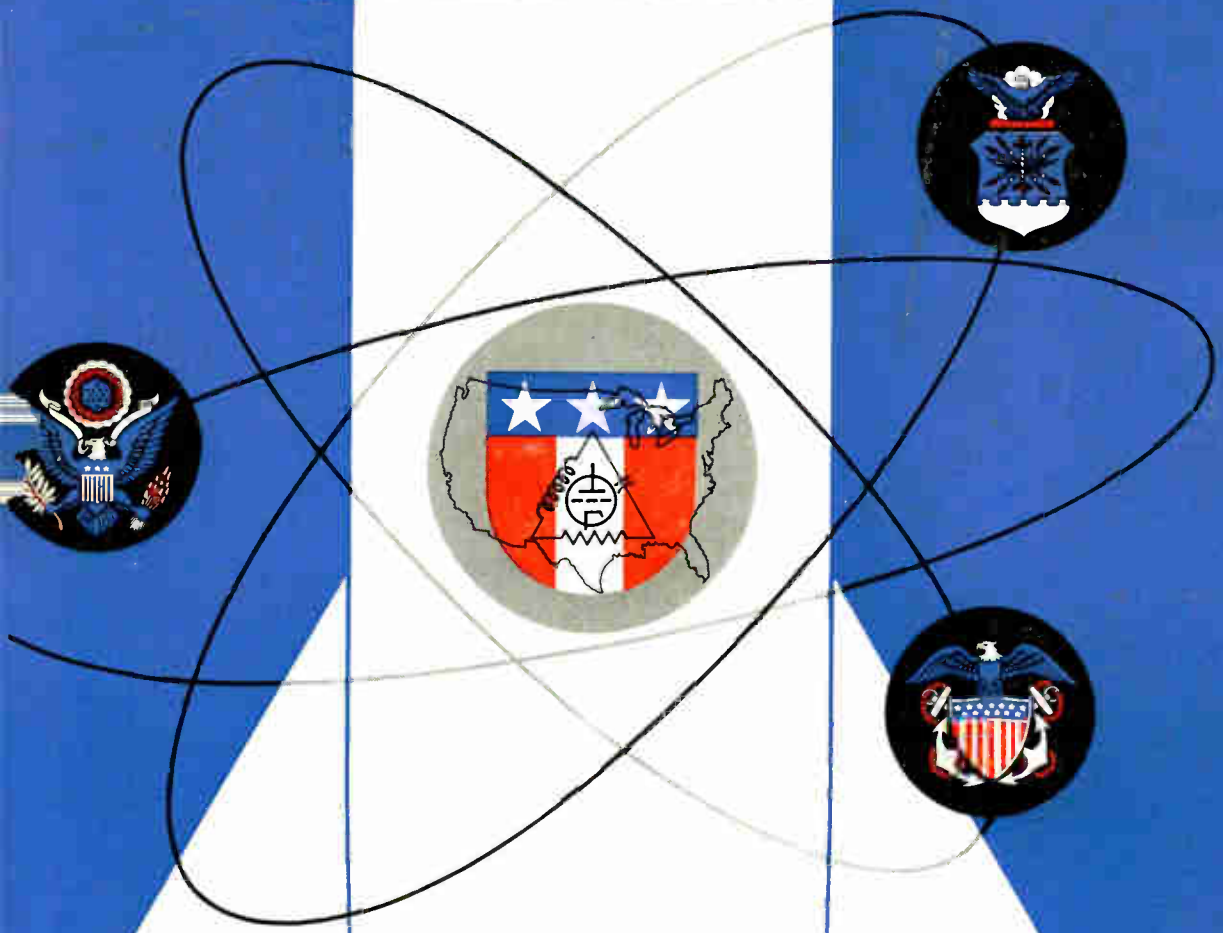
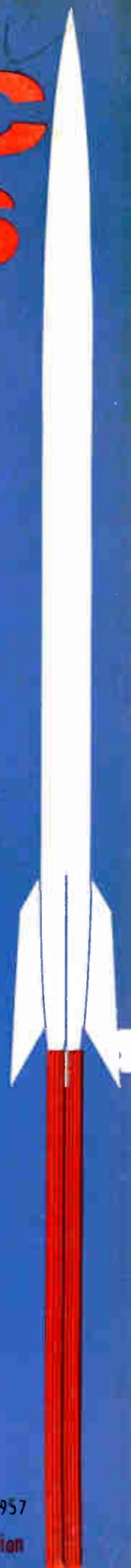
ELECTRONIC INDUSTRIES

