals

Composite Wires

Laboratory Apparatus

Precious Metal Salts and Solutions

Stainless Steel, Nickel & Nickel Alloy Tubing

JB

J. BISHOP & CO. PLATINUM WORKS

Department CW

Malvern, Pennsylvania

CIRCLE 99 ON READER-SERVICE CARD

12-V Detector-Amplifier Tube

Combined Diode and Tetrode

For use in 12-V systems, type 12DL8 is a 9-pin combined twin diode and space grid tetrode with independent unipotential cathodes. The diode section is intended for use as a detector while the tetrode section is a power amplifier designed to drive a transistor audio output stage.

Sylvania Electric Products, Inc., Dept. ED, 1740 Broadway, New York 19, N.Y.

CIRCLE 100 ON READER-SERVICE CARD

Angular Accelerometer

1 Per Cent Accuracy

Model 6-9 angular accelerometer is designed for controlling spin or rotation of aircraft and missiles. A spring restrained, bearing supported, cylindrical rotor operates a wire-wound potentiometer with linear or functional output, giving precise indications of rotational acceleration. The unit is available in ranges of ± 2 rad per sec^2 up to a maximum of ± 4000 rad per sec^2. Steady acceleration of 50 g on each axis causes no damage or change in calibration. Linear acceleration error is less than 1 per cent. Withstands vibration of 0.06 in. da at 10 to 55 cps and ± 10 g at 55 to 2000 cps. Each axis will withstand shocks of 15 g without damage or change of calibration.

Edcliff Instruments, Dept. ED, P.O. Box 307, 1711 S. Mountain Ave., Monrovia, Calif.

CIRCLE 101 ON READER-SERVICE CARD

CIRCLE 102 ON READER-SERVICE CARD ➤

for: MISSILE, ELECTRONIC and INDUSTRIAL CONTROLS

NEW ELECTRO SNAP modular mounting

lighted push-button panel switch

Simplifies Control Panels; Saves Space, Cuts Cost. May be used singly or in "stacked" arrangement.

3 UNITS IN 1 COMPACT MOUNTING

NAME-PLATE + PILOT-LIGHTS + PUSH-BUTTON SWITCH UNIT

In one compact assembly, this unit provides new space and cost economy whether used individually or in "stacked" arrangement. You get quality appearance with "thumb-size" operation.

TWO-PIECE, PLASTIC NAME-PLATE PROVIDES EASY COLOR-CODING; SIMPLIFIES OPERATION IDENTIFICATION

Virtually any operating condition can be identified with this push-button name-plate arrangement. The snap-in button is easily removed for insertion of slip-in name-plate. Use of various colored button bases, or various colored lamps, permits wide range of codings and monitoring.

This new Electro-Snap push-button panel switch efficiently combines a name plate, pilot light assembly and a switching unit in one compact modular assembly. The trim, streamlined design permits easy "stacking" on control panels or consoles. It eliminates congestion by replacing three individual units (nameplate, pilot light assembly and switch unit). You can achieve greater operating efficiency and quality appearance while making substantial savings in space and cost. A wide variety of configurations is available in:

- **circuit arrangements of switch and pilot lights**
- **colored buttons for color coding**
- **colored lights for color monitoring**

The operating and indicating combinations possible through the variation of arrangements provides almost unlimited applications for sequencing, movement-limit, start-and-stop, position-indicating and similar control operations.

Check the design and construction advantages of this significant advance in panel switches for your own applications. For further details contact your local representative or write to:

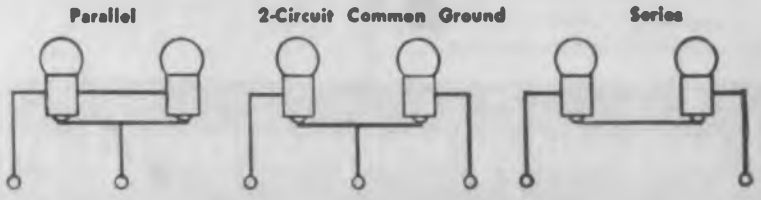
ELECTRO-SNAP SWITCH & MANUFACTURING COMPANY
4216 W. Lake St. • Chicago 24, Ill.
VA 6-3100 TWX #CG-1400

- **Snap-in button permits easy lamp replacement from front of panel**
- **Barrier can be color-anodized to your specification**

The lighted push-button switch assembly is also available without the switch unit for use where only pilot light duty is required.

VARIETY OF CIRCUIT ARRANGEMENTS PERMITS WIDE RANGE OF INDICATING AND SWITCHING COMBINATIONS

- **Lamp circuit can be wired independently of switch circuit—or through switch unit.**
- **Since two lamps are provided, independent external circuits can be indicated on single unit with different lamp colors and white push-button.**
- **Complete push-button switch unit or pilot-light assembly can be supplied in any of the three following circuit arrangements.**

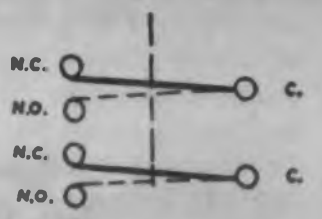


- **6V. or 28V. lamps may be used (solder terminals on lamp assembly)**

Switch terminals available
- **Solder** • **Turret** • **Double Turret** • **AMP quick-disconnect**

Switching Circuits to Meet Your Needs

The double-pole, double-throw switching unit may be wired normally-open or normally-closed.



a standard ELECTRO-SNAP UNIT

- Compact
- Space Saving
- Precision-Engineered
- Low Cost

Rotary Transducer

Inductive Sensing

Model RT-22A-120 employs variable permeance to give infinite resolution, high sensitivity and accuracy. Null position can be shifted electrically at will. The transducer measures 1-1/4 in. diam and operates into standard measurement and control equipment.

Crescent Engineering & Research Co., Dept. ED, 5440 N. Peck Rd., El Monte, Calif.

CIRCLE 103 ON READER-SERVICE CARD

Packaging

High Shock Absorption

This package consists of a fluted corrugation which holds and protects inserted objects such as tubes, capacitors, transistors and other components. The main feature of the packaging is the spring-clip action of the partitions. Inserted objects are held in a cushion of air, giving built-in shock absorption. The packs are also designed to hold rectangular and odd-shaped items.

American Rondo Corp., Dept. ED, 100J Sanford St., Hamden 14, Conn.

CIRCLE 104 ON READER-SERVICE CARD

Low-Mu Triode

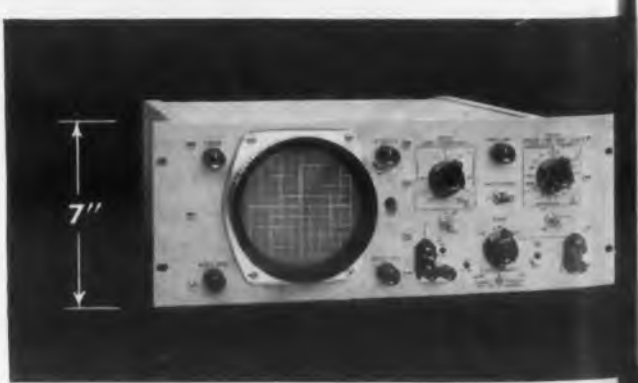
Color TV Deflection Tube

Designated Type 6CK4, this high permeance, low-mu triode is designed for use as a vertical deflection amplifier tube, and features a maximum plate dissipation of 12 w and an average

Fast Delivery!

Look at

New -*hp*- 120A Oscilloscope and -*hp*- 120AR Rack Mount Oscilloscop
Note space-saving 7" high panel on rack mount instrument.



CIRCLE 105 ON READER-SERVICE CARD

this all-new -*hp*- $435 oscilloscope!

- **Check the simple panel. Few controls—faster, easier measuring!**
- **Check the specs; DC to 200 KC, automatic trigger, high stability, accuracy**
- **An -*hp*- thoroughbred; finest quality, rugged, dependable, portable**

Let's spell out this new -*hp*- oscilloscope very fast.

It's medium priced, deliberately engineered for simple operation, accuracy and dependability. Lightweight, only 32 pounds.

There's absolutely no compromise with quality or features to bring you the attractive price.

It has automatic triggering, no adjustment over entire range. Yet a front panel adjustment can cut out automatic triggering and base line to provide a bright, steady trace for photography. Only -*hp*- offers this.

The oscilloscope has sweep speed range from 1 μsec/cm to 0.5 sec/cm. Speeds are slow enough for mechanical or medical work, fast enough for most rapid transients. There's a "times-5" sweep expansion and a vernier to give continuous control of sweep speed. There are 15 calibrated sweeps, 1-2-5 sequence.

Instantaneous automatic synchronizing is available on any internal or external voltage; instrument may also be triggered by line voltage.

The DC-coupled vertical amplifier has a pass band of 200 KC. Calibrated vertical and horizontal amplifiers have identical bandwidths for phase measurements. High sensitivity permits working directly from transducers in many cases.

High stability is insured by regulated power supplies, including a transistor regulated vertical amplifier filament supply.

The 5AQP1 cathode ray tube comes out easily through the front panel: you change filters in 30 seconds. The 5AQP1 is the same CRT used in more expensive -*hp*- 'scopes. It provides linear response, uniform trace intensity and perfect focus over the entire tube face. Fully illuminated graticule, CRT beam adjusting lever.

You might call the -*hp*- 120A the first *multi-purpose deluxe* oscilloscope ever offered at medium price. Here is calibrated performance for precision lab work and brute ruggedness for the production line. -*hp*- 120AR Rack Mount is ideal for fixed installations and test console applications.

Call your -*hp*- engineer for a demonstration, or write direct for details. Fast delivery!

BRIEF SPECIFICATIONS

SWEEP

Trigger selector: internal, external, line. *Triggers automatically* on 0.5 cm. display internal or 2.5 volts peak-to-peak external. Displays base line in absence of signal. No sync controls required.
15 calibrated sweeps in 1-2-5 sequence, 5 microseconds/cm to 200 milliseconds/cm ±5% accuracy; vernier 2.5/1 range (lowers sweep speed). 5 times sweep expansion, applicable on all ranges.

VERTICAL AMPLIFIER

Bandwidth: DC Coupled – DC to 200 KC.
AC Coupled – 2 cycles/sec to 200 KC.
4 calibrated sensitivities: 10 mv/cm, 100 mv/cm, 1 v/cm, 10 v/cm; ±5% accuracy; 10/1 vernier.
Balanced input available on 10 mv/cm range.
Internal amplitude calibrator provided.

HORIZONTAL AMPLIFIER

3 calibrated sensitivities: 0.1 v/cm, 1 v/cm, 10 v/cm; 10/1 vernier.
Bandwidth same as vertical amplifier.

GENERAL

Cathode Ray Tube: 5AQP1 with 2500 v accelerating potential.
Intensity Modulation: terminals on rear.
Power Input: approximately 130 watts.
All DC power supplies regulated.
Size: Cabinet, 9¾" x 15" x 21¼"; 32 lbs.
Rack, 19" x 7" x 18"; 31 lbs.
Price: -*hp*- 120A or 120AR (Rack Mount), $435.00.

Data subject to change without notice. Prices f.o.b. factory.

HEWLETT-PACKARD COMPANY
4620K Page Mill Road
Palo Alto, California, U.S.A.
Cable HEWPACK • DAvenport 5-4451
Field engineers in all principal areas
4620

-*hp*- provides industry's newest, most complete oscilloscope line!

CIRCLE 105 ON READER-SERVICE CARD

cathode current of 100 ma. With a maximum peak positive-pulse plate voltage of 2000 v (absolute) and a maximum peak cathode current of 350 ma, the 6CK4 is practical for both black-and-white and color TV.

Sylvania Electric Products, Inc., Dept. ED, 1740 Broadway, New York 19, N. Y.

CIRCLE 106 ON READER-SERVICE CARD

Tachometer Generator

45 V per 1000 RPM

Model 1201 tachometer generator operates to a maximum speed of 7500 rpm with a ripple voltage of less than 4 per cent. Output is 45 v dc per 1000 rpm. The unit measures 4 in. long by 2-1/2 in. diam.

Lyndon Aircraft, Inc., Dept. ED, 140-39 Clifford St., Newark, N.J.

CIRCLE 107 ON READER-SERVICE CARD

Delay Line

Total Length of 100 mSec

Precise matching of LC networks makes possible the successful cascading of four 25-msec units, so that complex input waveforms can be delayed a full 100 msec with minimum deterioration. The delay line has 100 external taps, permitting the delay to be selected in 1-msec increments. Input and output sections of the four 25-msec units are externally disconnectable, thus permitting separate use.

Epsco, Inc., Dept. ED, 588 Commonwealth Ave., Boston 15, Mass.

CIRCLE 108 ON READER-SERVICE CARD

APPLICATIONS

Electrical and Acoustical Measurements
Electrical Communication Systems (Selective Calling)
Remote Operation and Supervisory Control of Machinery and Apparatus
Electrical Computers and Telemetering Systems
Electro-Mechanical Bandpass Filters

Frahm Oscillator Controls, Type ROC, make possible the design and construction of inexpensive, precision tone generators that are small and light weight. These generators will have accurate output frequency and output voltage with very nearly sinusoidal wave shape.

They can be made with any one nominal control frequency between 20 and 1100 cps. They will control the output frequency of circuits, under specified conditions, constant within ±0.15% of the nominal control frequency.

We particularly encourage your inquiries and correspondence on special applications and problems. If you haven't explored these Frahm Oscillator Controls we'll be glad to send you complete specifications, characteristics, etc. Write for Bulletin 34-ED.

B-706

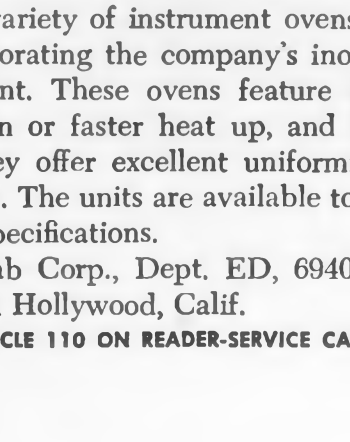
JAMES G. BIDDLE CO.
ELECTRICAL TESTING INSTRUMENTS • SPEED MEASURING INSTRUMENTS
LABORATORY & SCIENTIFIC EQUIPMENT
1316 ARCH STREET, PHILADELPHIA 7, PA.

CIRCLE 109 ON READER-SERVICE CARD

New Products

Instrument Ovens

Rapid Area Heating



A wide variety of instrument ovens are available incorporating the company's inorganic film type element. These ovens feature low power consumption or faster heat up, and being area heaters, they offer excellent uniformity of heat distribution. The units are available to individual customer specifications.

Thermolab Corp., Dept. ED, 6940 Farmdale Ave., North Hollywood, Calif.

CIRCLE 110 ON READER-SERVICE CARD

Thyratron Relay

Controls Large Currents

The model ESS-2 relay is capable of switching currents of 15 amp at 115 v ac through a contact resistance of 10 meg. The relay features high-speed operation at 5 cps, and employs silicone diodes, and a 2050 thyratron.

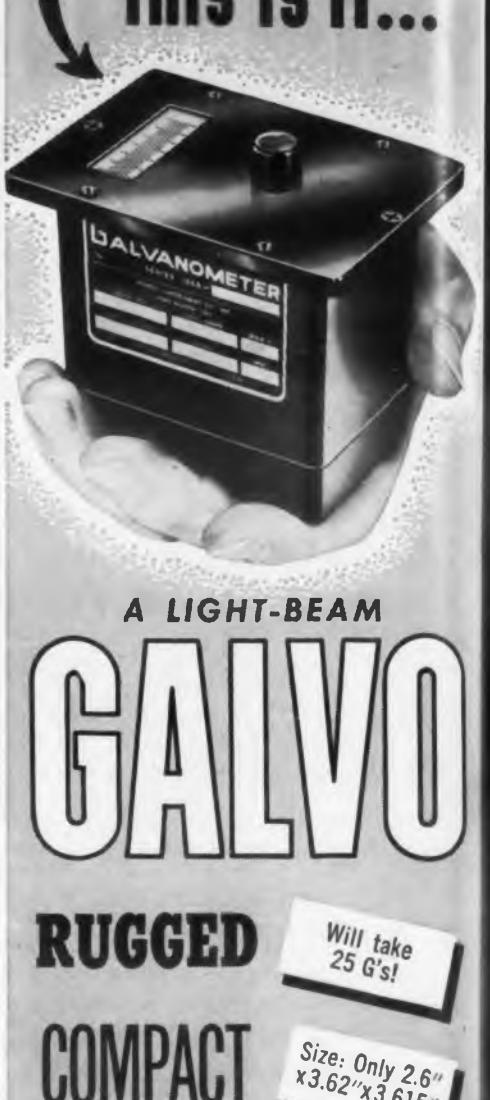
Winstrom, Dept. ED, P. O. Box 452, Northampton, Mass.

CIRCLE 111 ON READER-SERVICE CARD

Telemetering Receiver

Transistorized 50 Mc Unit

Completely transistorized, this crystal controlled single frequency receiver is intended for telemetering applications requiring high performance low power drain at frequencies up to 50 mc. The unit can be supplied with a resonant reed type output relay to permit selective control by means of tone modulation, or with a standard



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.

Resistances: 20, 100, 500 and 1000 ohms. Short period; high speed response. Sealed construction.

For full information please write or wire

HOWELL INSTRUMENT Company
3101 Trinity St. • Fort Worth 7 Texas

SALES-ENGINEERING OFFICES
VALLEY STREAM, L.I., N.Y.: 108 So. Franklin • LO 1-9220
DAYTON, OHIO: 209 Commercial Bldg. • BA 4-4565
COMPTON, CALIFORNIA: 105 N. Bradfield St. • NE 6-8970

CIRCLE 112 ON READER-SERVICE CARD

If it's

QUALITY

you need in

TEFLON®

...then you need

CHEMPLAST

Take rods of "Teflon," for example . . . Chemplast produces top-quality rods, certified to meet the most exacting requirements. Rods of "Teflon" made by Chemplast are produced under closely controlled conditions . . . carefully inspected before shipment.

Here's what you get from Chemplast:

- **STRESS-RELIEVED RODS** . . . no further treatment necessary.
- **UNIFORM DENSITY.**
- **NO CONTAMINANTS** . . . snow-white color.
- **ALL SIZES** of rod from 1/32" to 2" . . . to the nearest 0.001" at no extra cost. Sizes over 2" can be supplied in molded rod.
- **ANY LENGTH** . . . normally supplied in 12-foot lengths, but we'll ship it any length you say.
- **ALL PRODUCTS FOR ELECTRONICS INDUSTRY** made from virgin "Teflon" . . . meet AMS 3651B and MIL-C-17B specifications.
- **IMMEDIATE DELIVERY** on all sizes.

Chemplast also supplies tape, tubes, and sheets of "Teflon" . . . and wire coated with "Teflon." Write today for a prompt quotation.

CHEMPLAST INC.

CENTRAL AVE., EAST NEWARK, NEW JERSEY

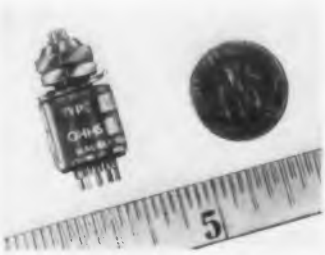
TEFLON is the Du Pont Company's trade-mark for its tetrafluoroethylene resins.

CIRCLE 113 ON READER-SERVICE CARD

audio output circuit delivery 100 mw. A plug-in sub-chassis arrangement is used. Sensitivity is 2 μv 30 per cent modulated for 65 mw output, with overall bandwidth of 6 kc. An age circuit is provided with a threshold level of 2 μv. Battery power requirement is 40 mw under no-signal conditions, rising to 400 mw for full output.

Industrial Television, Inc., Dept. ED, Clifton, N. J.

CIRCLE 114 ON READER-SERVICE CARD



Trimming Potentiometer

Dissipates 1/2 W at 150 C

Model 50-M14 wirewound trimmer potentiometer will dissipate 1/2 w at an ambient temperature of 150 C. The trimmer is housed in a 1/2-in. diam by 1/2-in. long stainless steel case, sealed against pressure by a Teflon gasket under pressure. Mechanical stops built to withstand 60 oz-in. torque, unit can withstand a 1500 v rms dielectric breakdown test at room temperature.

Maurey Instrument Corp., Dept. ED, 7924 S. Exchange Ave., Chicago 17, Ill.

CIRCLE 115 ON READER-SERVICE CARD

Industrial Power Triode

Radiation Cooled

Internal anode type 7092 power triode is designed for industrial oscillator applications in ultrasonic, induction or dielectric heating equipment. Used in continuous class C operation, 2 kw power can be obtained, and 3 kw in intermittent operation. The thoriated-tungsten filament is rated at 6.3 v, 32.5 amp.

Amperex Electronic Corp., Industrial Tube Div., Dept. ED, 230 Duffy Ave., Hicksville, L.I., N.Y.

CIRCLE 116 ON READER-SERVICE CARD

STANDARD OR SPECIAL FABRICATED
CHASSIS OR CASES

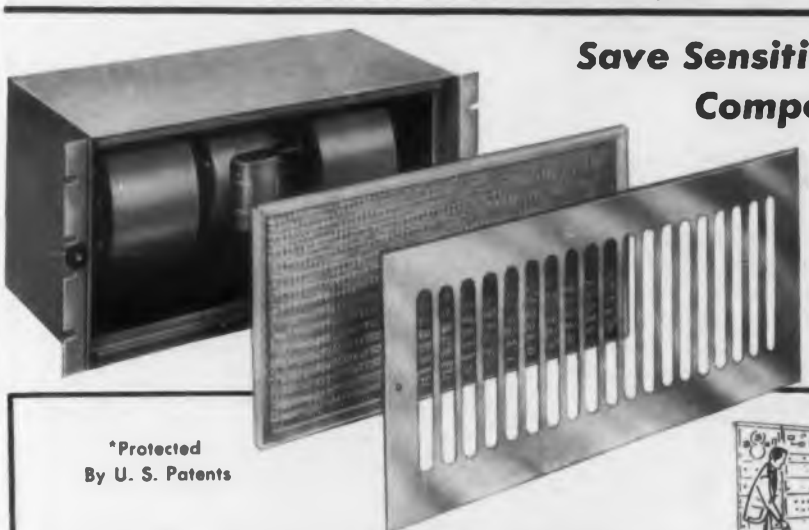
Insuline's standard or special fabricated chassis and cases, using the economical "Rapid-Tooling" method, are known for quality workmanship at low cost. Housings and chassis are made in multiple sizes of aluminum or steel and are designed for maximum accessibility. Available in 3 types — channel-lock, flexi-mount or slip cover.

Standard units are now available — or we can fabricate to your specifications. Write us for quotes. Orders filled promptly.

FREE CATALOGUE

insuline
CORPORATION OF AMERICA
Division of Van Norman Industries
186 Granite St., Manchester, N. H.