& TELE-TECH



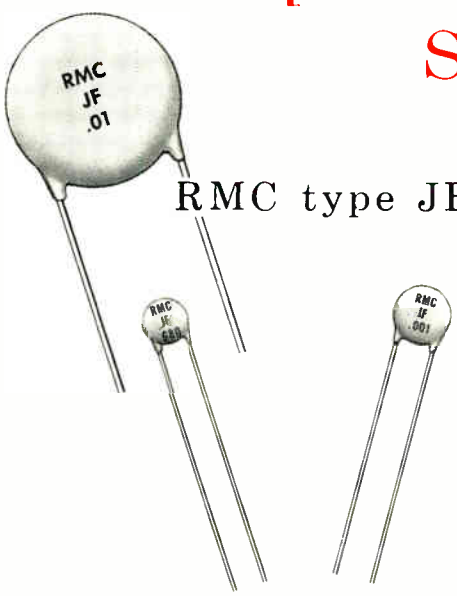
1957 DIRECTORY of MILITARY ELECTRONIC PROCUREMENT



September • 1957

A Chilton Publication

frequency stability



RMC type JF DISCAPS retain excellent stability under a wide range of frequencies. These DISCAPS extend the available capacity range of the RETMA Z5F type capacitors between +10° C and +85° C and meet Y5S specifications —30° and +85° C. Now in capacities between 150 MMF and 10,000 MMF, Type JF DISCAPS exhibit a change of only ±7.5% between +10° and +85° C.

For applications requiring a capacitor with superior frequency stability it is wise to specify Type JF DISCAPS. Write today on your company letterhead for complete information.

DISCAP CERAMIC CAPACITORS

RMC

RADIO MATERIALS CORPORATION
GENERAL OFFICE: 3325 N. California Ave., Chicago 18, Ill.
Two RMC Plants Devoted Exclusively to Ceramic Capacitors
FACTORIES AT CHICAGO, ILL. AND ATTICA, IND.

Circle 1 on Inquiry Card, page 101

ELECTRONIC INDUSTRIES
& TELE-TECH

Vol. 16, No. 9 — September 1957

MONTHLY NEWS ROUND-UP

NEW ELECTRONIC EQUIPMENT

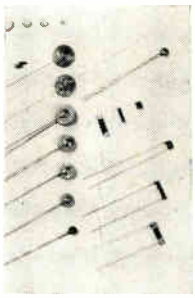
DEPARTMENTS

BPA NBP

Guided Missile Control 54

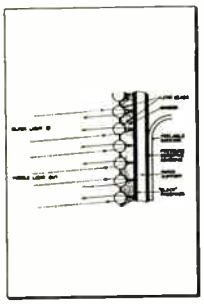
In designing missile control systems, problems arise from the fact that the missile itself is part of the feedback system and its dynamic response.

Low, Low Temperatures 58



In line with the continuing investigation into the superconductive characteristics in the region of absolute zero, new thermistor sensing elements read temperotures to within 1°K.

Black Light 62



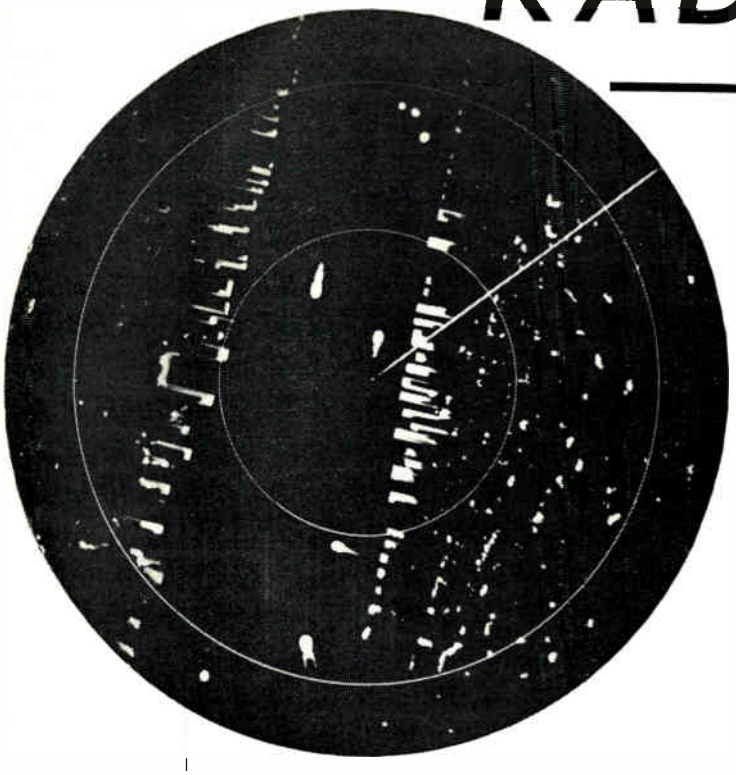
Ultra violet rays are being investigated by the military as a possible new means of short range communication and as a means of secret signaling and control.

Portable Or Not? 65

Many pieces of "portable" test equipment are never used, simply because they are either too clumsy or too heavy for the technician to take with him on the job.

ELECTRONIC INDUSTRIES & Tele-Tech, Sept. 1957. Vol. 16, No. 9. A monthly publication of Chilton Co. Executive, Editorial & Advertising offices at Chestnut & 56th Sts., Phila., Pa. Accepted as controlled circulation publication at Philo., Pa. 75¢ per copy, except June (Directory issue) $3.00. Subscription rates U. S. and U. S. Possessions: 1 yr. $5.00; 2 yrs. $8.00; 3 yrs. $10.00. Canada 1 yr. $7.00; 2 yrs. $11.00; 3 yrs. $14.00. All other countries 1 yr. $10.00; 2 yrs. $16.00.

RADARSCOPE



TRUE TRACKING RADAR

Off-center radar positioning and a panoramic presentation are features of the new commercial marine radar introduced by Sperry Gyroscope Company. In a panoramic picture presentation, moving objects appear in perspective as moving blips of light. Stationary objects are clearly defined, stay fixed on the scope, and have no trails.

GUIDED MISSILE DEVELOPMENT should be placed in private industry rather than in government arsenals or universities, says the Aircraft Industries Association. Transferring development knowledge to the private production facilities introduces an unnecessary lag between development and production! The association points out the similarity of plane and missile design, development, and production, and cites the aircraft industry's experience as unequaled qualification for this work.

IMPROVED DC DATA SYSTEM utilizing ordinary telephone lines has been developed by Burroughs Research Center, Paoli, Pa. The new CORDAT units are used at both the transmission point and the reception point. It digitizes, in binary form, radar-furnished d-c analog voltages for transmission; and, at the reception point, reconverts this digital data into d-c analog voltages for use by aircraft detection computers. The system can be easily adapted to industrial use.

CLEAR CHANNEL TO THE STARS is contained in the frequency 1420 MC. This is the characteristic frequency at which hydrogen atoms emit and absorb radio energy. Much of the effort of radio astronomists is directed toward study of 1420 MC energy from the universe.

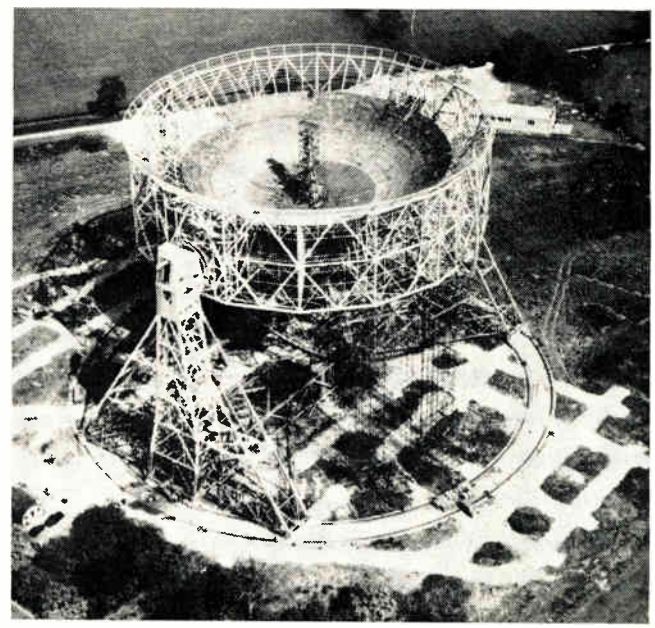
UHF TV TAX EXEMPTION is proposed in HR 8675, a bill introduced by Representative Ikard. According to this, the excise taxes on TV receivers would not apply to sets capable of receiving TV broadcasts in all of the UHF channels. Passage of this bill could have a significant influence in the growth of the TV industry.