CIRCLE 117 ON READER-SERVICE CARD



Save Sensitive Components!

mcLean

*Protected By U. S. Patents

COOL THAT CABINET with McLEAN FANS & BLOWERS*

RACK MOUNTED FOR EASY ASSEMBLY • FIT STANDARD 19" RACKS
STANDARD MODELS FOR OTHER RACK WIDTHS AND ANY ANGLE OF AIR DISCHARGE

Over 15 models available in panel heights of 3½" to 12¼" in increments of 1¾" . . . range 80 to 1200 CFM

Install McLean Fans and Blowers in computers, control units, etc. McLean's small packaged units pressurize cabinet with cool filtered air, keeping dust out. Complete in one unit and ready for use. Standard RETMA notching allows mounting on rack . . . without cutting or fitting. Smart stainless steel grilles . . . easily removable filters.

FREE! *12 Page Cooling Article • 16 Page Catalog • Individual Spec. Sheets*

McLean Engineering Laboratories
Princeton, New Jersey • Walnut 4-4440

Agents in Principal Electronic Manufacturing Areas

CIRCLE 118 ON READER-SERVICE CARD

HELI-COIL® INSERTS... PART OF AMERICA'S SUPERSONIC "SUNDAY PUNCH"!

Heli-Coil Screw-THREAD and Screw-LOCK Inserts are used throughout Convair's B-58 "Hustler". They help combine lightness with exceptional strength and rigidity in the power plant, fuselage, wings, control surfaces and electronic equipment. This adds up to rock-solid structural security for the nation's newest and fastest bomber.

HELI-COIL Screw-THREAD Insert . . . provides stainless steel threads that permanently resist wear, corrosion, stripping, galling and seizing . . . hold fast under vibration and shock. Conforms to military standards and all standard commercial and industrial thread forms.

HELI-COIL Screw-LOCK* Insert . . . new one-piece design provides all the advantages of the Screw-THREAD Insert *plus* an exclusive internally integrated locking feature that eliminates need for lock-nuts and lock-wiring . . . permits repeated disassembly and reassembly with locking action remaining unimpaired. Meets military specifications for locking torque and vibration.

*Pat. App. For

Write for detailed information.

HELI-COIL CORPORATION

401 Shelter Rock Lane, Danbury, Conn. *(A Division of Topp Industries, Inc.)*

In Canada: W. R. WATKINS CO., Ltd., 41 Kipling Ave., S., Toronto 18, Ont.

CIRCLE 119 ON READER-SERVICE CARD

New Products

Temperature Transducer

Has Fast Response

This precision resistance thermometer type of temperature transducer utilizes deposited platinum film techniques, giving an exceptional speed of response. Base resistance is as high as 10,000 ohms, with temperature ranges from −370 to +500 F.

Nacimco Products, Inc., Dept. ED, National City, Calif.

CIRCLE 120 ON READER-SERVICE CARD

Push Button Switch

Miniature Model

The smallest of the 39-1 series, this push button switch is a spst, momentary contact, normally open model, rated at 1/10 amp at 115 v ac resistive. Life expectancy is rated at 200,000 operations minimum at the rated load. The switch measures 1/4 in. diam.

Grayhill, Inc., Dept. ED, 561 Hillgrove Ave., La Grange, Ill.

CIRCLE 121 ON READER-SERVICE CARD

Oscillograph Photo-Recording Paper

Available Pre-Printed

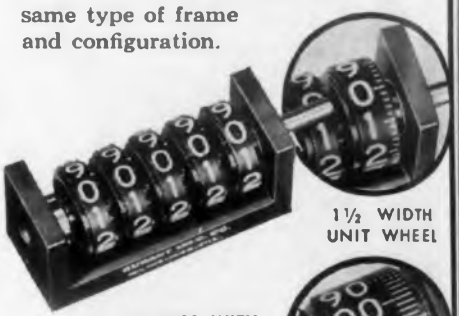
Pre-printed, orthochromatic, photo-recording oscillograph paper can be furnished in any width up to 12 in., slit, packaged, and rolled with or without cores. Amplitude lines are printed to an accuracy of ±0.005 in. Ultra-violet and tungsten

96 STANDARD VARIATIONS

New Y

DIGITAL READ-OUT COUNTERS by DURANT

Design engineers can now select one or more standard units from a range of 96 Instrument Counters, having the same type of frame and configuration.



1½ WIDTH UNIT WHEEL

5-Y-8822 WITH SINGLE WIDTH UNIT WHEEL

SINGLE BANK SERIES
(Right or Left Drive)
2 to 7 Figures

DOUBLE WIDTH UNIT WHEEL

Here is a family group that provides uniformity in digital recording to satisfy nearly all design requirements . . . on radar equipment, navigation instruments, computers, missile tracking devices, and gauging instruments.

They are compact, average weight only 2 ounces, have easy to read figures, white on black . . . speeds to 2500 RPM. Available in single or dual bank style, in 2 to 7 figures capacity . . . three styles of unit wheel configuration.

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Gudebrod flat braided lacing tapes hold harness securely—no bite-through or slip, yet are easy on the hands. Some resist high temperature, some are color-coded . . . and they come wax-coated or wax-free . . . rubber-coated . . . or with special coating. Gudebrod makes many tapes for many purposes, including defense work. Send us your lacing problems or your specifications . . . we can supply the answer to both.

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sensitive photo-recording papers, in any of several speeds can be handled by process which prints through the photo emulsion to the paper base, without desensitizing the emulsion at the point of impression.

The Bristol Company, Dept. ED, P.O. Box 1790, Waterbury 20, Conn.

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High Sensitivity Oscilloscope

1 Mv per Cm

Featuring a 1 mv/cm sensitivity, model 130BR oscilloscope has electrically similar vertical and horizontal amplifiers with less than 1 deg relative phase shift at 50 kc. Balanced signals may be used on the most sensitive ranges of the instrument, therefore several transducers may be connected directly to its terminals. Designed for 19-in. rack mounting, the scope has a frequency range from dc to 300 kc.

Hewlett-Packard Co., Dept. ED, 275 Page Mill Rd., Palo Alto, Calif.

CIRCLE 125 ON READER-SERVICE CARD

Silicon Power Rectifiers

Handle 20 Amp at 135 C

Capable of handling up to 20 amp at case temperatures of 135 C, these rectifiers cover the range of 50 to 350 v peak inverse. Of diffused junction construction, the units operate at ambient temperatures ranging from −50 to +165 C, and can be stored at temperatures from −65 to +180 C. They are available in current ratings of 5, 10, and 20 amp, with peak inverse voltages of 50, 100, 150, 200, 250, 300, and 350.

General Instrument Corp., Automatic Mfg. Div., Dept. ED, 65 Gouverneur St., Newark 4, N.J.

CIRCLE 126 ON READER-SERVICE CARD

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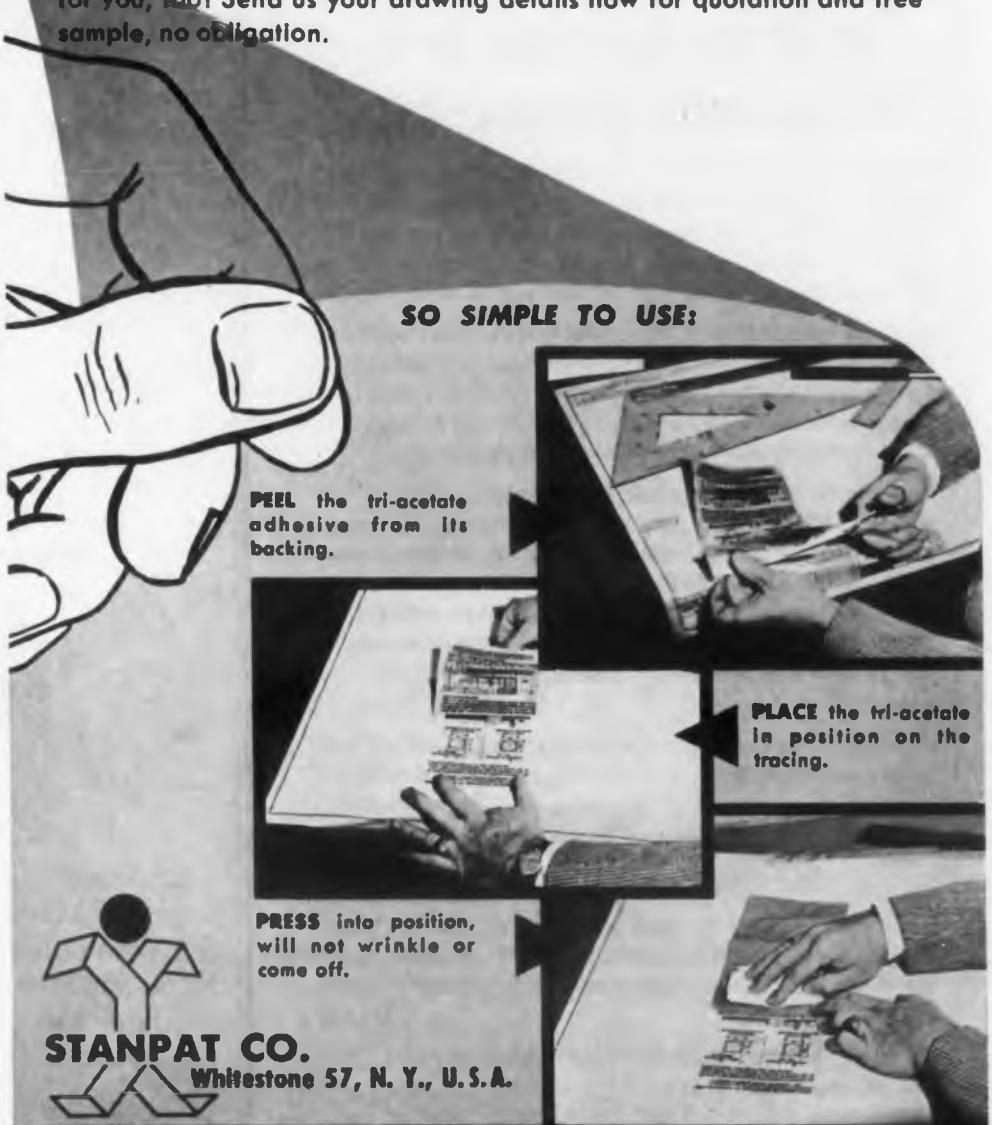

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We mean the very tangible satisfaction of a salary that reflects management's appreciation of your contribution and the years of training that made it possible...a salary that you feel is better than "just adequate". We mean an office without a time-clock. We mean a reasonably small staff—you can't be an individual in an "engineering mill". We mean an engineering-management staff promoted from the ranks. We mean a career-opportunity, not just a job.

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ONE TRANSFORMER ENGINEER

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New Products

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144 Eight Bit Characters

A transistorized magnetic core storage unit, model 144 BQ-8, is designed for delay, temporary storage or buffer use to provide compatibility between two data systems having different operating characteristics. The unit stores 144 characters of eight bits each. Loading or unloading time is 14 μsec. All control circuitry is mounted on plug-in etched circuit boards.

Telemeter Magnetics Inc., Dept. ED, 2445 Pontius, Los Angeles 64, Calif.

CIRCLE 128 ON READER-SERVICE CARD

28 V DC Inverter

Supplies 115-200 V 400 CPS

Designed to invert 27.5 v dc to a regulated source of 115-120 v, 400 cps, at a 3500 va load, this power supply is primarily intended for airborne applications. Model 433 weighs 68 lb and measures less than 19 in. long by 11 in. diam. Both voltage and frequency regulation are obtained by a potted magnetic amplifier regulator. A ±1 per cent excursion on both frequency and voltage is maintained over any combination of load-temperature-input voltage change within the limits of variation in load of 50 per cent and within the temperature range of −65 to +165 F ambient and input voltage of ±5 per cent. The inverter is packaged in a pressure-tight canister and incorporates an integral heat exchanger.

Western Design & Mfg. Corp., Dept. ED, Santa Barbara Airport, Goleta, Calif.

CIRCLE 129 ON READER-SERVICE CARD

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for sealing, gasketing, pressure pads, vibration dampening −100°F to 480°F

Low density COHRlastic R-10470 silicone sponge rubber is completely flexible after 72 hrs. at 480°F, shows no brittleness after 5 hrs. at −100°F. High tensile, tear and elongation. Closed cell construction is non-absorbing. Called out on aircraft and electronic drawings and specifications. Available from stock in sheets 1/16" thru 1/2", in rod .180" thru .585". Special extruded shapes made to order.

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ACTUAL SIZE

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F80-I-G	0- 80 inch grams
F8-I-O	0- 8 inch ounces
F16-I-O	0- 16 inch ounces
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F80-I-O	0- 80 inch ounces
F160-I-O	0-160 inch ounces

Inch pound models and larger foot pound ranges also available

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Compact, Accurate and Inexpensive Secondary Frequency Standard

★ Crystal-controlled fundamental frequencies at 10 kc, 100 kc, 1 Mc and 10 Mc; usable harmonics to 1,000 Mc

★ High stability of 1 ppm/°C after 1 hour warm-up, when used with Type 1201-A Regulated Supply

★ New crystal-mixer circuit produces and detects beats over entire 1,000 Mc range; with self-contained audio amplifier locates calibration points for r-f oscillators without additional equipment

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Type 1201-A Unit Regulated Power Supply: $85.00

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CABLE WRAP.—This latest version of cable wrapping, Heli-Tube 275 F, has a softening point of 275 F or 135 C with no sacrifice of its spring-like quality.

M. M. Newman Co., Dept. ED, Marblehead, Mass.

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SILICON RECTIFIER JUNCTION.—Rated at 200 amp rectified dc output, and in piv voltages of from 100 to 400 v, this series of junctions has been designed to withstand severe shock and vibration.

International Rectifier Corp., Dept. ED, 1521 E. Grand Ave., El Segundo, Calif.

CIRCLE 135 ON READER-SERVICE CARD

SELENIUM RECTIFIERS.—Featuring inverse rms voltage ratings of 45 and 52 v per cell, these rectifiers offer substantial saving over the standard 26 v cell. These cells also have approximately one-half the leakage current at 52 v that standard cells are permitted at 26 v.

International Rectifier Corp., Dept. ED, 1521 E. Grand Avenue, El Segundo, Calif.

CIRCLE 136 ON READER-SERVICE CARD

TEFLON TAPE COAXIAL CABLES.—Electrically equivalent to RG-117/U, types 421-103 (vinyl jacket) and 421-121 (fiberglas jacket) have an impedance of 50 ohms, dielectric strength of 10,000 volts rms and a maximum attenuation of 3 db per 100 ft at 400 mc. Temperature range are −55 to +85 C and −100 to +200 C respectively. The cables are said to provide greatly improved flexibility.

Amphenol Electronics Corp., Dept. ED, 1830 S. 54th Ave., Chicago 50, Ill.

CIRCLE 137 ON READER-SERVICE CARD

POWER TRANSISTOR.—A pnp germanium alloy high voltage type has been added to the renewal line. Designated type 2N296, it is suited for power amplifier and switching applications in which 25 to 60 v supply voltage is required.

Sylvania Electric Products, Inc., Dept. ED, 1740 Broadway, New York 19, N. Y.

CIRCLE 138 ON READER-SERVICE CARD

PUSHBUTTON TEST OSCILLATOR.—Designed for repetitive test and maintenance operations, model 25A has eight factory-preset frequencies within any 10-octave range between 100 cps and 150 kc. Providing a balanced-output impedance of 600 ohms, the unit weighs 6-1/2 lb including batteries.

Consolidated Electrodynamics Corp., Dept. ED, 200 N. Sierra Madre Villa, Pasadena, Calif.

CIRCLE 139 ON READER-SERVICE CARD

RESISTANCE THERMOMETER.—Designed to indicate on its meter, at one central location, temperatures of remote check points.

Barber-Colman Co., Dept. ED, 1300 Rock St., Rockford, Ill.

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We mean a position of full project responsibility; an assignment that draws upon your best abilities; a competent supporting staff of junior-engineers, draftsmen, and technical aides to free you of the routine drudgery that can dilute the pleasure one gets from top-level circuit design.

We mean the self-respect and dignity that can come only from belonging to a hand-picked staff of specialists; men selected on the basis of background, education, and personality; men who can teach you and learn from you, so that the entire staff benefits from an atmosphere of close, cooperative association.

We mean the very tangible satisfaction of a salary that reflects management's appreciation of your contribution and the years of training that made it possible...a salary that you feel is better than "just adequate". We mean an office without a time-clock. We mean a reasonably small staff—you can't be an individual in an "engineering mill". We mean an engineering-management staff promoted from the ranks. We mean a career-opportunity, not just a job.

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New 'Diamond H' Series S Relays Doubly Dependable

in dry circuits

Separately sealed coils isolated from completely inorganic switches within their hermetically sealed cases make these new "Diamond H" Series S aircraft type 4PDT relays supremely reliable in dry circuits.

Physically and electrically interchangeable with "Diamond H" Series R relays, widely used in guided missiles, computers, jet engine controls, automation control systems and similar critical applications because of their broad range of performance characteristics, Series S relays will permit intermixing of dry and wet circuits safely.

Contacts are specially processed and cleaned before assembly; subsequent contamination from gases off the coil insulation is prevented by the coil seal. The switch mechanism has been simplified and is completely inorganic to eliminate other possible causes of malfunctioning.

Standard contact ratings include 30 V., D. C.; 115 V., A. C.; 2, 5, 7-1/2 and 10 A., resistive; 2 and 5 A., inductive, with special ratings available to 350 V., D. C., 400 MA, or other combinations including very low voltages and amperages, or amperages up to 20 for short life requirements. Coils are available with resistances of 1 ohm to 50,000 ohms. Operating time of 24 V. models is 10 ms. or less; dropout less than 3 ms.

Vibration resistances range from 10-55 cycles at 1/16" double amplitude to 55-2,000 cycles at 20 "G"; operational shock resistances to 50 "G" plus, and mechanical shock resistance up to 1,000 "G". Nine standard mounting arrangements, plus a ceramic plug-in socket, are available. The unit displaces only 1.6 cubic inches, excluding terminals.

"Diamond H" engineers will be happy to work out a variation to meet your specific requirements. Tell us your needs . . . or write for bulletin on new "Diamond H" Series S relays.

THE HART MANUFACTURING COMPANY

210 Bartholomew Avenue, Hartford, Conn.

CIRCLE 141 ON READER-SERVICE CARD

New Products

200 AMP SILICON RECTIFIERS.—Five types are being produced with current ratings ranging from 20 to 200 amp dc with piv range from 50 to 300. Features include compact design, and positive or negative base polarity.

Sarkas Tarzian, Inc., Rectifier Div., College Ave., Bloomington, Ind.

CIRCLE 142 ON READER-SERVICE CARD

GYRO COMPASS.—A field instrument capable of automatically determining true north, the equipment can be integrated in a radar system to permit fully automatic alignment of a radar antenna's azimuth.

North American Aviation, Inc. Autonetics Div., Dept. ED, 9150 E. Imperial Highway, Downey, Calif.

CIRCLE 143 ON READER-SERVICE CARD

LOAD TRANSDUCERS.—For measuring weight, force, twist or torque, these cells are enclosed in a shielded metal case approximately 3 x 3 x 2 in. Ranges of the cells are ±1 gr to ±50 lb.

Testing equipment Sales Co., Dept. ED, Murry Hill, N. J.

CIRCLE 144 ON READER-SERVICE CARD

TEST JACKS AND TERMINALS.—Teflon-insulated, these units have been color-coded in ten colors. The line includes test jacks, feed-thrus and standoff terminals for board thicknesses from 1/32 t/o 18 in.

Hiram Jones Electronics, Dept. ED, 2313 W. Olive St., Burbank, Calif.

CIRCLE 145 ON READER-SERVICE CARD

VTVM.—Of compact size, this voltmeter incorporates features of larger instruments including a 6-in. panel meter, frequency response of 20 cps to 100 kc and high input impedance. Full scale ranges of 10 mv to 300 v in 10 db steps are provided.

Metronix, Inc., Pameco Div., Dept. ED, Mill Lane, Waterford, Conn.

CIRCLE 146 ON READER-SERVICE CARD

COIL BOBBINS.—Custom-molded thermosetting forms for transformers are made inexpensively from single cavity tooling utilizing transfer presses. Coil forms with walls as thin as 0.018 in. are available.

Booker and Wallestad, Inc. Dept. ED, 3336 Gorham Ave. Mineapolis 26, Minn.

CIRCLE 147 ON READER-SERVICE CARD

NYLON CLAMPS.—Made of a tough, pliable material, these clamps open wide to slip over wires and cable. Available from 0.562 to 1 in. id.

Holub Industries, Inc., Dept. ED, P.O. Box 903, Sycamore, Ill.

CIRCLE 148 ON READER-SERVICE CARD

CIRCLE 149 ON READER-SERVICE CARD

Johnson pilot lights immediately available for original equipment or in-the-field replacement!

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Available types include: continuous indication neon types; models for high and low voltage incandescent bulbs; standard or wide angle glass and lucite jewels in clear, red, green, amber, blue or opal. Specials, including those meeting military specifications are also available in quantities.

E. F. Johnson Company

3413 Second Ave. S.W. • Waseca, Minnesota

CIRCLE 150 ON READER-SERVICE CARD

25 KW SILICON RECTIFIER.—Model S125-200 has a dc output of 125 v nominal at 200 amp with ac input of 208, 230 or 460 v, 60 cps, 3 phase. Voltage regulation is 5 per cent no load to full load, and ripple is 5 per cent rms.

Perkin Engineering Corp., Dept. ED, 345 Kansas St., El Segundo, Calif.

CIRCLE 151 ON READER-SERVICE CARD

HIGH VOLTAGE POWER SUPPLIES.—Offered in 25 basic models with outputs from 0-1 to 0-250 kv dc at from 5 to 3000 ma. Series 2000 features two-unit construction for remote operation.

Sorensen & Co., Inc., Beta Electric Div., Dept. ED, 333 E. 103 St., New York 29, N. Y.

CIRCLE 152 ON READER-SERVICE CARD

HIGH VOLTAGE POWER SUPPLY.—Output of 0-30 kv at 3 ma. The unit is oil immersed and uses selenium rectifiers and filter to give 0.001 per cent ripple per ma. Housed in a steel tank measuring 16-1/2 x 16-1/2 x 22-1/8 in.

Del Electronics Corp., Dept. ED, 521 Homestead Ave., Mount Vernon, N. Y.

CIRCLE 153 ON READER-SERVICE CARD

TAPE TRANSPORT.—Designed to drive recording tape with extremely low flutter. The unit accommodates up to 4800 ft of 1-in. tape on 14-in. reels.

Telectro Industries Corp., Dept. ED, 35-18 37th St., Long Island City 1, N. Y.

CIRCLE 154 ON READER-SERVICE CARD

FREQUENCY STANDARD.—A transistorized unit weighing 17 oz which offers high accuracy and stability to 70 C. The unit provides a continuous spectrum beyond 200 mc at usable levels, and has 1 mc, 100 kc and 10 kc markers.

Transitron, Inc., Dept. ED, 186 Granite St., Manchester, N. H.

CIRCLE 155 ON READER-SERVICE CARD

DEGAUSSER.—Model 9205-A commercial tank-type degausser is designed for erasing program material and residual noise from magnetic tape and film. Degaussing is accomplished by rotating reels by hand on top of the unit.

Aerovox Corp., Cinema Engineering Div., Dept. ED, 1100 Chestnut St., Burbank, Calif.

CIRCLE 156 ON READER-SERVICE CARD

SPLIT SOLDER TERMINALS.—Available in a wide variety of sizes and mounting studs, either in silicone impregnated ceramic, or with Teflon. Terminals are silver plated brass.

Cambridge Thermionic Corp., Dept. ED, 445 Concord Ave., Cambridge 38, Mass.

CIRCLE 157 ON READER-SERVICE CARD

SPEED CONTROLLED MOTOR.—Type C60 operates a 3/4-hp shunt wound motor on 220-230 v 50-60 cps single phase. Motor has full torque from 300 to 2300 rpm. Controller embodies acceleration control, reverse, coarse and fine speed adjustment.

Gerald K. Heller Co., 1819 Industrial Rd., Las Vegas, Nev.

CIRCLE 158 ON READER-SERVICE CARD

BULOVA

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NEW AM-100

"MULTI-PURPOSE" OVEN

Now Bulova pioneers an entirely *new*, ultra-simplified means of temperature compensation...the "multi-purpose" AM-100 oven.

The AM-100 is designed to yield exacting temperature control of more than just crystals. *Now* entire circuits, components and/or complete sub-assemblies can be housed in one, low cost unit...the highly stable AM-100.

By eliminating costlier, less dependable, heavier and more complex temperature compensating factors, hundreds of design hours can be saved...circuits can be simplified and more dependable, and have a far wider operating range.

THE AM-100 FEATURES: Rugged lightweight construction (less than 7½ oz.); Long life expectancy due to triple insulation on heater winding; High stability ± .1°C.; Standard octal plug-in (stud mounting available); The unit draws 20 watts on initial warm-up, with average dissipation of less than 5 watts after warm-up; Meets vibration tests per MIL-E-5272; Overall 3" diameter x 5" high – cylindrical cavity 1¾" diameter x 2¾" high.

A complete line of precision Bulova ovens are available in quantity, with custom designed units available on request.

BULOVA

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Electronics Division
Woodside 77, N.Y.

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Full Information
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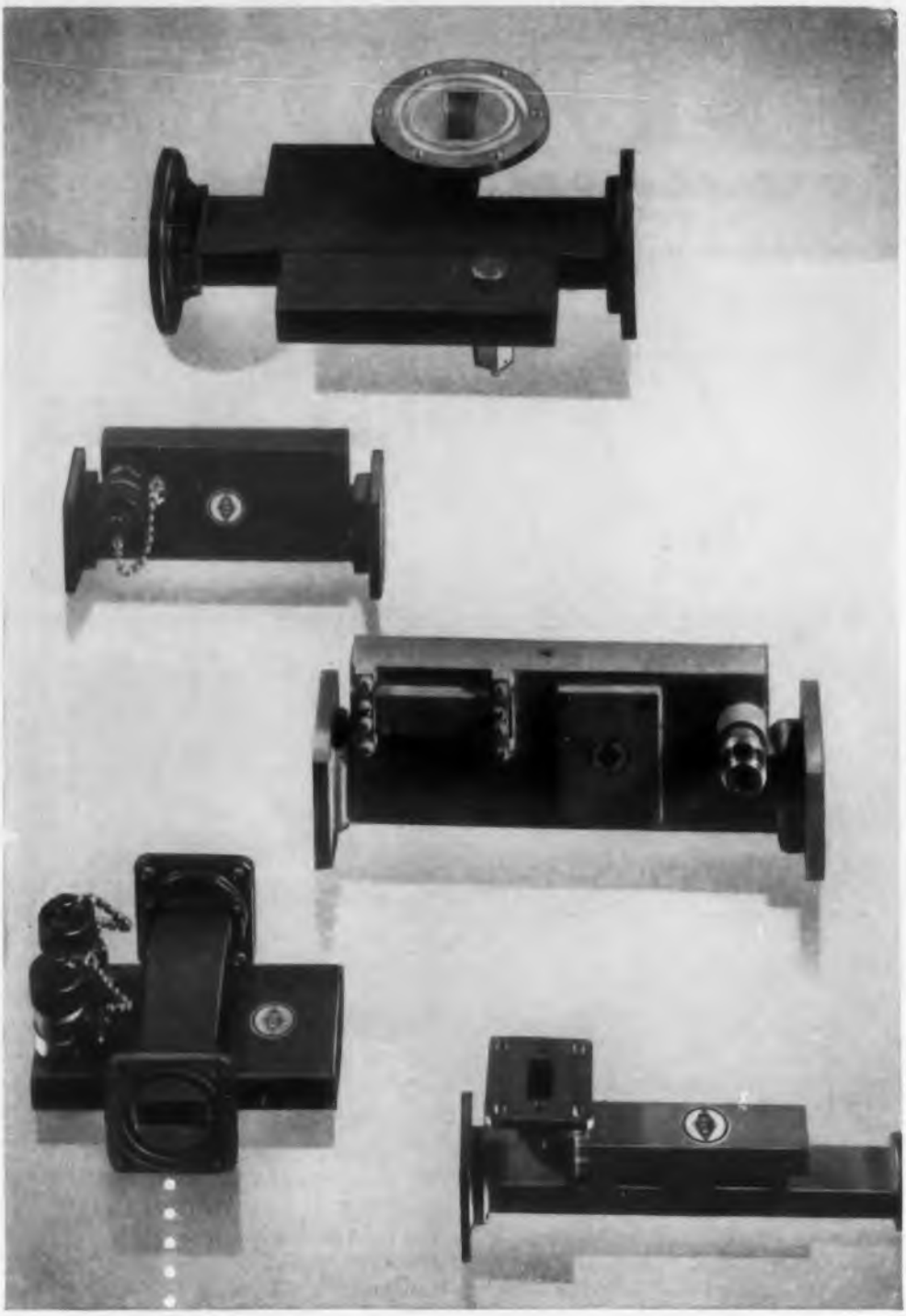
CIRCLE 159 ON READER-SERVICE CARD



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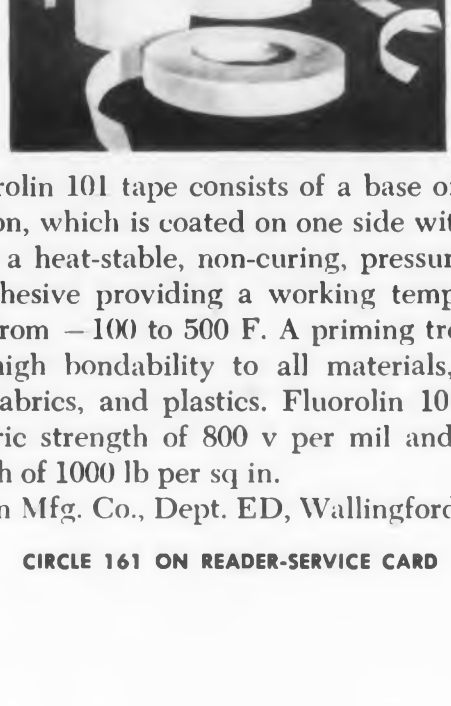
Heat Stable Adhesive



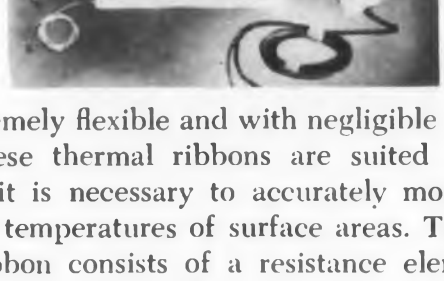
Fluorolin 101 tape consists of a base of 3 mils of Teflon, which is coated on one side with three mils of a heat-stable, non-curing, pressure-sensitive adhesive providing a working temperature range from −100 to 500 F. A priming treatment gives high bondability to all materials, metal, glass, fabrics, and plastics. Fluorolin 101 has a dielectric strength of 800 v per mil and tensile strength of 1000 lb per sq in.

Joclin Mfg. Co., Dept. ED, Wallingford, Conn.

CIRCLE 161 ON READER-SERVICE CARD

Thermal Ribbon

Thin and Flexible



Extremely flexible and with negligible thermal lag, these thermal ribbons are suited for use where it is necessary to accurately monitor or control temperatures of surface areas. The thermal ribbon consists of a resistance element of high nickel content alloy wire encased in a flexible outer covering. Less than 0.02 in. thick, the ribbon may be cemented to flat, cylindrical, or irregular surfaces. Designed to operate over wide temperature ranges and at high altitudes.

Minco Products, Inc., Dept. ED, 740 Washington Ave. North, Minneapolis 1, Minn.

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- No Training
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- No Clippings
- Uniform Crimps
- 22 Sizes

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GRegory 2-2500

212 PIAGET AVE., CLIFTON, N. J.

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Ceramic Wirewound Resistors

Precision, Low-Cost Units

These stabilized lug and radial lead ceramic wirewound resistors are for use where accuracy is required but price is a factor. The resistors are reverse pi-wound to minimize inductance, and are available in a resistance range of from 0.1 ohms to 10 meg, in standard tolerances of 1, 0.5, 0.1, 0.05, and 0.02 per cent or better. Having a temperature coefficient of ± 20 ppm, they are designed to operate in temperatures of from -65 to $+105$ C.

General Resistance, Inc., Dept. ED, 577 E. 156th St., N.Y. 55, N.Y.

CIRCLE 165 ON READER-SERVICE CARD

Liquid Adhesive

One Drop Lifts Two Tons

Capable of bonding a wide variety of dissimilar materials, type 910 adhesive has an unusual combination of rapid set-time and high strength. One drop of the fluid placed between opposing ends of 2-in. steel rod will lift 200-lb within 5 min. Within 30 min, the joint will support 5000 lbs. This bonding is accomplished without the necessity for heat, pressure, or evaporation of a solvent. Among the plastic materials to which the adhesive has been successfully applied are cellulose acetate, cellulose acetate butyrate, styrene, polyester glass laminates, phenolics, epoxies, acrylates, urethanes, and vinyls. Among the metals tested, combinations of steel, aluminum, copper, magnesium, bronze, and brass can be bonded effectively. Other materials include rubber, cork, felt, and porcelain. The adhesive is presently available in sample kits.

Eastman Chemical Products, Inc., Dept. ED, Kingsport, Tenn.

CIRCLE 166 ON READER-SERVICE CARD

MEMO
TO *Designers of Electronic Equipment*

NOW YOU CAN REPLACE ALL OF THESE COMPONENTS

Shown approx. ⅓ size

WITH A SINGLE HYCON EASTERN CRYSTAL FILTER

Shown approx. ⅓ size

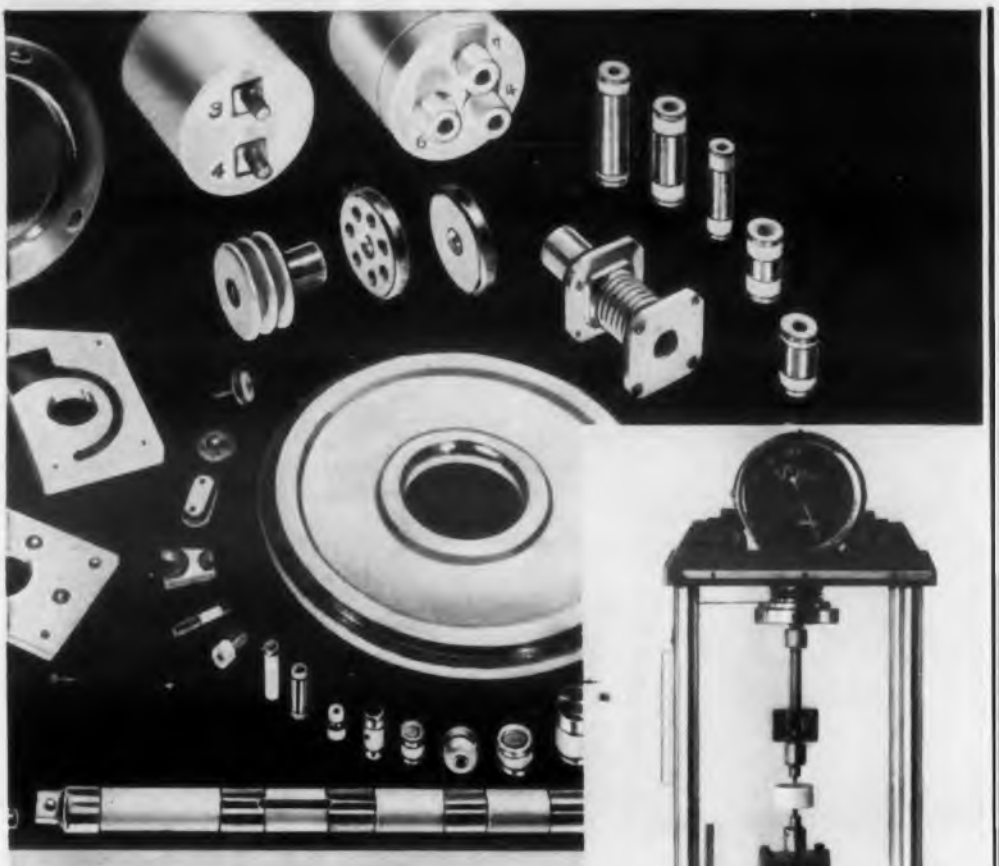
AND REDUCE WEIGHT, SAVE SPACE,
IMPROVE PERFORMANCE AND RELIABILITY

It will pay you to investigate how this unique component can improve performance and reduce costs of your communications equipment. Hycon Crystal Filters make possible single conversions in AM and FM receivers while retaining the important advantages of double and triple conversions. These units permit excellent reception in the presence of strong jamming or interfering signals. Center frequencies are accurate to .001%. Insertion loss is 1/10 of other filtering methods. Aircraft and guided missile environmental requirements are exceeded. Write for Crystal Filter Bulletin.

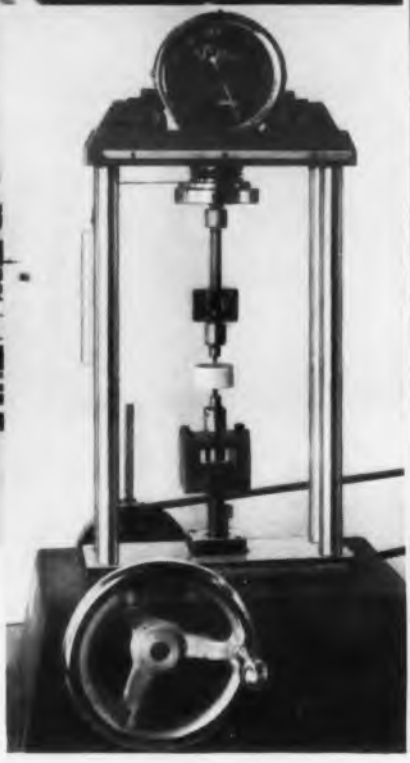
HYCON EASTERN, INC.

75 Cambridge Parkway Dept. F, Cambridge 42, Mass.
Affiliated with HYCON MFG. COMPANY, Pasadena, California

CIRCLE 167 ON READER-SERVICE CARD



Tensile stress of 400 lbs. failed to separate the 1/10 sq. in. metallized bond from the CRL ceramic body. Bond is strong enough to pull a freight car.



4,000 psi. pull can't separate this bond in Centralab Metallized Ceramics

Quality control tests show that the metallized surfaces on Centralab ceramics withstand a pull of 4000 psi. Increased pull fractured the ceramic, *but the metallized bond remained intact.*

You can rely on all CRL metallized surfaces for superior adhesive strength. These include metallized Steatite bodies for use at low temperatures... and super-tough 85% and 95% High Alumina metallized bodies for high-temperature applications.

Centralab engineers can design — and Centralab facilities can produce — the metallized ceramic part you need for either hermetic seal or mechanical applications. Furthermore, they will produce the part from properly matched metal-ceramic combinations to meet your specifications for soldering, dipping, or brazing. In addition to silver-fired bonds, Centralab can furnish parts with pressed-on metal surfaces.

Remember, too — Centralab offers you 35 years of experience in the design, manufacture, and application of metallized ceramics This wealth of background and modern facilities can help you to improve your production efficiency and save on costs. Send your inquiry to Centralab. Write for Bulletin EP-88.

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In Canada: 804 Mt. Pleasant Road • Toronto, Ontario

CIRCLE 168 ON READER-SERVICE CARD

New Literature

Hard, Bright Gold 169

Detailed information on a hard, bright gold is compactly presented in a recent brochure. The 4-page folder cites several typical applications, operating data, and directions for preparation, aging, and replenishment. Technic Inc., 39 Snow St., Providence, R.I.

Tantalum Foil Capacitors 170

The distinguishing and unique characteristics of tantalum foil capacitors with respect to stability, shelf life, capacitance per unit volume, and other criteria are outlined in Bulletin 152. Applications and limitations of the polar and nonpolar types of tantalum foil electrolytics are covered. The 2-page publication also provides detailed physical and operational specifications and a table of many standard capacitance and voltage values. Ohmite Mfg. Co., 3655 Howard St., Skokie, Ill.

Facilities Brochure 171

Designed to acquaint industrialists with the extensive research and development program for industry, Bulletin RD 150 is now available. The 8-page illustrated brochure highlights the activities in the areas of materials research, component development, data instrumentation, ultrasonic and acoustic research, medical instrumentation, underwater sound, ordinance development and nuclear research. Gulton Industries, Inc., 212 Durham Ave., Metuchen, N.J.

Corrosion Testers 172

Testers for determining rates of corrosion are discussed in a 16-page brochure. Two models, a line-operated, and a portable battery-operated, are considered along with probes of steel, nickel, Monel, copper, brass, aluminum, and lead. Labline, Inc., 3070-83 W. Grand Ave., Chicago 22, Ill.

for maximum reliability

hold miniature tubes and components securely with easy access for service with

BIRTCHER TYPE 2 TUBE CLAMPS

MATERIAL
Type 302 stainless steel

SIZES
12 modifications in height and design available for retention of all miniature tubes and plug-in components.

Designed for the positive retention of all miniature electronic tubes and plug-in components, Birtcher TYPE 2 TUBE CLAMPS offer ready access for service or tube replacement. The spring-loaded cap slides up the post and swings completely out of the way for service in tight quarters. More than one-million of these clamps are in use in civilian and military equipment.

Write for catalog

THE BIRTCHER CORPORATION	
INDUSTRIAL DIVISION	4371 Valley Blvd., Los Angeles 32, Calif.

CIRCLE 173 ON READER-SERVICE CARD

Tube and Bar Stock 174

This bulletin, "8 Reasons" gives information of the standard bar and tube stock offered in three special materials: GC Meehanite Metal, GA Meehanite Metal and Type #1 Ni-Resist. In addition to illustrating uses and outlining the particular features of these materials, the bulletin contains a comprehensive physical properties chart as a guide in application.

The bulletin reports these tubes and bars are well suited for the production of bearings, bushings, gears, liners, pump and valve parts, pistons, sleeves and sprockets, as well as other items. The Shenango Furnace Co., Dover, Ohio.

AN Connectors 175

A simplified guide for selecting and specifying hermetic seal glass-to-metal AN connectors for military and commercial applications is contained in a 16-page catalog. Designated 657C, the catalog has photographs and detailed drawings of a wide range of shell sizes and insert configurations for aircraft, communications, electronic controls, instrument applications. Hermetic Seal Corp., 29 S. 6th St., Newark 7, N.J.

Strong Castings 176

The mass production techniques and advantages of a process for producing permanent mold, high tensile strength castings, are described in Bulletin WIZ-795. The 6-page foldout bulletin contains an information sheet for use in designing permanent mold castings and a table listing permanent mold characteristics and properties. General Electric Co., Schenectady 5, N.Y.

Wire, Cable, and Conduit 177

"Guide to Representative Wire, Cable, and Conduit" describing a line of products is now available. In booklet form, the 6-page bulletin contains illustrations and is punched for easy notebook insertion.

Included also is information on insulation and sheathing materials; bare and weatherproof wires; magnet wires; building wires; service cables; machine tool and control wires; hook-up wires; power cables; portable cords and cables; street lighting cables; instrumentation, station control, supervisory and signal cables; and conduit. The information also features common terms for the trade names of the company as well as a list of the firm's district sales offices. Rome Cable Corp., Rome, N.Y.

CIRCLE 178 ON READER-SERVICE CARD

FOR VARIETY, AVAILABILITY, ECONOMY AND QUALITY . . .

YCBTBS*

*Translation: You Can't Beat The Bendix "Supermarket"

Before you specify rotating components, make sure you talk to Bendix.

Because we produce a greater variety and greater volume of rotating components every day than anyone else, we have become the "supermarket" of the industry, offering you availability and economy with finest quality.

Our line includes the following, built to practically any specs you could want:

Synchros and resolvers • Temperature-compensated tach generators and motor-driven tachs • Low-inertia servo motors and motor generators • Motor gearheads and component packages • External slip ring synchros • Analog-digital converters • Gyros • Radar antenna devices.

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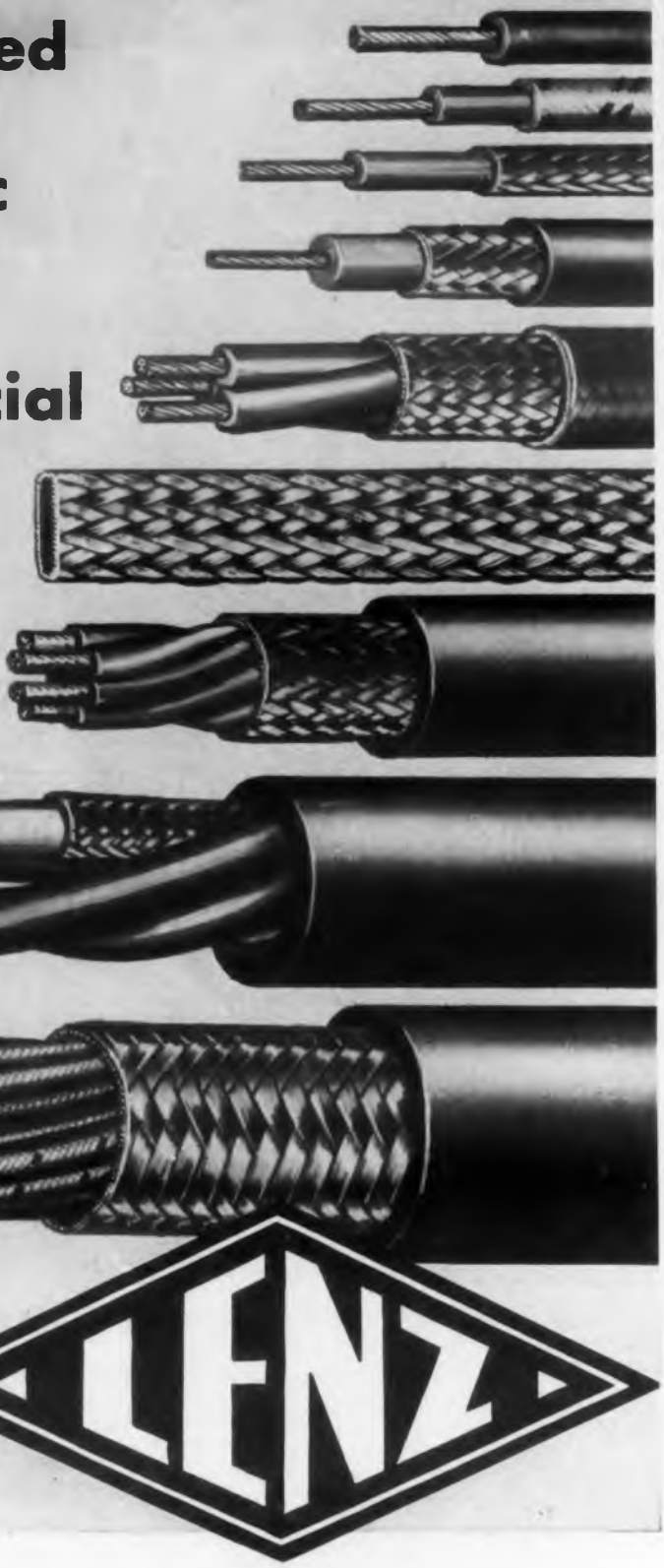
CIRCLE 179 ON READER-SERVICE CARD

WIRES & CABLES

Engineered for the Electronic Industry to Commercial and Military Specifications



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CIRCLE 180 ON READER-SERVICE CARD

New Literature

Miniature Selenium Rectifier 181

Bulletin GEA-6538B is a 2-page illustrated description of a miniature double-diode selenium rectifier meant for use as a TV horizontal-phase-detector diode. With minor modifications in the basic circuit, the unit may also replace the 6AL5 tube now used. The literature discusses applications, models, mechanical and environmental specifications and ratings. General Electric Co., Schenectady 5, N.Y.