SUBMARINE MENACE is still held to be our foremost threat by some defense experts. They point to a need for better Sonar with increased range and less dependence on the human ear for discrimination of targets—also, we need a better way to locate enemy mines.

FUSION RESEARCH under way at England's Harwell atomic research station is expected to soon produce detectable fusion reactions. If successful, the experiments will mark a major milestone in the search for practical fusion power. The principles used in the new apparatus have not been revealed, but it is known that studies have been made of a reaction caused by passing a large current through a magnetically contained column of plasma. Our own Naval Research Laboratory has been investigating possibilities of generating the necessary fusion temperatures by electromagnetically induced shock waves. Early work has produced ionic temperature equivalents exceeding 100,000°K.

GIANT RADIO EYE

This radio telescope, being built for Manchester University at Jodrell Bank, Cheshire, England, will search out into space to a distance of 1,000 million light years—and automatically track a distant star for astronomical research.



FERRITE MICROWAVE AMPLIFIER has been successfully operated at Bell Labs. Although still in the lab stage, this amplifier is an important addition to the growing family of solid-state devices. It operates at room temperature, and is expected to have a much lower noise level than conventional microwave amplifiers. In principle, the present device requires that a ferrite sample be placed in a microwave cavity which is simultaneously resonant at two signal frequencies. Microwave power at a frequency equal to the sum of the two signal frequencies is then pumped into the cavity. A d.c. magnetic field, properly oriented and of sufficient intensity to cause gyromagnetic resonance at this sum frequency, must also be applied. Through nonlinear coupling in the ferrite, amplification or oscillation will be exhibited at either of the lower frequencies, or frequency conversion of a microwave signal can take place between these two frequencies.

FLASHLIGHT CELLS are finding increased acceptance in transistorized portables. Big advantages are ease of loading and almost universal availability of the cells. (Flashlight cells are on the counters of over 800,000 drug, grocery, hardware, etc. stores.) Battery manufacturers predict standardization around D, C, and AA size cells, as well as NEDA numbers 1600, 1601, and 1603. Latest development is a patented battery holder for flashlight cells which maintains proper polarization no matter which end of the cell is put in first.

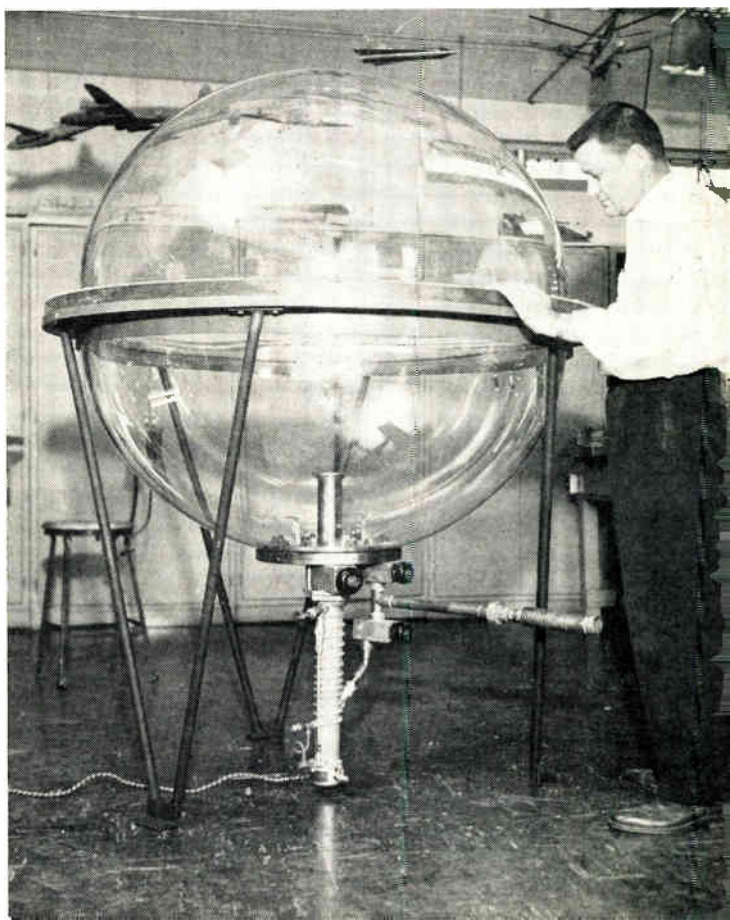
BENDIX ACQUIRED manufacturing and sales rights in U. S. and Canada for Dectra, the new navigation system now in operation between Newfoundland and Scotland. Bendix also holds rights to Decca, the similar but shorter-range navigation system now in use throughout Europe. Dectra, operating over a range of 2300 miles, automatically plots the exact course of a plane or ship, showing where it has been, where it is at any moment, and its heading toward the desired destination.