Production Control 182

Automation is the topic of a 16-page illustrated brochure. Written in nontechnical language, the booklet clarifies some of the broader aspects of automation and indicates some of the procedures found useful for its development and application within the process industries. Patterson-Emerson-Comstock, Inc., Automation Div., 313 E. Carson St., Pittsburgh 19, Pa.

Lampholders, Indicator Lights 183

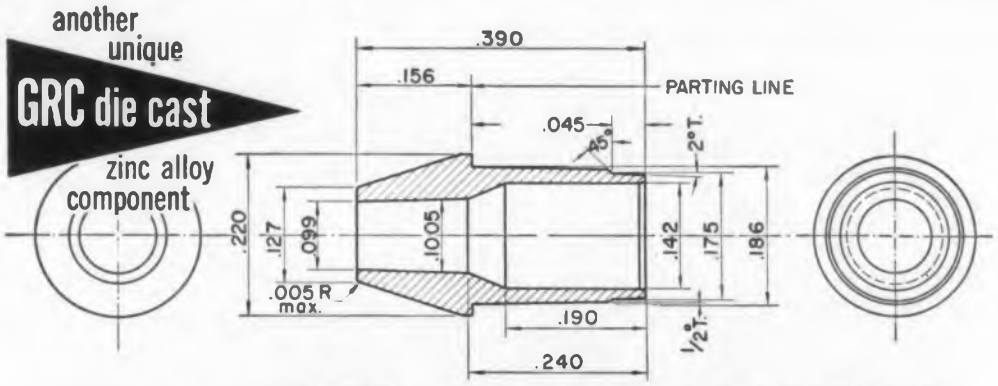
Two bulletins are available to those interested in lampholders and indicator lights. The first is a 1-page check chart designed to simplify selection of correct miniature lighting units meeting military specifications. It places military style numbers side by side with the equivalent catalog numbers.

The second bulletin is a 2-page catalog supplement which gives complete details about two candelabra lampholders—a screw base type with a snap-in method of lamp insertion and a double contact bayonet type. Outline drawings illustrate the lampholders and also available terminals. Drake Mfg. Co., 1711 W. Hubbard St., Chicago 22, Ill.

Accelerometer Calibrator 184

An angular acceleration generator is described in Data Sheet S-120. The 2-page sheet contains specifications, photographs, and charts and covers the principal features of the instrument. Statham Development Corp., 12411 W. Olympic Blvd., Los Angeles 64, Calif.

another unique GRC die cast zinc alloy component



GRC CUTS TINY BUSHING COST TO $2.00/M

Die cast by GRC in zinc alloy in a single automatic operation, this former screw machine part for a ball point pen, now costs little more than $2.00 per thousand in lots of a million. Each bushing is uniform, clean and accurate—no cut-off marks, no burrs, no secondary trimming and no scrap loss. Typical of the production economies and wide design latitude which GRC's exclusive patented methods have made possible on parts "no bigger than your thumbnail!" (Maximum size is 1¾" long, ½ oz.; no size too small).

Simple or complex, let GRC's unique techniques go to work for you . . . on tiny die cast *and plastic molded* parts made to order . . . on their wide variety of standard parts available in stock—wing and round head thumb nuts and screws, cap nuts, rivets, gears and pinions—you'll be glad you did.

Write, wire, phone Today for bulletins, spec sheets and prices. Send prints or specs for quotation.

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World's Foremost Producer of Small Die Castings

40 Second Street, New Rochelle, N. Y. NEw Rochelle 3-8600

CIRCLE 185 ON READER-SERVICE CARD

Switch Catalog T86

Now available is a 35 page manufacturer's switch catalog with complete specifications on rotary, slide, and lever switches. The catalog provides specifications on a line of switches capable of handling power from a kilowatt to a microwatt. Centralab, 900 E. Keefe Ave., Milwaukee, Wis.

Transistor Replacement Chart 187

A transistor replacement chart is available upon request. The chart indicates the correct transistors to use for the replacement of weak or burned out ones. Bendix Aviation Corp., Red Bank Div., Semiconductor Products, Long Branch, N.J.

High Q Toroids 188

A complete listing of toroids appear in a recent general catalog, TR-57. New to the catalog is a series of toroids which covers the 10,000 to 20,000 cps range with maximum Q. Triad Transformer Corp., 4055 Redwood Ave., Venice, Calif.

High Amp Silicon Rectifiers 189

Type RW-12 silicon rectifier which has a threaded stud design and uses one simple plate-type cooling fin, is described in 2-page data sheet now available. The sheet lists the features, discusses applications and characteristics and provides graphic performance data. General Electric Co., Schenectady 5, N.Y.

Potentiometer Selector

By means of an inner rotating wheel, a plastic coated circular chart shows individual mechanical and electrical specifications for a complete line of precision potentiometers. Window cutouts illustrate 19 models and give complete data on case materials, mountings, bearings, ganging, housing, resistance, power, linearity, resolution, rotation, and winding. The reverse side of the model selector offers illustrations and detailed specifications of the various elements. *For a free copy of this 8-3/4 in. chart, write on company letterhead to De-Jur-Amsco Corp., Electronic Sales Div., Dept. ED, 45-01 Northern Blvd., Long Island City 1, N.Y.*

SOLDERABILITY *is no problem*

when you design with **ANCHOR** *in mind*

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Aluminum or Magnesium*, plated with new, Anchor Fused Tin or AF-14 finishes, can be soldered easily and effectively! No lifting or peeling of the plating under heat. Anchor's exclusive process creates a *positive absolute bond* with the Aluminum, Magnesium or other base metal to provide:

- *Excellent solderability and shelf life*
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* Licensed by Dow Chemical Co.

Regardless of your design requirements, check with Anchor Plating *FIRST* for the answer to your plating problems. Samples to your specifications will be plated at no charge. Write, wire or phone TODAY for informative brochure.

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APPROVED PLATERS OF:
Electro-Tin • Fused Tin (Bright) • Cadmium • Gold (24K Electronic) • Silver • Rhodium • Copper • Bright Nickel • White Nickel (soft, ductile)

CIRCLE 190 ON READER-SERVICE CARD

New PRECISION FREQUENCY

STATIC INVERTER SUPPLY

INPUT 28V D.C. ± 10%

OUTPUT Nom. 115V ± 2% 400 CPS ± 0.01%
1 ø (2- or 3-phase output available)

RATINGS: 30VA 50VA 100VA
Higher ratings available.

APPLICATION:

For gyro wheel supplies and where precise 400 cycle voltages are required in aircraft, radar and missile computers.

FEATURES:

PRECISION OUTPUT FREQUENCY
RUGGED
EXCELLENT WAVEFORM
SIMPLICITY OF CIRCUITRY
FAST STARTING TIME
GOOD VOLTAGE REGULATION
throughout an adjustable range
ISOLATED CASE DESIGN
HIGH RELIABILITY
VIBRATION ISOLATED
COMPACT
LIGHTWEIGHT
MILITARY SPECIFICATIONS

(Send for Bulletin S-864)

PERFORMANCE SPECIFICATIONS

MODEL NUMBERS	± .01% CPS	SIS 40311	SIS 40511	SIS 410011
	± .05% CPS	SIS 40315	SIS 40515	SIS 410015
INPUT VOLTAGE		28V DC ± 10%		
MAX. OUTPUT POWER		30VA	50VA	100VA
OUTPUT VOLTAGE		115V AC (Adjustable ± 10%)		
OUTPUT FREQUENCY		400 CPS ± .01% 400 CPS ± .05%		
VOLTAGE REGULATION		±1% For Line Variations ± 2% For Load Variations		
FREQUENCY DISTORTION		3% Maximum At Full Load		
LOAD POWER FACTOR		+0.5 to −0.5 Maximum		
MILITARY SPECS.		MIL-E-5400A & MIL-E-5272A		
AMBIENT TEMPERATURE		−55°C to +71°C when mounted to heat sink		
VIBRATION		20G 10 to 2000 CPS		
UNIT DIMENSIONS		L5" D 2 7/8" H 2 13/16"	L8" D 2 7/8" H 2 13/16"	L10" D 4 1/2" H 2 13/16"
WEIGHT (Approx.)		2 lbs.	3.5 lbs.	5 lbs.

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West Coast Division
136 WASHINGTON ST. • EL SEGUNDO, CAL. • OREGON 8-2665

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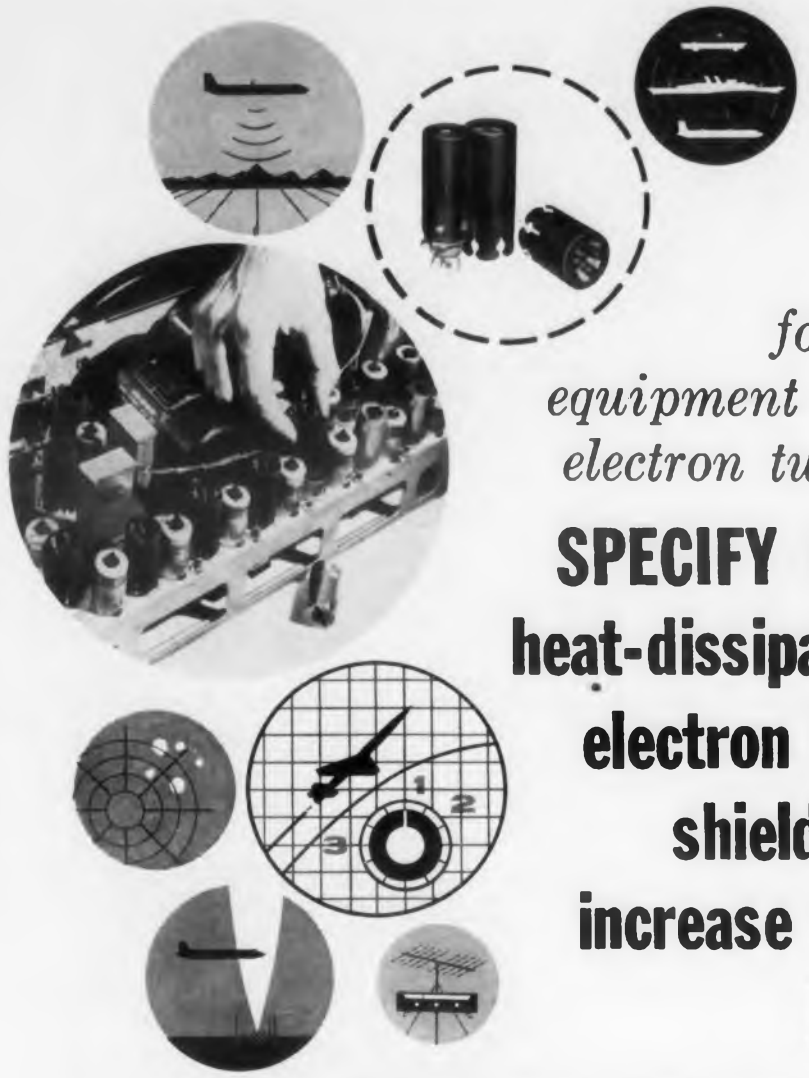

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SPECIFY IERC heat-dissipating electron tube shields to increase tube life!

Maintenance "down time" and costs reduced for all electron tube-equipped guidance, radar, aircraft, mobile surface communication, radio-TV and other industrial and commercial types of electronic equipments!

You can get immediate, most effective results *only* with IERC Heat-dissipating Tube Shields—the exclusive, patented, time-proven design available in a wide selection to meet every electronic equipment requirement for new or retrofitting applications. IERC shields give you the only commercially-available heat-dissipating shield which will actually meet or exceed military specifications because they provide greatest reduction of electron tube bulb operating temperatures, maximum vibration and shock protection plus compatibility with all tube diameter tolerances.

Investigate this *proven way* to get increased tube life and equipment reliability by eliminating electron tube failures commonly caused by heat, vibration and shock!

We'll gladly send you our IERC Heat-dissipating Tube Shield Guide showing over 1,400 tubes and tube shield combinations to select from for increased tube life and reliability. Write today!

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Heat-dissipating electron tube shields for miniature, subminiature octal and power tubes

CIRCLE 192 ON READER-SERVICE CARD

New Literature

Teflon Machining Facilities 193

A folder showing facilities for custom machining Teflon parts is now available. The two color publication also displays the assortment of types of components the division makes of Teflon and states the tolerances that can be held on these parts. Raybestos-Manhattan, Inc., Mannheim, Pa.

Industrial Tubes 194

Two booklets, "Industrial Tubes" and "Guide to Replacement" are now available. The booklet "Industrial Tubes" describes the general characteristics of vacuum power tubes, beam power tubes, rectifiers and ignitrons. It also lists the maximum ratings of these types. In addition, there are sections devoted to reliable and ruggedized tubes. The other booklet, "Guide to Replacement" lists the basic designation, tube class and various manufacturers' type numbers for over one hundred tubes in the line. Sylvania Electric Products Inc., 1740 Bway., New York 19, N.Y.

Audio Frequency Amplifiers 195

An amplifier line that stresses the laboratory type units and was designed essentially for maintenance-free sound systems, scientific laboratories, tape and disc recording equipment, motion picture film recording use and other purposes is described in catalog No. 16-C now released.

Specifications listed in the catalog are based on normal vacuum tube characteristics. The brochure is illustrated with charts and diagrams and is divided into: pre-amplifiers, "boom" microphone preamps, line amplifiers, oscillators (for magnetic recorders), equalizer-amplifiers (for magnetic film playback), plug-in chassis in kit form, mounting frames and power supplies. Aerovox, Cinema Engineering Div., 1100 Chestnut St., Burbank, Calif.

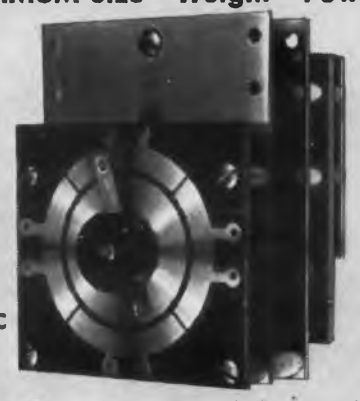
PC Connectors 196

Specifications, diagrams and general information on printed circuit connectors with right angle pins and polarizing screwlocks are described in this 2-page technical bulletin. DeJur-Amsco Corp., 45-01 Northern Boulevard, Long Island City 1, N.Y.

HIGH ALTITUDE BALLOON CONTROL INSTRUMENTS

require **MAXIMUM Performance MINIMUM Size - Weight - Power Drain**

Brailsford AGC Timers Are Unmatched In These Basic Requirements



Model AGC

If You Have A Timing Problem Where Size, Mass and Power Drain Are Critical Read These

SPECIFICATIONS

Number of decks—1-4 • Speed regulation—±1.0% at 50% voltage shift

Size—1¾" x 2¼"—depth depends on number of decks

Segments per deck—2-8 for stock units.

Special commutators to order for a nominal tool charge.

Shorting or non-shorting contact • Power input—.008 Amp. at 6 VDC

WRITE FOR LITERATURE

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ENGINEERING DEVELOPMENT MANUFACTURING

SUB FRACTIONAL WATT D C MOTORS — BRAILSFORD — SIGNALLING SYSTEM COMPONENT

CIRCLE 197 ON READER-SERVICE CARD

ring Washers 198

To make it easy for designers to specify standard spring washers, a revised bulletin talogs the dimensions of many available sher-dies. More than 1000 different sizes enumerated. The list encompasses nking and punching dies for making flat, pped, curved, wavy, slotted, and belle- le spring washers ranging from 0.125 to 35 in. od, and also dies for making mul- le-finger loading springs for pre-loading ll bearings, and wavy spring washers for same purpose. Associated Spring Corp., istol, Conn.

ctrometer 199

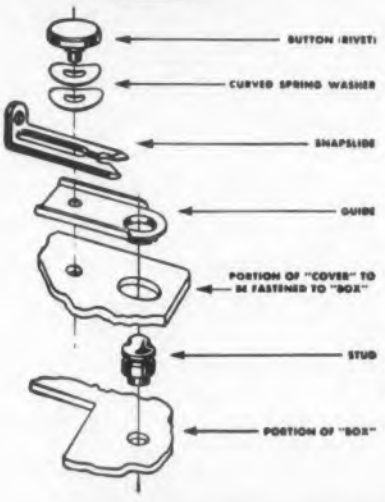
Designed to fill the need for a stable and able instrument for measuring low cur- ts in ion chambers and high impedance works, Model 565A electrometer is de- bed in bulletin now available. The 2- or illustrated bulletin outlines suggested s and applications, and gives complete cification and performance data, ac- acy and ranges. It is made to ORNL cifications. Victoreen Instrument Co., 6 Hough Ave., Cleveland 3, Ohio.

Nylon Applications 200

Some recent literature contains many case histories designed to assist engineers in applying nylon parts in various industries. The stories are indexed according to standard industrial classifications and cover applications in chemical, electrical, machine tool, food, textile, instrument, and other fields. The Polymer Corporation of Pennsylvania, Reading, Pa.

Valve Position Indicator 201

The "Capswitch" Position indicator that automatically signals a control board apparatus when the opening or closing cycle has been completed, is described in a bulletin now available. The position indicator attaches directly to a valve or actuator and is a rugged, lightweight, compact, environmental proof unit. There are two models described—Model 65M41 is a spdt switch weighing less than 0.1 lb. Model 65M83 is a dpdt unit that weighs only 0.19 lb. The bulletin contains all important specifications and technical data about the position indicators. Robertshaw-Fulton Controls Co., Bridgeport Thermostat Div., Milford, Conn.



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This positive, quick-action fastener was originally developed to hold airborne equipment with security—even under severe stress and shock of carrier-based aircraft operations—and yet permit equipment replacement in a matter of seconds.

A wide variety of industrial uses has been found for the fastener. Perhaps you can use it profitably. It requires no tools; thumb and finger fasten and release. Even with repeated use no adjustments are necessary. Available in two sizes, with parts to match different thicknesses of mounting plates.

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Dependable Airborne Electronic Equipment Since 1928

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CIRCLE 202 ON READER-SERVICE CARD

ANTENNAS by CANOGA
and Antenna Tuners

COMMUNICATION & NAVIGATION

Airborne UHF-VHF communications and navigation antenna with built-in dual channel filter.

An extremely low drag L-band blade antenna for C&N applications.

ANTENNA MATCHING DEVICES

At right is a Tuner Assembly for matching a Marker Beacon Antenna which is mounted in a supersonic aircraft.

At left is high-Q VHF parallel resonant circuit for matching a VOR antenna of a commercial airplane.

TELEMETERING ANTENNAS

A very broadband antenna which easily covers the 2Kmc telemetry band.

A high gain telemetering antenna for the 200 mc band.

RADAR SYSTEMS USING ANTENNAS DESIGNED AND MANUFACTURED BY CANOGA

SCR-584	MPQ-7	MPQ-21
SCR-615	MPQ-10	MSQ-1
SPQ-2	MPQ-12	MSQ-1a
MPS-6	MPQ-14	AFMTC-II
MPG-2	MPQ-18	AFMTC-III

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- ☐ RADAR SYSTEMS
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SIE® **E-2 COMPARISON BRIDGE**

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- Five meter ranges: 1%, 2.5%, 5% 10% and 25% difference readings at full scale.
- Accurate within 0.1% on 1% scale.
- Component differences of 1 part in 10,000 can be detected.
- Can be used with decade box for precise component measurements.

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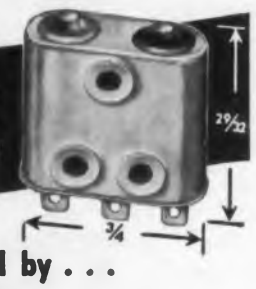
NEW HAYDON SWITCH DESIGN!



***ONE* Sealed Switch for *TWO* Rugged Environments! Unaffected by . . .**

1. Corrosive Atmosphere

2. High Ambient Pressure or Vacuum

Haydon's new switches are hermetically sealed, impervious to immersion in corrosive liquids—and actuation force remains constant under ambient pressures as high as 180 PSI!

Switches can be furnished with an actuation force of either 10 oz. max., or 32 oz. max. A built-in balancing system automatically equalizes ambient pressures on the switch mechanism, insures uniform operation. This new design can be applied to miniature and subminiature switches of various electrical ratings.

REMEMBER: A broad line of "standard" hermetic and plastic switches is available from Haydon Switch . . . plus a complete design and development service. Don't let difficult switching problems limit your product applications—get in touch with Haydon Switch.

Send today for new catalog giving data and specifications on "standard" miniature and hermetically sealed switches.

HAYDON Switch INCORPORATED

WATERBURY 20, CONNECTICUT

CIRCLE 205 ON READER-SERVICE CARD

Model G-625

Model G-627

AERO-POT*

miniature trimming

potentiometers

featuring **extreme reliability!**

All-metal case gives maximum rigidity, ruggedness and long life, plus high resistance to impact and torque. Settings are stable under vibration of 30 G's from zero to 2000 cps...under acceleration, shock and ambient temperature changes. Excellent heat dissipation and protection against high humidity, splashing and dust. Zero end resistance.

The Aero-Pot is adjustable throughout 32 turns by means of a slotted leadscrew. Resistance range: 100 to 100,000 ohms in one case size. Can be supplied completely sealed. Write for literature.

*PATENT APPLIED FOR

AERO ELECTRONICS CORP.

Sales Office: 2311 W. Burbank Blvd. • Burbank, Calif.

CIRCLE 206 ON READER-SERVICE CARD

New Literature

Amateur Equipment

A 28-page catalog, no. 957, giving detailed descriptive data on the Viking amateur equipment, is now available.

The well-illustrated catalog features photo schematic diagram on the various items include as well as the accessory line. E. F. Johnson Co. Waseca, Minn.