AMERICAN NUCLEAR POWER POLICY has been endorsed by the National Association of Manufacturers. NAM agrees that production of electric power from nuclear energy holds great promise for the United States and for the rest of the world, but points out that the abundance of economical energy sources in the U. S. precludes competitive nuclear power in many areas during the immediate future. NAM feels present partnership of private enterprise and government will lead to the greatest fund of technological and economic knowledge; denounces suggestions of government-accelerated construction of full-scale industrial nuclear power reactors at this time. The NAM Nuclear Energy Committee urges vigorous industry participation in developing foreign demand for nuclear equipment, pointing out that nuclear power costs are competitive with conventional sources in many areas of the world. They urge the government to accelerate release of power reactor technology to be applied abroad.

IMPROVED RADAR MAPPING is possible with the Radar Restitutor developed by the Electronics Division of Fairchild Controls Corporation. The chief distortion on the original radar photographs is caused by the fact that radar records the distance between the radar station and an object, and for airborne radar sets this means that the slant distance is recorded. For mapping purposes, though, it is necessary to know the ground distance between the aircraft nadir and the ground object. Another source of error is the fact that an airborne radar is continually moving while the radar display does not take this motion into consideration. The Restitutor computes these distortions and several additional distortions as well and positions the ground object at the corrected coordinates on the new photograph which it produces.

ANTENNA TEST SPHERE

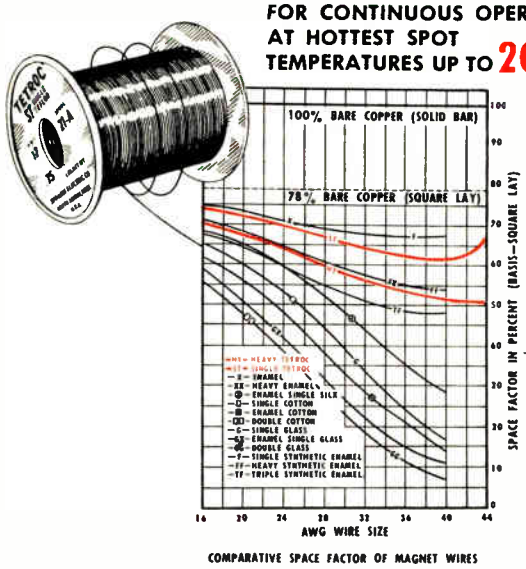
At Stanford Research Institute, high altitude r-f antennas are placed inside this great sphere which is then evacuated for simulated high altitude antenna tests.



THESE ARE SPRAGUE'S TWO OUTSTANDING

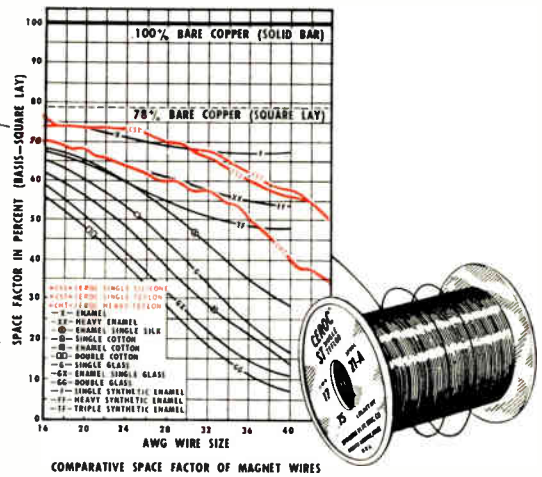
HIGH-TEMPERATURE MAGNET WIRES

FOR CONTINUOUS OPERATION AT HOTTEST SPOT TEMPERATURES UP TO **200°C**



Tetroc®

FOR CONTINUOUS OPERATION AT HOTTEST SPOT TEMPERATURES UP TO **250°C**



Ceroc®

SPRAGUE offers you a choice of 2 *truly* high-temperature magnet wires:

TETROC is recommended for continuous operation at hottest spot temperatures up to 200°C (392°F) and up to 250°C (482°F) for short periods of time. Tetroc, a teflon-insulated wire is available in both single and heavy coatings.