Tape Wound Core Calculator

Engineers are offered a slide rule for tape wound core problems. With it goes a book of instructions. The two combined will help find speedy answers to voltage to flux, current to magnetizing force, and wire to space factor equations. They permit quick design of cores to support a given frequency, voltage, and current capacity. They may also be used to find the number of turns required to reset cores to a specific magnetizing force. The book lists AIEE and other standard sizes. In addition, it outlines the characteristics of wire sizes for design use. Magnetics, Inc., Butler, Pa.

Power Supply

A 2-page catalog sheet, designated as Bulletin 250, illustrates and describes Model TM25 Voltage Regulated DC Power Supply. The two-color bulletin includes detailed electrical specifications as well as dimensions and weights of both the rack mounting and portable models.

The equipment described is a tubeless, laboratory type, power supply with a continuous duty rating of 0-150 vdc at 2 amp. Voltage regulation is held to plus or minus 1 per cent ripple and less than .03 per cent of the average dc at maximum output. Opad Electric Co., 69 Murray St., N. Y. 7, N. Y.

Self-Locking Connectors

Vibrations and pull proof interlock connectors with constant low resistance are described and illustrated in this 24-page catalog. Features automatic locking and quick disconnecting, panel jacks, angle plugs and jacks, terminal strips, miniature connectors, quick disconnect terminal strips, flexible terminal strips, 4-in-1 test prod and accessories for use with it, the brochure fully covers all the specifications of the connectors. Avnet Interlock Sales Corp., 36 N. Moore St., N. Y. 13, N. Y.

Data Reduction 211

Brochure 5-02-110 is a 6-page explanation of an integrated automatic data reduction system. In this system, the Millisadic analog-to-digital converter is linked to the Datatron electronic computer by special modifications permitting the computer to read and process test data directly from the Millisadic's magnetic tape and bypass the card-punching and in-put operation. ElectroData, Div. of Burroughs Corp., 460 Sierra Madre Villa, Pasadena, Calif.

Connectors 212

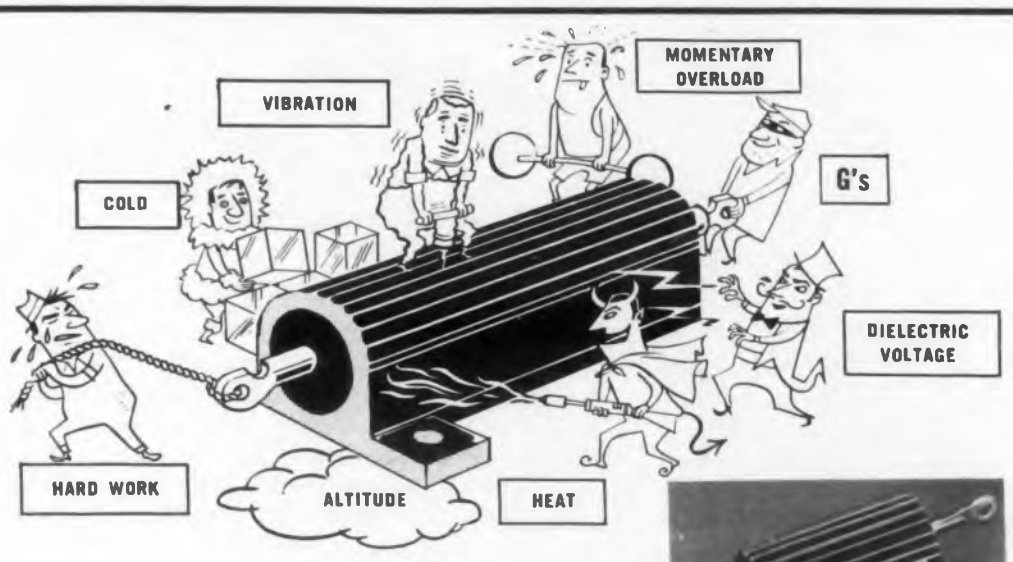
Condensed version of a comprehensive catalog of power and electronic circuit connectors, and associated equipment is now available. This short-form catalog illustrates the complete line of connectors, and lists key specifications and operating characteristics. The line covers subminature and miniature power and electronic connectors in several configurations; pressurized, waterproof and hermetically-sealed. Also described are printed circuit connectors and card receptacles. U.S. Components Inc., 456 E. 148th St., New York 55, N.Y.

Pulse Equipment 213

A 5-page catalog describes a line of fast pulse transmission equipment. Included are all standard coaxial cables prefabricated to any length with any standard connectors, coaxial line terminations, impedance matchers, pulse splitter-mixers, pulse attenuators, and pulse delay units. Electrical and Physical Instrument Corp., 42-19 27th St., Long Island City 1, N.Y.

Lab, Production Equipment 214

Meter calibrators, voltage regulators, digital readout meters, dc power supplies and other electronic equipment for either laboratory or production use are described in an 8-page catalog now available. Two different types of dc power supplies are shown. The highly regulated tube-types offer high voltage, low current outputs while the transistor regulated tubeless-types serve as high current, low voltage sources. Thirty different models are available covering a wide range of voltage and current ratings. The booklet gives complete information and operating data for all models. Davenport Manufacturing Co., 1713 N. Ashland Ave., Chicago 22, Ill.



SAGE pioneered the metal-clad, chassis-mounted resistor. Truly miniature for the job it does, the Type "M" is establishing a reputation for dependable, trouble-free performance—a tribute to SAGE engineering skill and manufacturing "know-how."

We invite your inquiry regarding heat-sink applications . . . Write for complete specifications.

NEW SAGE "Silicohm"
TYPE "M", METAL-CLAD
RESISTORS
Available in 25 and 50 watts up to 60,000 ohms. Meet MIL-R-18546 requirements.

SAGE ELECTRONICS CORPORATION
309 North Goodman St., Rochester 7, N. Y.

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MOLDED SUB-MINIATURE TOROIDS

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ARE NOW AVAILABLE FROM

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HEXSEALS*

APM HEXSEALS for Switches and Shafts consist of a grooved nut to which is molded a rubber boot. High pressure sealing is maintained by a gasket rib — an integral part of the boot — which seats firmly against any panel surface regardless of finish.

APM SEELSKREWS — Pre-assembled, vibration resistant fasteners, designed for panels and motor housings. A rubber O-ring is pressed into a groove underneath the head of the screw. They will seal in excess of 500 psi, internal and external pressure.

SEELSKREWS*

HEXSEALS and SEELSKREWS Meet Military Specs:

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MIL-B-19257 (Ships)
SCL-6303 (Sig. Corps)

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*Trade Mark

APM AUTOMATIC and PRECISION MANUFACTURING CO.
252 Hawthorne Ave., Yonkers, N. Y.

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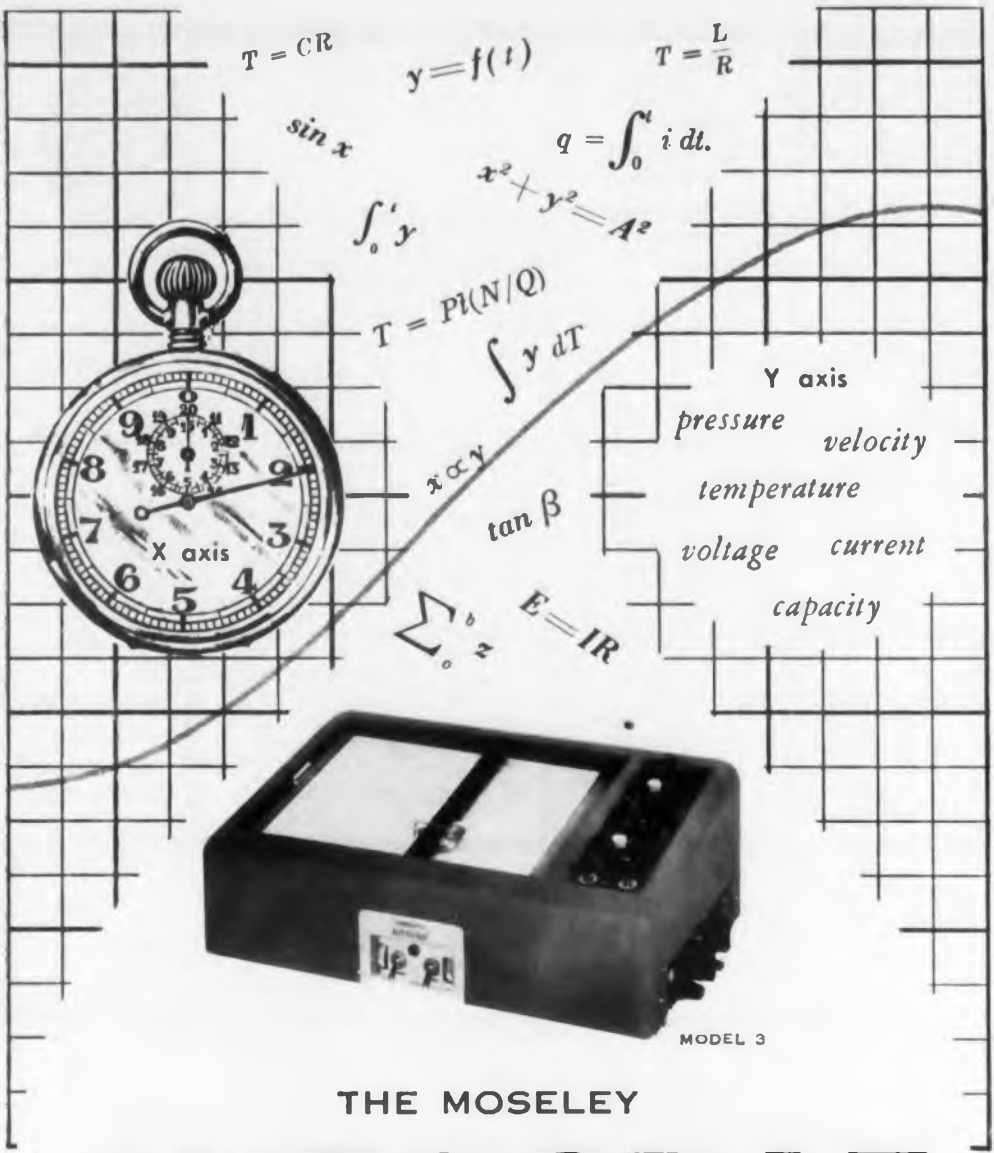

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AUTOGRAF

trade mark

X-Y-Ⓣ RECORDER

Hundreds of users of the Moseley AUTOGRAF, already familiar with the many advantages of this graphic recording instrument, will be pleased with the development of a new concept in versatility, the X-Y-Ⓣ Recorder. The AUTOGRAF X-Y-Ⓣ Recorder continues to offer the rugged construction, high accuracy, and stability of a laboratory instrument with the added feature of a built-in time base or sweep circuit. Without external attachments, the AUTOGRAF X-Y-Ⓣ Recorder will plot versus time any mechanical or physical function which can be reduced to electrical form. Available at finger-tip control are five calibrated time intervals from 5 seconds to 500 seconds for full scale X-axis pen travel. When the time base is not used, regular two-variable plotting may be accomplished as desired. Contact your regional representative or write for full information on this remarkable new instrument. Available in all models, bench or rack mounting.

Model 20 DC Voltmeter A servo-actuated electronic voltmeter with large, easy to read linear scale. Ranges from 3 millivolts to 300 volts. Available with digital output.

Model 60 Logarithmic Converter 60 db dynamic range; AC or DC; 20-20,000 cps; with AUTOGRAF and appropriate signal generator automatically plots gain-frequency characteristics.

F. L. MOSELEY CO.

409 N. FAIR OAKS AVENUE, PASADENA, CALIFORNIA

CIRCLE 218 ON READER-SERVICE CARD

New Literature

Data Automation System 219

Features of the Univac II data automation system are fully described and illustrated in a 79-page manual. A complete guide for both specialist and layman, the U 23 manual contains five sections: (1) descriptions and illustrations of all available equipments and their function, (2) a nontechnical guide to the binary number system and the seven-place code of the Univac, (3) a technical description of how the central computer is organized functionally, (4) an explanation of the system's entire repertoire of instructions, and (5) illustrations of how the computer responds to special conditions. A 2-page fold-out diagram depicts the system and its peripheral equipment. Other features of the manual are a chart showing the 63 code combinations of the system, a simplified block diagram of the central computer, and a compendium of the conventions, symbolic notation, and instruction codes used with the system. Remington Rand Univac, Div. of Sperry Rand Corp., 315 Fourth Ave., New York 10, N.Y.

Brakes, Clutches, Controls 220

Easy to read facts about electric brakes, clutches and controls for miniature mechanisms or high torque machine drives are given in this 8-page catalog digest 6292 now available. Warner Electric Brake & Clutch Co., Catalog Digest, Beloit, Wis

Semiconductor Soldering 221

A reference chart for semiconductor soldering applications has been made available. The chart offers phase diagrams for the more popular soldering alloys used in semiconductors and lists available high-purity elements, indicating the purity degree of each. Anchor Metal Co., Inc., 966 Meeker Ave., Brooklyn 22, N.Y.

Reliable Capacitors 222

In Catalog XR-461 a line of high reliability capacitors is presented. These capacitors are manufactured under strict quality control procedures governing raw material selection and manufacturing conditions. The Gudeman Co., 340 W. Huron St., Chicago 10, Ill.

CIRCLE 223 ON READER-SERVICE CARD

last Cleaning 224

"Special Cleaning Problems Solved" ows by photographs and schematic draw- gs how airless blast cleaning, air blast aning, and wet blast cleaning have been ployed in specific applications. Desig- ted 105-D, the 34-page brochure cites re than 50 short case histories and also scribes an engineering demonstration boratory. Wheelabrator Corp., 1750 S. kit, Mishawaka, Ind.

iniature Bearings 225

Miniature bearings of the 814 series 1/2 OD with a 1/4 in. bore in all of the ndard variations such as flanged and elded retainer bearings, are described 1957 catalog now available. Another ring series included is the high speed es which has been expanded to include standard R2 size—.375 in. OD and .125 bore. These high speed bearings are of ular contact design and can be obtained h either outer race or inner race relieved a separable or non-separable design. iniature Precision Bearings, Inc., Preci- n Park, Keene, N. H.

Thermal Circuit Breakers 226

Built-in type miniature overcurrent circuit breakers which are single pole and thermally operated are listed in Catalog 1a/52. Besides an illustrated enumeration of a variety of units and combinations, the 18-page booklet contains a full discussion of the circuit breakers—their main features, mechanism, performance, and application. Units with alarm circuits are listed and discussed in a separate section. Graphs, photographs, dimensional and circuit diagrams illustrate the booklet. E-T-A Products Co. of America, 5085 N. Elston Ave., Chicago 30, Ill.

Sintered Metal Parts 227

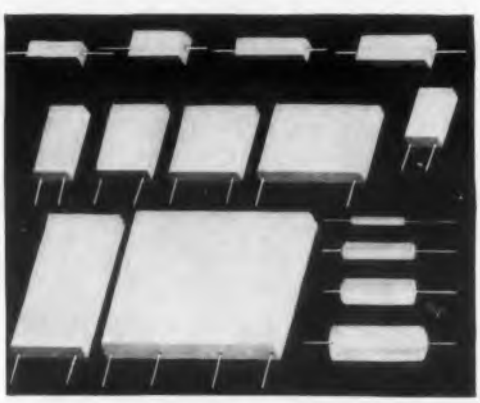
A 12-page booklet on advanced powder metallurgy for the design engineer and management personnel is now available. It describes the advantages of powder metal parts; how they are made; and the principles of economical design and production which should be considered. Typical characteristics of available powder metal alloys are given. Dixon Sintaloy Inc., 535 Hope St., Stamford, Conn.

NEW CTS BOBBINLESS PRECISION WIRE FIXED RESISTORS

Featuring Unique CTS "Floating" Element
Small Space Factor • More Stable

New CTS patented winding process now permits resistance elements and contacts to be firmly embedded in epoxy resin, forming a monolithic mass. No bobbin or winding form—no wire strain. Exceptional Stability—permanent change in resistance less than 0.2% under most environmental conditions.

Guaranteed Close Tolerance—resistors guaranteed to be in tolerance under normal conditions of measurement. Tolerances down to ± 0.05% available in standard sizes depending upon resistance value. Closer tolerances or matched multiples available.



Low Inductance and Low Capacitance Characteristics with reproducible uniform frequency response made possible by new CTS patented winding technique. Less than 0.2% resistance change with humidity (MIL-R-93). Less than 0.2% resistance change with temperature cycling (MIL-R-93). Withstands extreme vibration and shock due to unique construction and encapsulation method. Extremely stable—resistance change with load life or 100% overload (MIL-R-93) less than 0.3%. Low temperature coefficient wire available. Offered in rectangular or tubular shapes in a wide variety of standard sizes with wattages ranging from 0.25 to 2.0 and resistances from 0.1 ohms. Special dimensions, tolerances, wattage ratings, etc. can be made to your exact specification.

CHICAGO TELEPHONE SUPPLY CORPORATION
Elkhart, Indiana • Founded 1896
CIRCLE 228 ON READER-SERVICE CARD

DIRECTIONAL COUPLERS

VSWR and RF POWER MEASURING EQUIPMENT

New Products included in new Catalog No. 12 create the most extensive line available.

RF POWER and VSWR INSTRUMENTS

Model No.	Frequency Range (mcs.)	Power Range Incident & Reflected (watts)	RF Connectors and Impedance
261**	0.5 - 225	0 - 1000	Type 83-1R 52 ohms
262	"	0 - 1000 (relative)	Indicator only
263	0.5 - 225	0 - 10; 100; 1000	Type N* 52 ohms
702N	28 - 2000	0 - 4	Type N* 52 ohms
703N	20 - 2000	0 - 12	Type N* 52 ohms
▲705N	20 - 2000	0 - 120	Type N* 52 ohms
▲706N	28 - 2000	0 - 400	Type N* 52 ohms
711N	25 - 1000	0 - 30; 75; 300	N plus 83-1R Adapters
▲722N	1000 - 3000	0 - 4	Type N 52 ohms
▲723N	1000 - 3000	0 - 12	Type N 52 ohms
405B8	28 - 2000	0 - 4000	1⅝" Flange 51.5 ohms
445A9	28 - 2000	0 - 12,000	3⅛" Flange 50.0 ohms
445A10	20 - 2000	0 - 40,000	3⅛" Flange 50.0 ohms

DC OUTPUT DIRECTIONAL COUPLERS

Model No.	Frequency Range (mcs.)	Power Range Incident & Reflected (watts)	RF Connectors and Impedance
576N1	42 - 2000	1.2	Type N* 52 ohms
576N3	20 - 2000	0 - 12	Type N* 52 ohms
▲576N4	46 - 2000	0 - 40	Type N* 52 ohms
576N6	28 - 2000	0 - 400	Type N* 52 ohms
▲592N	1000 - 3000	0 - 4	Type N 52 ohms
▲593N	1000 - 3000	0 - 12	Type N 52 ohms
402B8	28 - 2000	0 - 4,000	1⅝" Flange 51.5 ohms
442A9	28 - 2000	0 - 12,000	3⅛" Flange 50.0 ohms
442A10	20 - 2000	0 - 40,000	3⅛" Flange 50.0 ohms

RF OUTPUT DIRECTIONAL COUPLERS

Model No.	Frequency Range (mcs.)	Coupling Attenuation	RF Connectors and Impedance
313N3	300 - 2000	30 db	Type N* 52 ohms
313N4	120 - 2000	40 db	Type N* 52 ohms
313N5	60 - 2000	50 db	Type N* 52 ohms
313N6	30 - 2000	60 db	Type N* 52 ohms
▲442A40	200 - 1000	40 db	3⅛" Flange 50.0 ohms

ABSORPTION TYPE RF WATTMETERS

Model No.	Frequency Range (mcs.)	Power Range (watts)	RF Connectors and Impedance
621N	1 to over 1000	0 - 120 milliwatts	Type N* 52 ohms
▲624N	1 to over 1000	0 - 4	Type N* 52 ohms
625C5	50 - 1000	0 - 120	Type C 50 ohms
▲651N	25 - 1000	0 - 25; 100; 500	Type N 52 ohms
▲611A7	50 - 1000	0 - 1200	3⅛" Flange 50 ohms
612A	44 - 1000	0 - 6000	3⅛" Flange 50 ohms

RF LOAD RESISTORS

Model No.	Frequency Range (mcs.)	RF Power Dissipation (watts)	RF Connectors and Impedance
633N	3000	50 (air cooled)	Type N* 52 ohms
635N	3000	200 " "	Type N* 52 ohms
636N	3000	600 " "	Type N* 52 ohms
636A	2000	600 " "	3⅛" Flange 50.0 ohms
638A	2000	6000 (water cooled)	3⅛" Flange 50.0 ohms

CALORIMETRIC TYPE Primary Standard of RF Power

Model No.	Frequency Range (mcs.)	Power Range (watts)	RF Connectors and Impedance
641N	0 - 3000	0 - 3; 10; 30; 100; 300	Type N 52 ohms

▲New products

*Also available with UHF, C, and HN Connectors.
**Coupler Unit Only for use with 262 Indicator.

M.C. Jones

M.C. JONES ELECTRONICS CO., Inc.
BRISTOL, CONNECTICUT

CIRCLE 229 ON READER-SERVICE CARD

for quick look at telemetered signals jet fighter builder uses

Century

ELECTROGRAPH

MODEL 420

ELECTROGRAPHS installed in the ground station provide an immediate record of 24 simultaneous air-to-ground telemetered flight parameters. Progress of the flight test is followed with virtually no delay, thus minimizing costly reruns and permitting program changes during the test sequence. The Model 420 ELECTROGRAPH is the *ONLY* photographic recorder suitable for truly "quick-look" applications. High contrast records visible to the observer may be produced within ½-*second* after receipt of the excitation signal . . . NO other photographic oscillograph approaches this performance. When the "quick-look" must be quick, specify the ELECTROGRAPH.

As in flight test use, most "quick-look" applications require a high degree of record readability. The high contrast of ELECTROGRAPH recordings is *UNEXCELLED* with the result that record readability is maximum. The black traces and timing lines embossed on light-colored, non-glare emulsion offer the optimum condition for ease of data reduction.

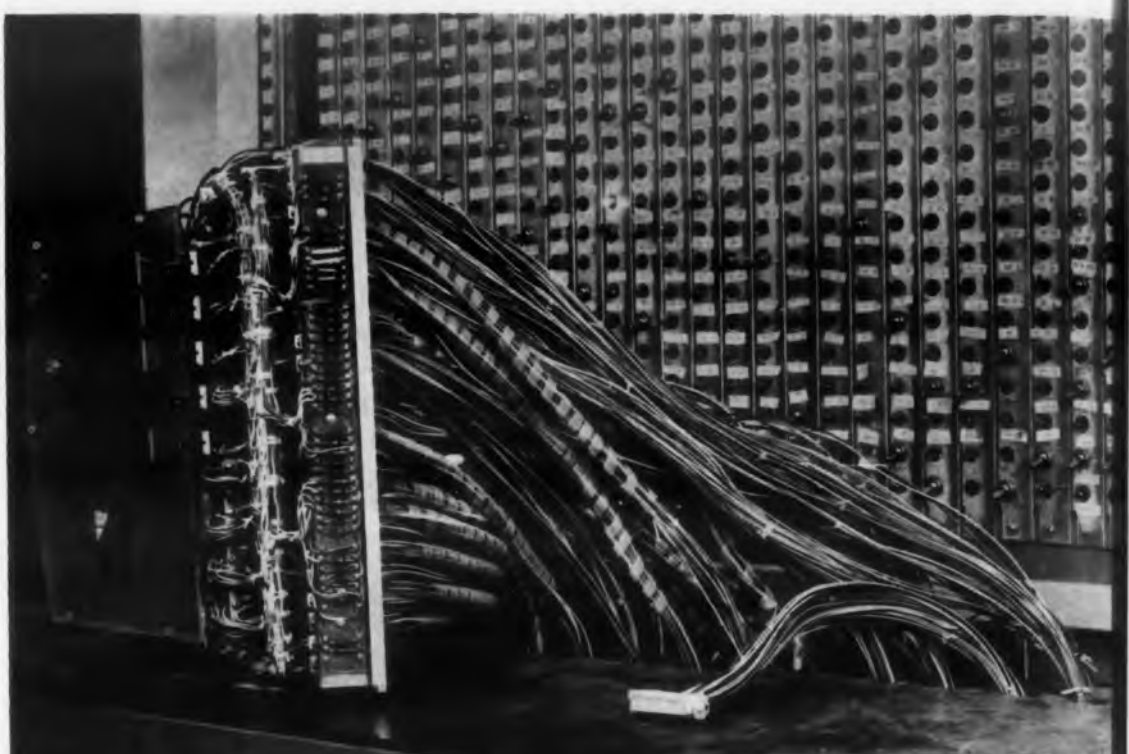
For additional details on this 24-channel recording oscillograph, you are invited to write, wire or call for bulletin CGC-311.

Century Electronics & Instruments, Inc.

1333 No. Utica, Tulsa, Oklahoma

CIRCLE 230 ON READER-SERVICE CARD

Computer Wiring Te



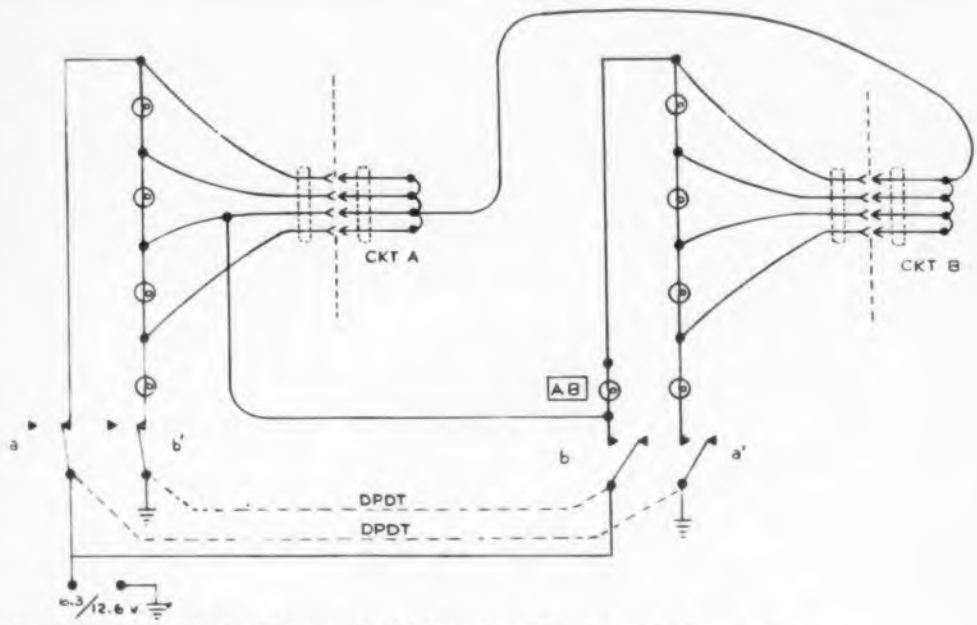
Computer matrix wiring tester detects and locates open and shorted circuits which may occur in making 1121 soldered connections in the computer. Computer matrix is connected to the tester, which paid for its design and construction on the first computer check.

WHEN THE equipment designer is enjoined to use modular construction in equipment, production checking of the modules is simplified—but that of the interconnecting wiring, where equipment complexity is then concentrated, is made more difficult.

To deal economically with this wiring problem, a matrix checker was developed to test 1121 wiring connections in the Litton 20 Digital Differential Analyzer. A plug is provided for each of the chassis-mounted sockets into which a module is normally plugged. When the Cannon connectors are plugged into these sockets, the tester will detect misplaced wires and narrow the search to one or two circuits. It will detect and locate missing connections, and although it will not detect a pin's being skipped when the circuit is carried through to the ot

Get $10.00 plus a by-line for the time it takes you to jot down your clever design idea. Payment is made when the idea is accepted for publication. Full information and an "entry blank" can be obtained by circling #278 on the Reader's Service Card.

gTester



Basic schematic to test branched circuits. Circuits with three connections to one pin are tested in this way. A missing wire from circuit *A* to circuit *B* will cause lamp AB to light.

ins, this last wiring fault has never yet een known to occur.

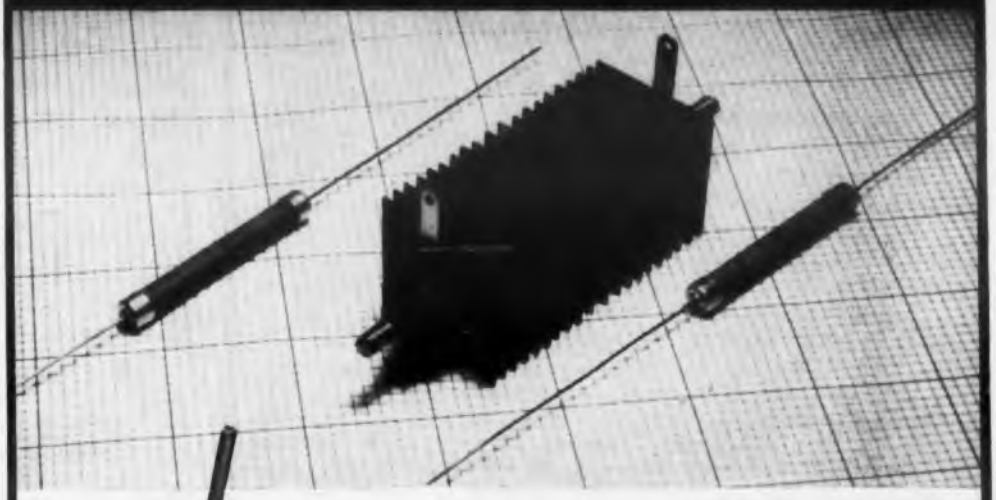
The schematic shows the setup used check circuits with three connections one pin. A missing wire from circuit to circuit *B* will cause lamp *AB* to ght up. When switch *a* is closed, *a'* pen and *b* open, circuit *A* is tested. When *b* is closed, *b'* open and *a* open, *B* tested. When the master switch is losed, only the *master circuit* lamp will ght if everything is normal. The lamp, cated directly above the switch, will urn at full brilliance if there are no issing connections in the circuit. hould a wire be missing, the *connection* mp between the two appropriate pin bels will light at half brightness. If veral circuits are missing a light will e seen for each one.

If a short exists to another circuit the *master circuit* lamp for that circuit will light. If trouble is found it is cleared before the operator proceeds, flipping each switch until all circuits have been checked and cleared.

The complete checker requires 168 switches, 1121 panel lamps, 33 Cannon connectors, a filament transformer and 10,000 feet of wire. Switches and lamps are mounted on strips of aluminum angle stock supported by wooden frame on top of a standard laboratory workbench.

Formerly, checkout time for the computer took two engineers more than a month. The matrix checker, designed and constructed in about three weeks, enables a technician to complete wiring checkout in less than a day. It has been in use for 19 months with no maintenance necessary, paid for itself on the first computer it was used to test.

Leading rectifier manufacturers select TUFF-TUBE to meet specifications...



...* and cut costs, too!

In high voltage rectifiers for military and commercial applications, the material used for housings and insulating tubes is of critical importance. Latest military specifications are calling for prolonged voltage surges, higher temperatures, severe humidity plus other rigid requirements. Add to these the necessity for high strength, light weight and close mechanical tolerances—the result is a difficult problem in material selection.

Leading rectifier manufacturers are solving this problem with **Lamtex TUFF-TUBE,** a high quality fiberglass-epoxy laminated tubing. Lamtex's exclusive impregnation and curing process, together with strict quality control, seals in properties that are unmatched for electronic component applications.

* A typical material formerly used for this application was glass-melamine G5. Direct cost comparison proved Lamtex TUFF-TUBE more economical, up to 16% savings in some cases.

Electronic design engineers are using TUFF-TUBE for waveguides, coil forms, spacers, component jackets, antenna housings, brush holders, tuning coils, motor insulation, commutator and printed circuit forms, and many other applications that require any or all of these characteristics:

INSULATION RESISTANCE	**HIGH TEMPERATURES**	**THIN WALLS, FROM .008"**
DIELECTRIC STRENGTH	**LIGHT WEIGHT**	**SMALL DIAMETERS, FROM .062"**
HUMIDITY-PROOF	**HIGH STRENGTH**	**DIMENSIONAL STABILITY**

AVAILABLE IN ALMOST ANY CROSS-SECTION SHAPE

Write for complete info — design features, tech data, application notes.

LAMTEX

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51 STATE STREET • WESTBURY, NEW YORK

CIRCLE 231 ON READER-SERVICE CARD

Electro
ADVANCED DESIGN TRANSDUCERS

Powr-Mite #3040 $25.00 list

NEW Self-Powered Speed Sensing Pickup operates relays directly*

Ferrous metals passing pickup operate relay without amplifier

No tubes or transistors needed with the Powr-Mite #3040 *self* powered magnetic pickup.

Simply feed the Powr-Mite #3040 output into any relay having 100 milliwatts sensitivity.

You get extra dependability through circuit simplification, plus important savings in weight and space.

Ideal for use with over and under speed controls.

Write for new bulletin

*100 milliwatts of power at surface speeds of 250 in./sec.

Electro
TRANSDUCERS FOR COUNTING CONTROL AND MEASUREMENT

ELECTRO PRODUCTS LABORATORIES
4501-D North Ravenswood, Chicago 40
Canada: Atlas Radio Ltd., Toronto

CIRCLE 232 ON READER-SERVICE CARD

You Get Things Done Better By Seeing What's Happening

BOARDMASTER VISUAL CONTROL

★ Gives Graphic Picture of Your Operations in Color.
★ Easy to Use. Type or Write on Cards, Snap on Board.
★ Facts at a Glance - Saves Time and Prevents Errors.
★ Ideal for Production, Scheduling, Sales, Inventory, Etc.
★ A Simple, Flexible Tool - Easily Adapted to Your Needs.
★ Compact, Attractive. Made of Metal. 250,000 in Use.

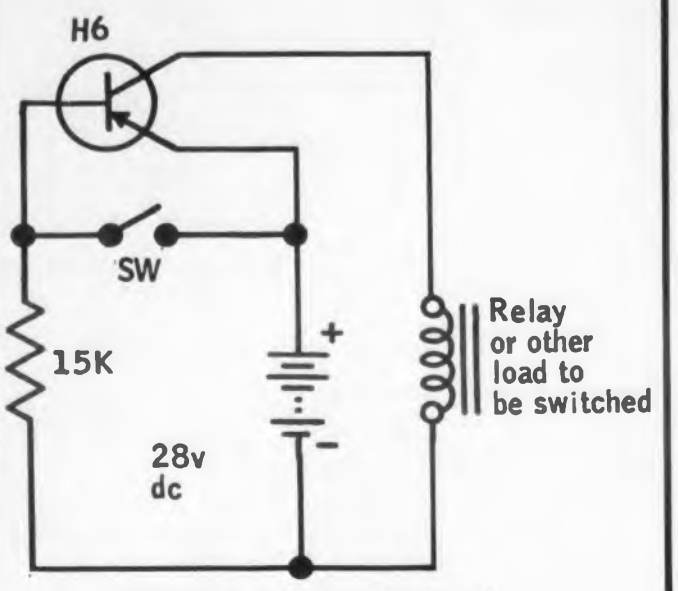
Complete Price $49.50 Including Cards

FREE 24-Page ILLUSTRATED BOOKLET N-40 Without Obligation

GRAPHIC SYSTEMS, 55 West 42nd St., New York 36, N.Y.

CIRCLE 233 ON READER-SERVICE CARD

Ideas for Design



Circuit for 40 db noise reduction.

Interference-Free Switching

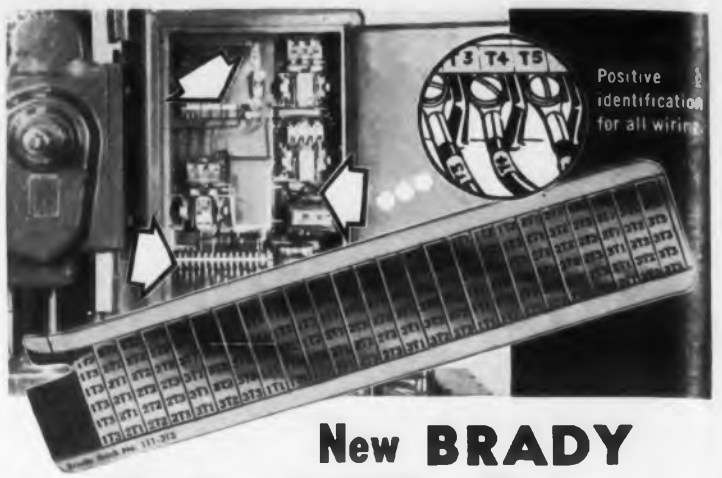
The switching of relays, heaters, capacitors, etc. without causing radio-noise interference is usually accomplished with LC filters which are bulky and costly.

The circuit shown can be used, which employs a transistor. The transistor is light, less costly, and does not require any special handling. Noise level in this circuit is down 40 db or better from that obtained on switching when there is no noise prevention.

R. G. Gray, Gray Electronics, 127 I. V. Willets Rd., Albertson, N. Y.

RF-Tight Joints at Low Cost

RF-tightness need not mean high production costs, as is true in other design problems. Considering the need for RF-tight construction in the drawing-board stage will save much time and money later. The weakest links in most RF-tight "black boxes" are the joints necessary for access. They are discontinuities in a shield across which conductivity must be restored for RF-tightness. A knowledge of the basic principle of RF-leakage will help in the understanding of the principles of good RF-design. Simply stated, it is: "At any given frequency the leakage through a discontinuity in a shield is proportional to the maximum dimension of gap, not its cross-sectional areas." For example, a 1/8 in. diam hole will leak much less than a slot 0.006 in. thick and 2 in. long although both have the same cross-sectional area.



New BRADY Aluminum Foil Wire Markers —Give Permanent Identification

Stick and stay in elevated temperatures, oils, most solvents

New Brady Aluminum Foil Wire Markers show which wire goes where at a glance. Permanently identify machine tool electrical systems, motor leads, control circuits, etc.

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The new model 126 VHS Meter-Relay is smaller than previous models. It has a moving coil armature which rotates in the flux gap of an Alnico magnet. A locking coil in the moving element develops extra torque for positive contact action. The case is solder sealed and may have a plug-in base or solder connections with hold-down screws.

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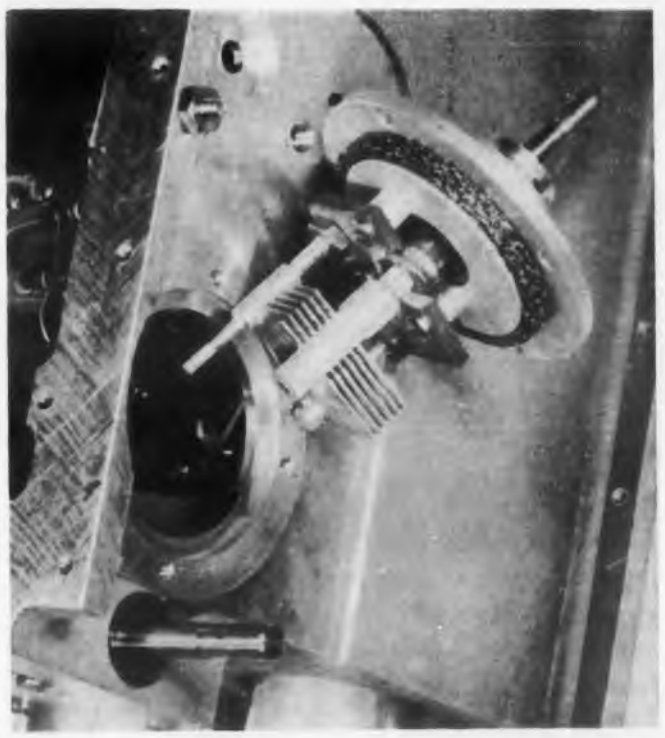
This is important in joint design since such long narrow gaps can easily occur at joints. The length of these discontinuities can be reduced by more accurate machining or by such "brute force" methods as many husky screws very closely spaced. Obviously, both methods are expensive and lead to greater bulk and less convenient accessibility. An analogous problem is pressure tight joints. Couplings in garden hose could possibly be made pressure tight by carefully machining the closure surfaces and using heavy threads which would be tightened with a wrench. But both these inconveniences and costs can be eliminated by using a very cheap gasket. Not only is total cost of the assembly less but seal reliability as well as accessibility is materially improved.

The same is true for RF joints. The introduction of a resilient metallic gasket will not only make a better and more dependable RF-tight joint, but will do it at less total cost than accurate machining or "brute-force" methods.

The photo illustrates the use of such an RF gasket in the oscillator section of a Boonton Radio signal generator. The gasket is a METEX (Metal Textile Corp., Roselle, N.J.) RF gasket made of Monel. It is resilient enough to require only four small screws to make the closure. Accessibility is very good. No difficult, expensive machining or husky construction is needed.

RF gaskets and electronic weatherstrips (RF gaskets in strip form) are available in a wide range of sizes and shapes.

Metal Textile Corporation, Roselle, N. J.



RF gasket shown in place on oscillator section of Boonton Radio Signal Generator.

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Report Briefs

Ferroresonant Trigger Limits

The basic component of a ferroresonant trigger circuit is a series LC circuit containing a nonlinear inductor. Two such LC circuits with associated excitation generator and series impedance form a complete ferroresonant trigger circuit. The basic LC circuit is considered separately and the magnitudes of current and voltage allowing at least two possible states of operation are developed. Both the loss-free and the lossy cases are considered. The results of the analysis on the basic LC circuit are used to predict the behavior of the complete ferroresonant trigger circuit for various conditions of operation. For the loss-free case, equations are developed for the boundary values of voltage and current. Similar boundary values are developed for the lossy case but, in general, these boundary values must be read from charts. These charts are presented in a normalized form applicable to any given circuit. Restrictions on the permissible range for the excitation frequency are also presented. *Limiting conditions in a Ferroresonant Trigger Circuit, J. C. Akalnik, Yale University, PB 124754, Oct. 1955, 54 pp, $3.60. Library of Congress, Washington 25, D.C.*

Ultrasonics to Test Bonding

An ultrasonic technique for the evaluation of structural adhesive bonds (the STUB-meter) is being developed and tested. The operation of the instrument is based on the empirically observed fact that the behavior of a ferroelectric transducer, when mechanically coupled to a test specimen, is affected by the structural properties of the test specimen. To define more closely the scope of the technique, an evaluation program is being carried out in cooperation with organizations in the aircraft industry. Initial data have already provided improved means of choosing optimum frequency ranges. Laboratory development of the STUB-meter has included work on probes for curved surfaces and for standard lap shear specimens; electrodes with improved wear resistance; visualization of vibration modes; effects of loading; and improved circuitry. *Development of Non-destructive Tests for Structural Adhesive Bonds, J. S. Arnold, Stanford Research Institute, Menlo Park, Calif., PB 131046, Feb. 1957, 62 pp, $1.75. Order from OTS, U.S. Dept. of Commerce, Washington 25, D.C.*

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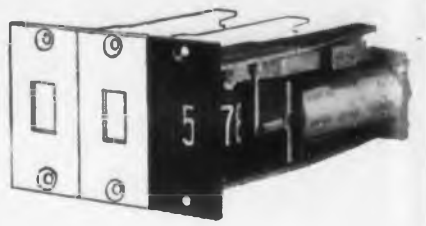

You can use these rugged single decade counters independently as decades or interdependently as a multi-digit counter to get practical solutions to an extremely wide variety of counting problems. Ten different contact arrangements are available to solve a number of problems. For example, an interesting application is the use of any number of decades as a remote predetermined counter in which any preselected number can be set up quickly from a remote location and made to operate a signal at either or both locations when the count returns to zero. In this application, if desired the preselected figure could be set up from a punched card.

The counters are small, measuring only 7/8" x 1¾" x 4⅜", and are suitable for flush mounting. Fast models are available with speeds up to 25 impulses/second. Power requirements are low-permitting their installation in electronic circuits. Long lived, tests indicate certainty of operation up to at least 50 million impulses.

Complete technical data is available, including circuitry recommended for a wide range of use. Write for Bulletin E-19.

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Magneto Resistance Effect

The theory of Davis and of Seitz on the magneto resistance effect is summarized, and its extension in several directions is begun. The case where the temperature is not close to absolute zero is briefly indicated, and the necessary formalism is also set up to deal with noncubic crystals. A new theorem is found regarding the absence of any magneto-resistance effect, either at low temperature or at all temperatures. Experiments are described measuring $\Delta p/p$ under various circumstances. Using a field of the order of 500 Gauss, most of the experiments deal with Bi and its anisotropy effects under various conditions and preparation. *Magnetically Sensitive Electrical Resistor Material, E. Katz, L. P. Kao, W. Tantraporn and H. Patterson, Michigan University, Engineering Research Institute, Ann Arbor, Mich., PB 125572, Mar. 1954, 32 pp, microfilm $3.00, photocopy $6.30. Order from Library of Congress, Washington 25, D.C.*

Experimental Distributed Power Amplifier

As a possible method of attaining a broad-band source of rf power at a level suitable for use as a final transmitter stage in the vhf and uhf bands, the use of distributed amplification in a pulsed power amplifier has been investigated. A method for the design of such an amplifier is described. *Experimental Distributed Power Amplifier, by S. K. Meads, U.S. Naval Research Lab., Aug. 1957, 19 pp, $.50. Order PB 131164 from Office of Technical Services, U.S. Department of Commerce, Washington 25, D. C.*

Asymptotic Formulas

A technique is discussed by which asymptotic solutions of reflection problems in paraboloidal and parabolic cylinder coordinates can be found for large wave numbers. This technique applies to reflections from the interior of parabolic and paraboloidal reflectors. Detailed discussions are then given for the cases of reflection of incoming plane waves, waves emitted by sources at the focus, and waves emitted by sources on the axis of the reflector, for both coordinate systems. *Asymptotic Formulas for Diffraction by Parabolic Surfaces, by Harry Hochstadt, New York University, Institute of Mathematical Sciences, Division of Electromagnetic Research, Mar. 1956, 34 pp, microfilm $3.00, photocopy $6.30. Order PB 125224 from Library of Congress, Washington 25, D. C.*

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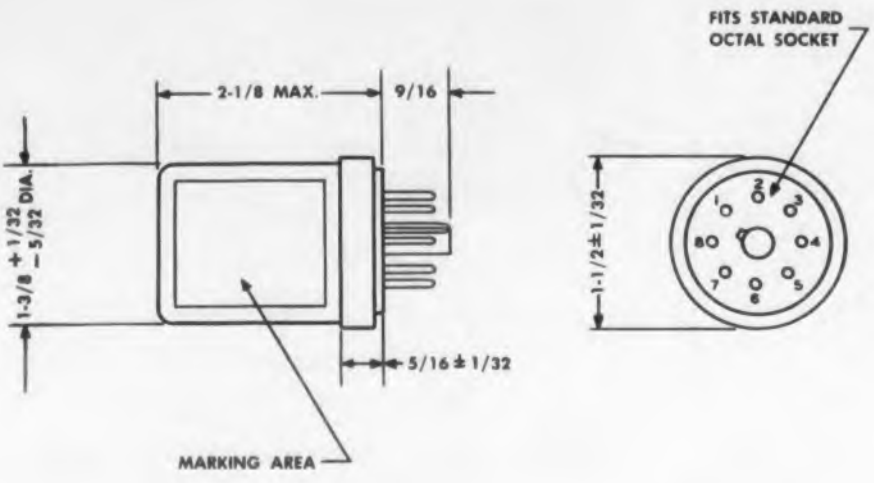

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Patents

Stabilized Semi-Conductor Oscillator Circuits

Patent No. 2,791,693. R. P. Moore, Jr. (Assigned to Radio Corporation of America)

Oscillator circuits using a semi-conductor or transistor as an element of the circuit lacks stability as to both frequency and amplitude under varying conditions of ambient temperature. Indeed if the collector resistance increases too much, oscillations may in fact cease. It has been found that a primary reason for the lack of stability was because of the variation in the collector resistance under varying ambient conditions. Usually the collector resistance decreases with an increase in temperature. The various circuits disclosed in the patent are directed more particularly to sine wave oscillator circuits.

The difficulties enumerated in this type of oscillator can be overcome by inserting a compensating resistor 42 into one of the electrode circuits of the transistor which resistor has a thermal responsive resistive characteristic. A thermistor provides a negative temperature resistive characteristic the resistance of which decreases with an increase in ambient temperature. The other circuit elements of the figure are in accordance with usual transistor oscillator practice with the oscillator circuit 36 in the base circuit. The oscillations are taken from the output terminals 47. In this circuit the compensation has been made for a transistor in which the collector electrode 20 experiences a decrease in resistance with an increase in the ambient temperature by inserting the thermistor 42 in the base circuit.

If the transistor should be one in which the collector electrode resistance increases with an increase in the surrounding temperature, which would have the effect of increasing the amplitude of the oscillations, then the ther-

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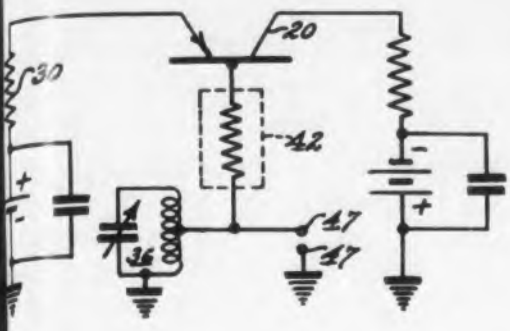

istor is inserted in the emitter circuit, it is, in place of resistor 30 of the cir- it illustrated. In this circuit, the ther- istor 42 is substituted by a common sistor of proper value. The patent dis- oses a number of other circuits, the es- ntial operation of which is as described th respect to the circuit of the figure.

kground Control for lor Television Receiver

tent No. 2,804,496. Loren R. Kirkwood. signed to Radio Corporation of Amer-

The system is used to control the mag- ude of the voltage for a plurality of trical utilization means, each of ich has a voltage control input ter- minal. An electrical network circuit consisting of four impedance arms which form a bridge circuit, has a first and a second set of access terminals with each set of access terminals defining a separate diagonal of the bridge circuit. The first set of terminals has an electrical potential applied thereto from a potential source. A tapped voltage dividing system is provided across the potential source. This voltage dividing system has a manually adjustable tap for adjusting the effective position of the tap thereon. A first manually controllable variable impedance element is provided between one terminal of the second terminal set and the voltage divider tap. A second manually controllable variable impedance element is provided between the other terminal of the second impedance set and the voltage divider tap. A connection is made from one terminal of the second terminal set to one of the input terminals for the voltage control of the utilization means. A connection is also made from the other terminal of the second terminal set to another voltage control input terminal. An impedance is inserted between the voltage divider tap and still another of the voltage control input terminals.

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*Ultrasonic welding — originated and developed by Aeroprojects Incorporated

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Patents

Electrical Impulse Generator

Patent No. 2,803,759 Normal L. Kreuder. (Assigned to Burroughs Corp.)

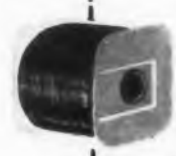
The generator includes a magnetizable core having a substantially rectangular magnetization characteristic. As a consequence under one condition of magnetization, the flux density remains relatively constant with variation in magneto-motive force and under another condition of magnetization of opposite polarity to the first condition, the flux density remains relatively constant with variation in magneto-motive force. A first winding is provided on the core for producing a magnetomotive force which causes the core to be placed in the first condition of magnetization. A second winding is also provided on the core for producing a magneto-motive force which causes the core to be placed in the other condition of magnetization. Finally a third winding on the core across which appears a signal when the core is changed from one of its conditions of magnetization to the other condition of magnetization. A switch is provided ha ing a movable contact connected with potential source, and two fixed contact one of which is coupled to the fir winding and the other fixed contact coupled to the second winding. Wi the circuit described an electrical i pulse appears across the third windi whenever the movable contact mak connection with one of the fixed contac for the first time after having been connection with the other of the fix contacts.

Phase Inverter Circuit

Patent No. 2,806,151. Francis J. Ianno (Assigned to The National Cash Regis Company)

The phase inverter amplifier compri an alternating voltage source having series non-linear circuit connected wi the source. This non-linear circuit i cludes a saturable core inductor and capacitance which is normally energiz to operate in series resonance. A paral non-linear circuit, consisting of a seco saturable core inductor in parallel w a second capacitance, is provided

design simplicity...



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es across the capacitance of the series
-linear circuit. The parallel circuit is
nally energized to operate in parallel
nance. A control winding on the core
he second saturable core inductor has
urce of control signals applied to it
hat the parallel circuit becomes non-
nant in response to a control signal.
s causes the series circuit to be loaded
a non-resonant condition.

able Device

nt No. 2,806,152. John Presper
rt, Jr. (Assigned to Sperry Rand
poration)

he bistable device uses a magnetic
lifier with an input and an ouput
inal. The magnetic amplifier has a
netic core with two stable states of
netic saturation and a coil adjacent
r on the core. The coil is energized
repeatedly driving the core from one
s stable states to the other without
lucing an output signal at the output
inal. A signal is applied to the input
inal for temporarily interrupting the
t of the energization of the coil to
produce an output signal at the output terminal. A feedback path is provided from the output terminal to the input terminal for feeding back at least a portion of the output signal to perpetuate the extant condition of the device. The feedback path incorporates at least an inductor which has a substantially unchanging value of inductance within the operating range of the device.

Pulse Coincidence Circuit

Patent No. 2,806,946. Stanley R. Rich. (Assigned to Raytheon Manufacturing Co.)

The circuit described is used to indicate coincidence between first and second overlapping input pulses. This is accomplished by electronically adding the first and second input pulses which added pulses are differentiated to obtain a wave form having unbalanced peaks. This wave form is applied to a balanced peak rectifier which is responsive to the wave form and from which an output signal is derived. This signal is indicative of coincidence between the first and second input pulses.

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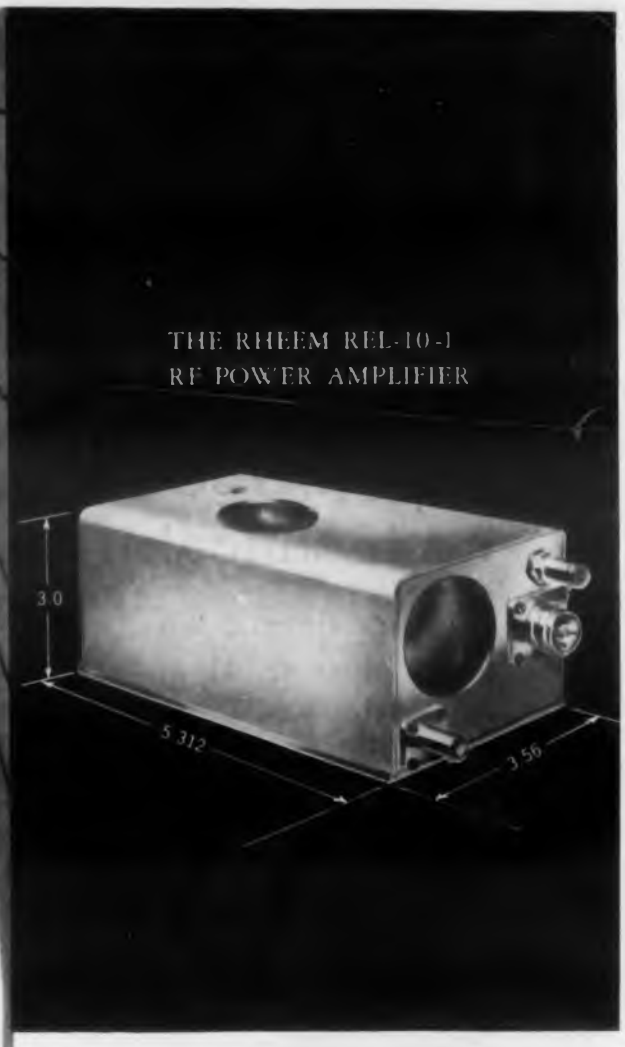

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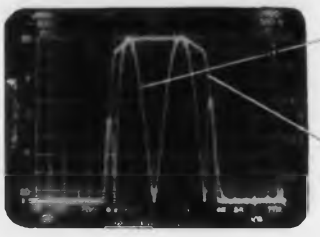

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Books

Ideas, Inventions, and Patents

Robert A. Buckles, Jr., John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N.Y., 270 Pages, $5.95.

Patents are legal documents which occupy an important place in the technical literature of our times. Many new technological advances are first announced through the publications of the U.S. Patent Office.

The author of this book is a practicing patent attorney, with a great deal of corporate experience. He is also an electrical engineer and an inventor.

Buckles feels that there is no reason for intelligent engineers and scientists to dispair when the questions of pate[nt] are raised.

In a concise, easy to read volume, [the] phases of the patent and copyright [laws] are covered. Legal jargon is avoided [and] this book is specifically designed to [help] readers with little or no experience in [the] field of patents. The author explains [the] fundamental facts that underlie pat[ents] in all areas of technology and provi[des] examples of specific applications.

A discussion of patents, how they [are] processed, and the role of a patent [at]torney are discussed in detail. The p[lan]ning of a patent program and the k[ee]ping of proper patent records for [im]prove[d] an

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ventor and corporations are detailed. One chapter is devoted to a case history of a simple invention. It begins at the time when the inventor first makes his invention and files his own patent application, and continues to the time the patent is finally issued.

A valuable feature of the book is the glossary of patent terms. The appendix includes representative forms of an approved engineer's agreement to assign inventions, a form of assignment, copies of all necessary formal papers (including the oath, petition, and power of attorney), as well as reproductions of the approved patent office drawing symbols and an original patent document.

Receiving Aerial Systems

I. A. Davidson, Philosophical Library, 15 E. 40th St., New York 16, N.Y. 152 pages, $4.75.

This book describes some of the technical problems associated with the installation of domestic antennas. Emphasis is on receiving antennas rather than aerials forming part of a communications system or are used at a transmitter.

This approach enabled the author to discuss his subject from the practical aspect of domestic installations. The book which resulted should be of value to those who work in the design of antennas for domestic use.

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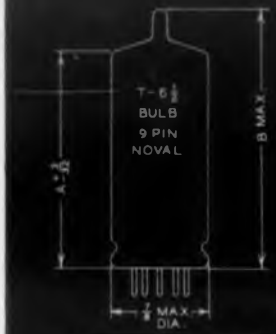

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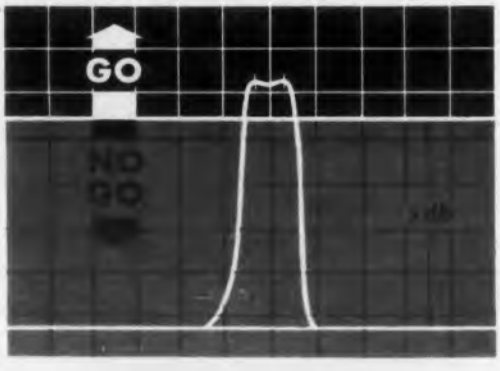

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Books

Automation in Practice

S. E. Rusinoff, American Technical Society, 848 E. 58th St., Chicago 37, Ill. 261 Pages, $6.50.

A practical work devoted to the industrial process of automation compiles the methods and machinery of the automated production in the metal industries.

The book begins with a discussion of the basic principles of automation. Self regulation, negative feedback, the theory of closed loop control systems, and other principles are included. These are then developed into concrete applications in the major types of control devices employed in today's automated and semi-automated plants.

Following chapters are devoted to the use of automatic equipment in all areas of metal fabrication. The final chapter details devices and systems for achieving automatic inspection and quality control in the manufacturing processes.

Numerical Analysis

Kaiser S. Kunz, McGraw Hill Book Co. Inc., 330 West 42nd Street, New York 36, N. Y. 381 pages, $8.00.

This book starts with the numerical solutions of algebraic equations, methods of interpolation, and numerical integration. It then proceeds to an application of the finite difference technique to ordinary and partial differential equations and the numerical solution of integral equations.

Considerable space is devoted to finite difference tables and notation, and numerical differentiation and integration. In preparation for the study of partial differential equations, the book treats rather thoroughly the solution of simultaneous linear equations and multivariate interpolation.

Many methods of numerical analysis are printed here for the first time in book form. A method of designating the multitudinous quadriture formulas and of obtaining them in a simple way from a lozenge diagram is presented. All of the methods as presented are directly applicable to either electric calculators or desk machines.

attention authors

Because an electronic design engineer must have hundreds of ideas to draw upon for each individual design decision, the editorial staff of *ELECTRONIC DESIGN* is continually trying to add to this storehouse of ideas. We are, therefore always interested in material based on your own experience which would be of immediate practical use to electronic design, development and research engineers. It is not difficult to write an article for *ELECTRONIC DESIGN* if you know what to write about and how we like to have our stories written. To simplify the preparation of an article, we have drawn up a brief guide for authors. Send for your copy today.

Edward E. Grazda, Editor.

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ience and Engineering Materials

ilip L. Alger, McGraw Hill Book Co., c., 330 West 42nd Street, New York , N.Y. 360 pages, $5.50.

The purpose of this book is to help the dent or engineer to use mathematics ectively. Arithmetic, trigonometry, al-bra, calculus, probability, and other pics are considered in successive chap-s. This permits each subject to be de-ed as an extention of earlier chapters. is presentation also allows the reader find, understand, and use the various thematical methods useful to engi-ers as interrelated and supporting tools opted to perform different tasks.

The book contains about 80 per cent the mathematical procedures and thods which an engineer will need to in the course of his career. Every thod and formula is explained in a y that will make it unnecessary to morize formulas. The misapplication formulas is almost impossible.

The text epitomizes what the student rns in mathematical courses up to the ferential equations level, and serves a springboard from which the student n go into more advanced work.

Designing for Industry

F. C. Ashford, Philosophical Library, 15 East 40th Street, New York 16, N.Y. 222 Pages, $6.00.

The purpose of this book is to provide a reliable picture of the profession of product designing as it exists today. As many specialized works exist dealing with materials, manufacturing processes, finishes, and other related subjects, no effort has been made to do more than indicate certain implications and suggest suitable readings for these aspects. Some subjects, as practice, and certain executive aspects have been treated in some detail. This work is dedicated to those people who are in need of a knowledge of the art of designing for manufacturing processes. As any product is, as the author points out, marketed for the purpose of profit, this book might well be considered as a primer on competitive marketing. The author covers such topics as the emotive aspect, the executive aspect, the material aspect, and the commercial aspect of designing. The author speaks with authority on British matters but his advice could be considered sound in any country.

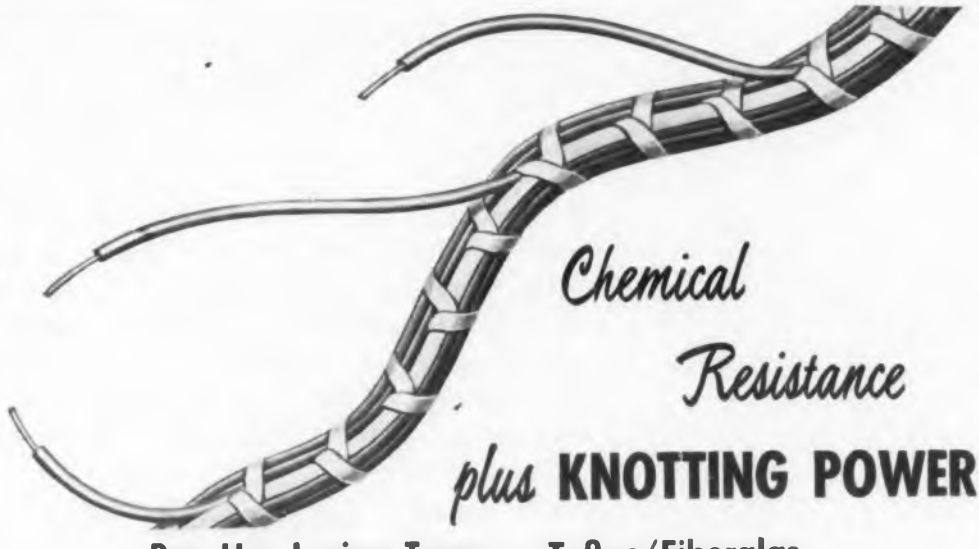

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Plate Voltage (Maximum DC)	300 volts	750 volts	350 volts
Screen Voltage (Maximum DC)	275 volts	325 volts	—
Peak Plate Voltage (Max. Instantaneous)	550 volts	750 volts	—
Plate Dissipation (Absolute Max.)	14.0 watts	30 watts	—
Screen Dissipation (Absolute Max.)	2.0 watts	3.5 watts	—
Heater-Cathode Voltage (Max.)	±450 volts	±450 volts	±500 volts
Grid Resistance (Maximum)	0.1 Megohm	0.1 Megohm	—
Grid Voltage (Maximum)	5.0 volts	0 volts	—
(Minimum)	−200 volts	−200 volts	—
Cathode Warm-up Time	45 sec.	45 sec.	45 sec.

*For greatest life expectancy, avoid designs which apply all maximums simultaneously.

**Voltage should not fluctuate more than ±5%.

MECHANICAL DATA	6094	6384	6754
Base	Miniature 9-Pin	Octal	Miniature 9-Pin
Bulb	T-6½	T-11	T-6½
Maximum Over-all Length	2⅛"	3 15/32"	2¼"
Maximum Seated Height	2⅛"	2 15/16"	2½"
Maximum Diameter	⅞"	1 7/16"	⅞"
Mounting Position	Any	Any	Any
Maximum Altitude	80,000 ft.	80,000 ft.	80,000 ft.
Maximum Bulb Temperature	300°C	300°C	300°C
Maximum Impact Shock	500G	500G	500G
Maximum Vibrational Acceleration	50G	50G	50G

West Coast Sales & Service: 117 E. Providencia Ave., Burbank, Calif.
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● DIT-MCO's Model 200 thoroughly tests circuits connected together at common terminal points such as grounding lugs, switches or relays. It automatically *energizes* and *functionally* tests solenoids, relays, actuators, panel lights and all external devices. Straightforward adapter cables adapt the Analyzer to any test, eliminating the need for modification within the machine. The operator can easily recheck corrected faults or spot test any circuit manually, without re-cycling.

● The Model 200 is a universal, highly accurate circuit tester which makes rapid, sequential tests of any complex, multiple interconnected circuitry at any stage of production, modification or maintenance. It automatically tests up to 200 circuits and can be expanded to test as many circuits as desired with the use of multiplier sections. The Analyzer is built with rugged, standard telephone-type components which give years of trouble-free service with minimum maintenance. Non-technical personnel easily master operation with less than one-half hour instruction.

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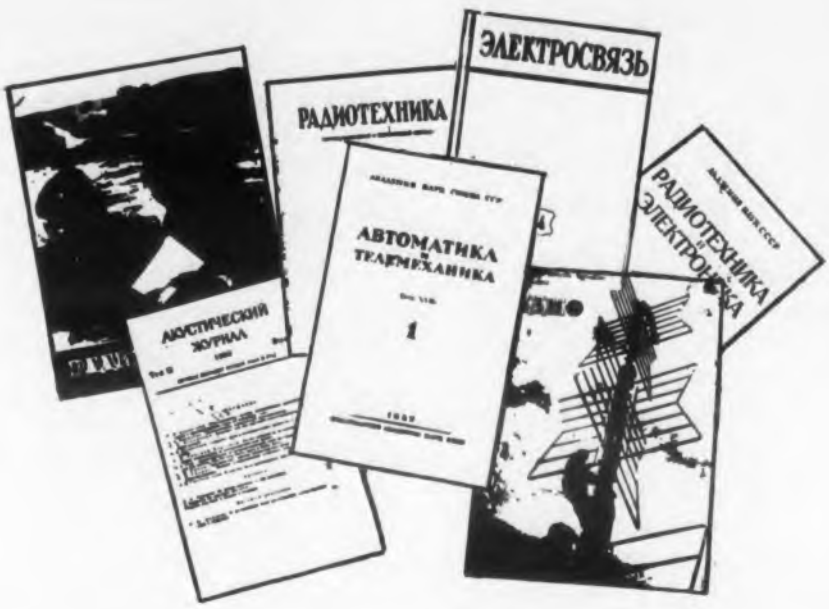

What the Russians are Writing

J. George Adashko

ELECTRICAL COMMUNICATIONS

(Contents of Elektrosviaz No. 5, 1957)

MICROWAVES

Oscillator-Modulator for Decimeter Waves, E. P. Korchagina, (7 pp, 3 figs.).

Description of a two-tube oscillator circuit with provision for frequency control. In this circuit (Figs. 1 and 2) both tubes deliver power to the load and both participate in the frequency control. The frequency deviations due to the tubes are additive if the feedback coefficients of the two tubes are complex and conjugate. The circuit produces greater frequency deviation than a reactive-tube circuit, and highest carrier frequency stability upon variation of the supply voltage (see Fig. 3.).

WAVEGUIDES

Use of Ferrites in Waveguide Design, A. K. Stoliarov, (12 pp, 20 figs.).

The basic phenomena occurring in waveguides with ferrites are discussed and explained. References are made to many American and British papers.

SPEECH TRANSMISSION

Systems for Compressing the Spectrum of a Telephone Signal, G. I. Tsemel' (6 pp, 6 figs.).

Survey of speech spectrum compression developed in recent times. An extensive reference lists most of the earlier American and British work.

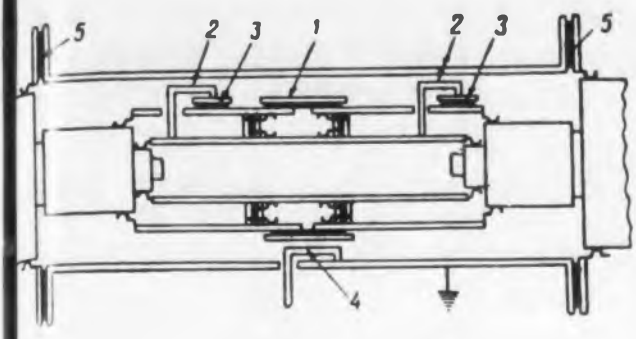

Fig. 1. Grounded-grid oscillator-modulator with metal-ceramic tubes. 1—blocking capacitor, 2—feedback loops, 3—blocking capacitors, 4—coupling loop, 5—blocking capacitor.

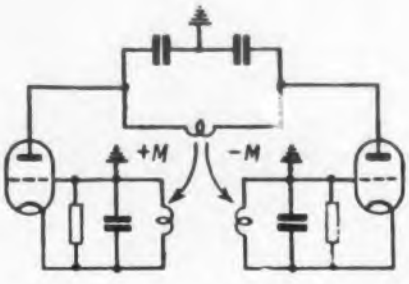

Fig. 2. Equivalent diagram of oscillator-modulator.

CIRCUIT THEORY

sign of Overdriven Oscillator with Detuned ad, E. P. Khmel'nitski, (8 pp, 8 figs.).

The operation of a strongly overdriven vacuum-be oscillator feeding a detuned load was dis-ssed by the author in the August 1955 issue of diotekhnika (ED, January 15, 1956) and in e June, 1956 issue of *Vestnik Svyazi*. This ar-de is devoted to the calculation of the engineer-g parameters of such a circuit.

INFORMATION THEORY

n the Most Expedient Utilization of Coding stems, V. I. Siforov, (8 pp, 2 figs.).

The properties of coding systems, operating der noise conditions, are examined for various tistical distributions of the letters contained. general expression is derived for the probable or per letter of a transmitted telegram. This per was delivered at the *Symposium on Infor-tion Theory*, held in Cambridge, Mass. in ptember 1957.

n the Theoretical Optimum Communication ystem, A. A. Khar'kevich. (4 pp, 5 figs.).

The choice of a communication system reduces eoretically to the choice of a transmission ethod (i.e., code) and of a reception method. this article the problem obtaining the opti-um system reduces to a certain variational roblem, the formulation of which incorporates so the noise-distribution probability. The hod of stating the problem is illustrated with veral examples.

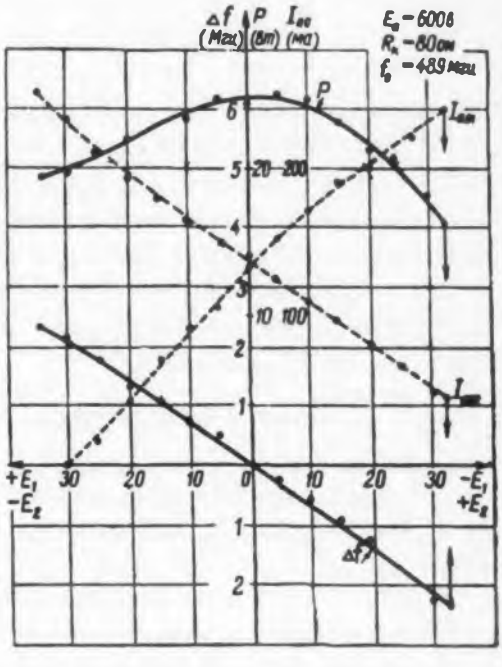

Fig. 3. Performance of circuit, operating with cathode self bias Δf (Mc), P (watts) I_{ao} (ma), $E_a = 600$ v $R_c = 80$ ohms $f_o = 489$ mc.

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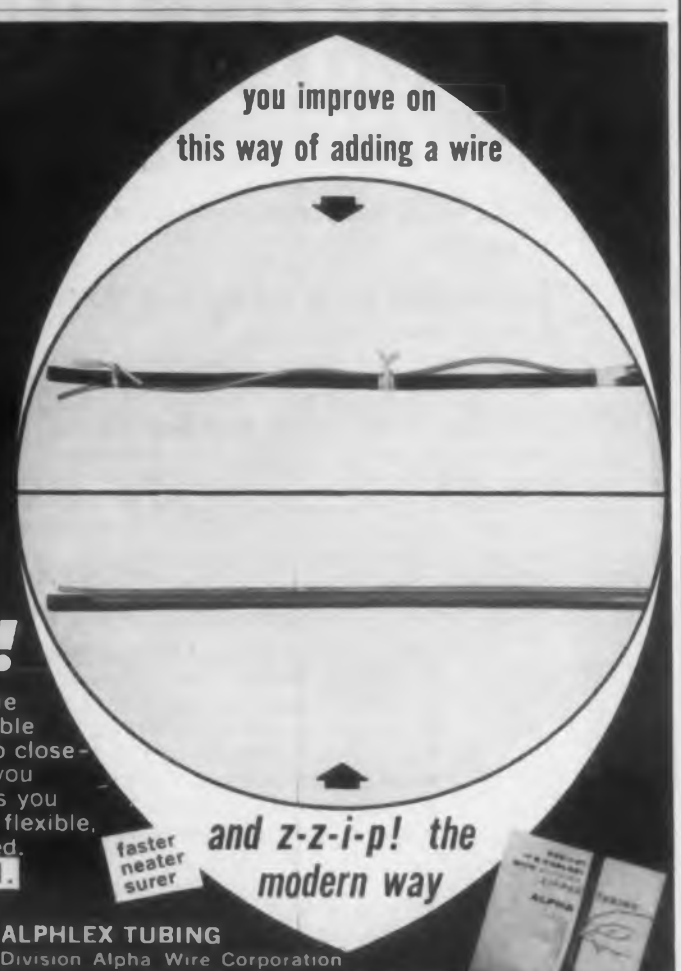

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Russian Translations

Other Articles in This Issue

Determination of the Steady State Error in Linear-Synchronism Pulse Systems, L. N. Shchelovanov, (6 pp, 7 figs.).

(Deals with synchronized telegraph systems.)

Analysis of DC Telegraph Switching Circuits, Kh. I. Cherne (9 pp, 10 figs.).

Oscillographic Method of Determining the "Swings" of the Scanning and Transmitting Sections of Facsimile Apparatus, M. A. Kudriashov, P. N. Ivanov (4 pp, 1 fig.).

RADIO ENGINEERING

(Contents of Radiotekhnika No. 6, 1957)

INFORMATION THEORY

The Relation Between the Speed of Message Transmission and the Noise Rejection of the Communication System, E. L. Blokh, (12 pp, 12 figs.).

Geometric methods are applied to a statistical investigation of the connection between the speed of message transmission and the noise rejection for the case of codes corresponding to the simplest and densest placement of the signal elements.

Grouping of Errors in Short-Wave Telegraphy, V. M. Rozov, (10 pp, 2 figs.).

The existing concepts concerning the causes of the appearance of errors in the reception of short-wave telegraph signals from remote radio stations are used to evaluate the average value of number of groups of false signals and the average duration of each group.

NETWORK THEORY

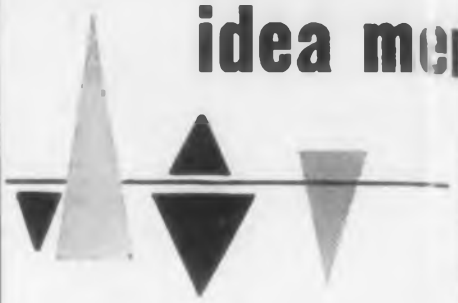
Use of Low-Frequency Equivalents for the Analysis of Transients Occurring in Diode Detection, L. S. Gutkin and O. S. Chentsova, (14 pp, 18 figs.).

A new method, based on linearization of the processes occurring upon detection and on the replacement of the detector and the tuned circuits with low-frequency equivalents, is proposed for the analysis of transients in a system consisting of a high frequency amplifier and a diode detector. The method makes possible a relatively easy determination of the transients in various types of tuned circuits feeding the detector for various variations of the input-signal envelope.

Balanced Center-Selection Filters, S. G. Kalikhman, (8 pp, 5 figs.).

The circuit parameters of balanced center-selection filters is given and a method is proposed for the analysis of such a filter with any number of elements. The experimental data cited confirm the theoretical prediction that the use of

attention idea men



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these filters in radio reception can improve considerably the adjacent channel selectivity.

RECEIVERS

Noise Figure of a Superregenerative Receiver, M. K. Belkin, (4 pp, 1 fig.).

The various sources of noise in a superregenerative receiver are analyzed, subject to several simplifying assumptions. The noise factor of a superregenerative is found to be only slightly above that of a superheterodyne. Refers to "Superregenerative Receivers" by Whitehead, (Cambridge, 1950).

Experimental Investigation of Limitation of Pulsed Noise with Spectrum Conversion and Variable Threshold, A. A. Gorbachev, (5 pp, 8 figs.).

Limitation of pulse noise accompanied by conversion of the useful-signal spectrum and of the noise spectrum, using a limiter with a limitation threshold that follows the level of the low-frequency useful signal, was investigated experimentally. It was found that the device suppresses satisfactorily pulse noise with durations up to several milliseconds.

COMPONENTS

Experimental Investigation of Low-Frequency Noise in Tubes and Transistors, B. V. Abramov and V. I. Tikhonov, (7 pp, 3 figs., 3 tables).

It is known that cathode-ion interaction sharply increases the spectral intensity of low-frequency noise in vacuum tubes below 10 kc. This noise must be taken into account whenever special high-frequency devices must operate at low frequencies. The author describes an experimental setup used to measure the noise and reports on the results obtained. Refers to "Noise in Current-Carrying Ohmic Conductors" by B. Meltzer *(Phil. Mag. Vol. 41, 393-398, 1950).*

VIDEO

Use of Cathode-Circuit Compensation in the Output State of a Video Amplifier, T. M. Agakhanian, (10 pp, 6 figs.).

It is shown that a network with compensation in the cathode circuit increases considerably the maximum output voltage of an amplifier. Curves and equations are given for the output voltage and for the current pulse amplitude.

TRAVELLING WAVES

Fast Waves in a Coaxial Helical Line, L. N. Loshakov and E. B. Ol'derogge, (6 pp, 7 figs.).

Propagation of fast waves in coaxial helical lines is analyzed under the assumption that the inner conductor of the line, namely the helix, can be replaced by an anisotropic conducting surface. The properties of several of the lower fast-wave modes are investigated and the dependence of the frequencies on the geometric parameters of the line is determined.

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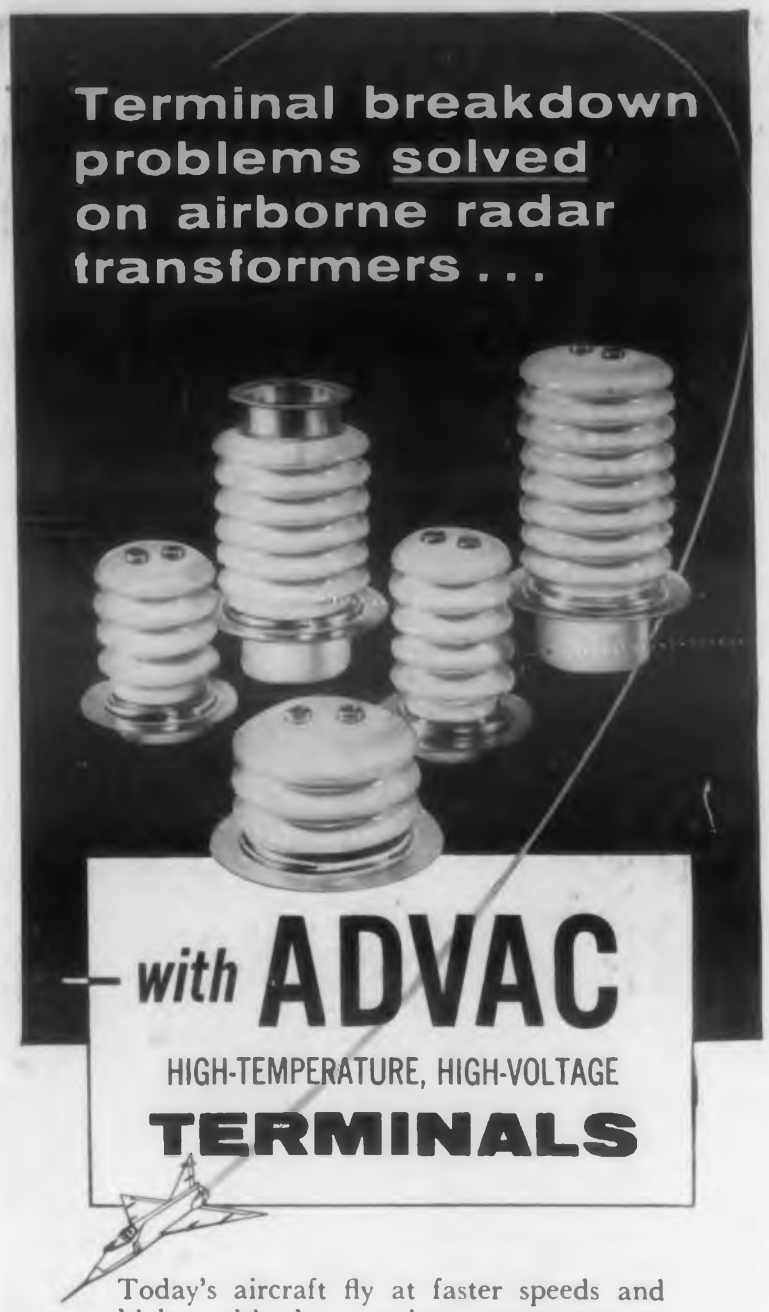

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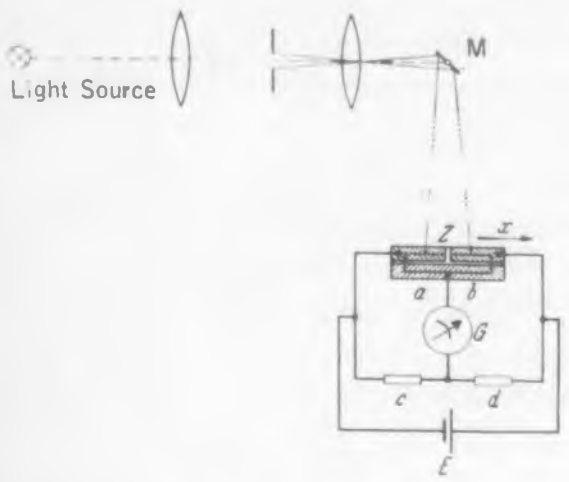

Circuit showing how a differential crystal is used as a light amplifier in an unbalanced bridge.

IN THE FIELDS of control systems and precision measurements the amplification of light is of considerable importance. Photoresistors can be used to advantage in systems of this type. These materials have extremely high sensitivity, require only small supply voltage and can therefore replace thermal elements or conventional photocells. The cadmium sulphide crystals exhibit a particularly large photoeffect and can be used in spite of the fact that their characteristics change with age and temperature if the associated circuitry is suitably designed.

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The bridge circuit shown in the Figure is a simple application of the *CdS* cell as a light amplifier. The cell, Z, is a single crystal which has been split with a scalpel. Thus it is not necessary to divide the beam of light into two beams. It can be shown that the output voltage of the bridge,

Survey of Microwave Tubes

IN LIGHTHOUSE tubes the electron transit time limits the upper frequency at which the tube can be used. These tubes were discussed in an earlier article (abstracted in ELECTRONIC DESIGN, 1957) In "transit time" or "velocity modulated" tubes the phenomenon which limits the utility of lighthouse tubes is utilized in the principle of operation of the tube. Such velocity modulated tubes can be divided into four classes.

1) Tubes in which there is no static field transverse to the beam. In such tubes the path of the beam is substantially linear. An example of this type of tube is the travelling wave tube.

2, 3) Tubes in which a centrifugal force is balanced by an electrostatic or magnetostatic force. Such tubes are at present not practical because the forces which are involved are exceedingly small so that only very small currents are possible.

assumed in the figure to be across a galvanometer G, is approximately proportional to the distance x through which the beam rotates when the mirror M rotates. (It is this rotation which unbalances the bridge if the null position of the mirror illuminates sections a and b of the "differential" crystal equally.) The approximation requires that the impedance level of the bridge be sufficiently high, a condition which is easily fulfilled. The output of the bridge when the unbalanced condition exists is proportional to the supply voltage but since a six volt battery suffices to energize the device this fact is not a handicap.

The gain which this particular system furnishes can be defined as the ratio of the angle through which the mirror of a galvanometer connected to the output of the bridge turns to the angle through which the mirror M turns. Amplification of the order of several thousand can easily be achieved.

It is shown in the original paper that the total error can be kept to between 3 to 5 per cent. The application of the device to slowly varying ac signals and its use as a nonlinear device (by "shading" half of the crystal) is also suggested.

(Abstracted from an article by H. Oswald and H. Straubel, Zeitschrift fur Angewandte Physik, *Vol. 9, No. 9, Sept. 1957, pp 438-442.)*

4) Tubes in which electrostatic and magnetostatic forces balance each other, tubes with crossed fields. The magnetron is an example of this type.

The various motions of the electron beam and the associated phenomena (bunching, interaction of the beam with waves etc.) are summarized in the original paper. A bibliography which consists of seventy references is included in this part so that each aspect of the tube mechanism is touched upon and then documented. The topics treated include the effect of delay lines, coupling impedance, beam focussing and noise in microwave tubed. So far only tubes without static crossed fields are treated, it is expected that succeeding articles will deal with the other types.

(Abstracted from three articles by R. Mueller and W. Setter Elektronische Rundschau, *Vol. 11, Nos. 7, 8 and 9, pp 206-211, 242-244, 268-270.)*

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N.B.S. HANDBOOK H 28, SCREW-THREAD STANDARDS FOR FEDERAL SERVICES, SEPTEMBER 10, 1957

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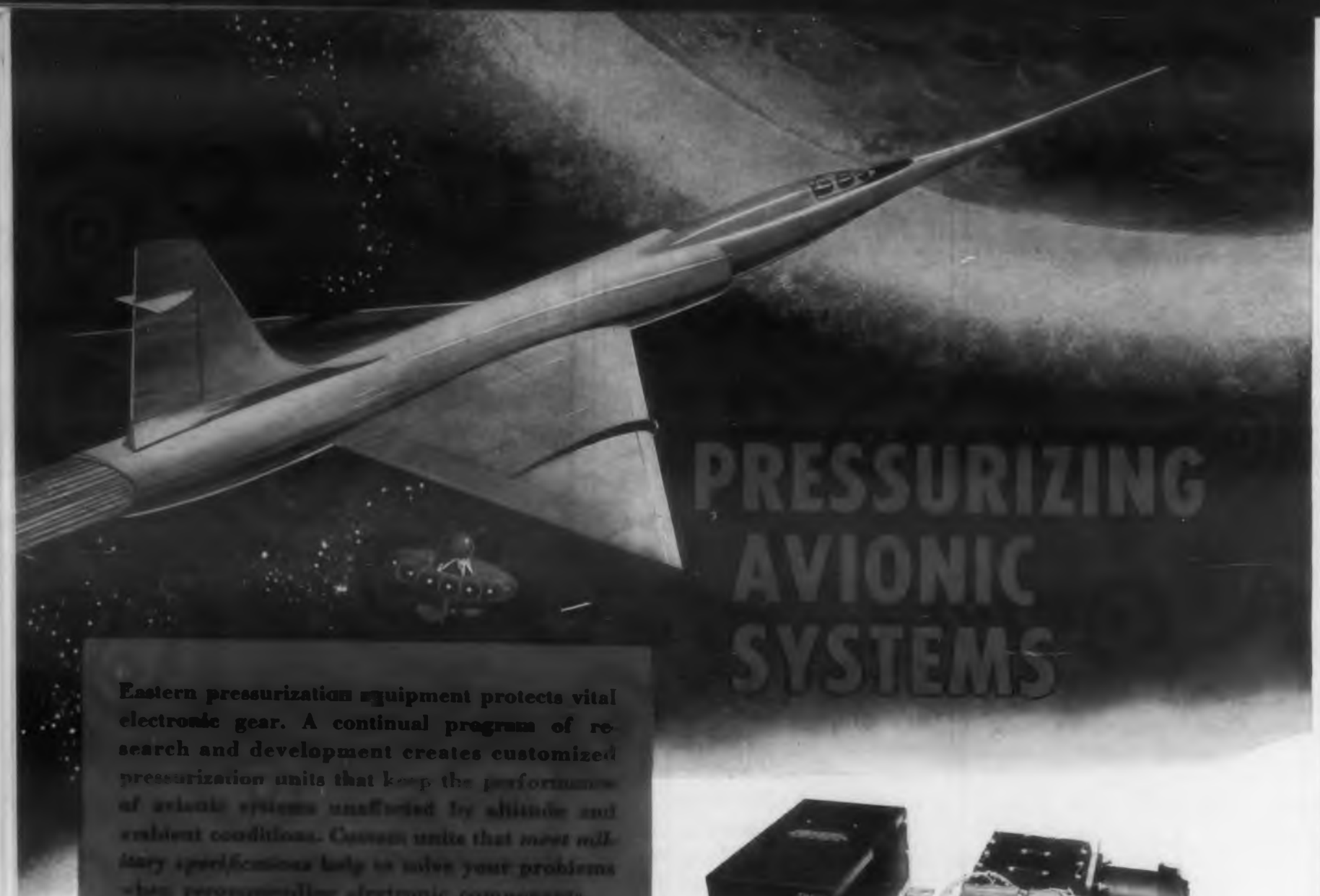

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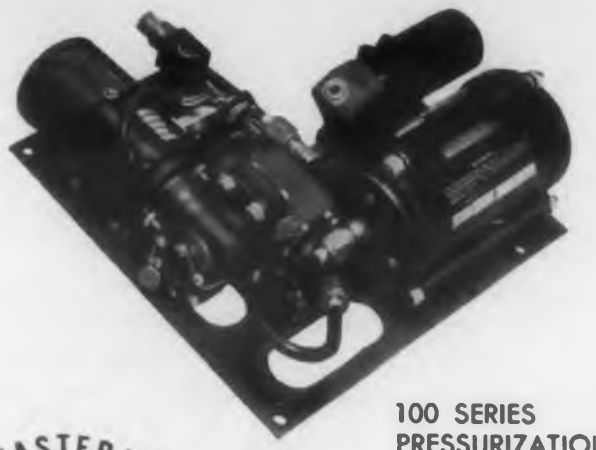

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