CEROC is recommended for continuous operation at hottest spot temperatures up to 250°C (482°F) and up to 300°C (572°F) for short periods of time. Ceroc wire insulation consists of a ceramic base with either single or heavy Teflon overlays—combining the best properties of both materials.

Both Tetroc and Ceroc Magnet Wires provide extremely high space factors.

FOR COMPLETE DATA WRITE FOR ENGINEERING BULLETIN 405 (TETROC WIRES) 400A (CEROC WIRES).

SPRAGUE ELECTRIC COMPANY • 233 MARSHALL ST. • NORTH ADAMS, MASS.

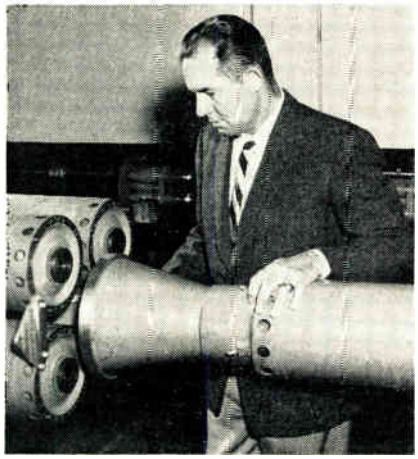
As We Go To Press...

POLICE RECEIVERS

RCA transistorized FM receivers are now undergoing experiments by the New York City Police Department. The sets are expected to be on the market this year.

Far Side Flight Tests Start This Month

The Far Side high-altitude rocket program moves into the flight stage this month, according to Ford Motor subsidiary, Aeronutronic Systems, Inc. Aeronutronic is prime contractor for sponsoring Air Force Office of Scientific Research. The four stage, solid propellant



Herbert L. Karsch, Director of Project Far Side, examines the cluster of first stage rocket engines and the single rocket engine of the second stage.

rocket vehicle will carry a 3½ pound package of scientific instrumentation to a height of several thousand miles.

A unique feature of the program is the use of a 200-foot diameter balloon as a launching skyhook to raise the rocket above the more dense portions of the atmosphere prior to firing. The balloon, a General Mills product, has already been tested.

No Engineer Shortage! Navaho Personnel Find

In Downey, Calif. last month industry got a fearful preview of what would happen with a sudden end of defense spending.

As the government announced the cancellation of their contract with North American Aviation for the Navaho missile more than 1,000 engineers, together with some 10,000 technicians and production personnel, suddenly found themselves unemployed. First reports were that a total of 15,000 personnel would be laid off. A few days later North American revised the figure to 12,500.

The engineers were dumped on the market at a time when rumors said that the engineer shortage was coming to an end. It soon became apparent that the engineers were finding it most difficult to find new jobs. Experienced engineers making $800 to $900 a month found it necessary to take cuts of up to $200 a month. And for engineers without any particular skill the only way out was to relocate.

To assist their discharged employees North American invited competing firms to come to Downey and recruit engineers. Recruiting teams from other firms were even invited inside the plant gates, and booths were set up in the company parking lot by agencies interested in hiring.

At the same time newspapers around the country were reporting a drop in "engineer help wanted" advertising for the fifth straight month.

Start CRT Production

Commercial production of 24-inch lightweight 110-degree TV picture tubes has been started by Sylvania. The new 24-inch tubes are approximately 4 pounds lighter and 5¼ inches shorter than previous 90-degree tubes.

The new tubes feature a non-ion trap construction, use a 600 ma heater, and are constructed with a rigid pin base. All of Sylvania's 110-degree line are aluminized.

REDSTONE

The Army's giant Redstone missile is now on public display in New York's Grand Central Station. The 62-foot rocket towers nearly to the ceiling.

Ultrasonic Technique Aids Brain Surgery

Newest technique in brain surgery involves focusing ultrasonic energy with pinpoint precision to destroy selected tissues deep within the brain. Secret of the new brain surgery is to use beams of ultrasonic energy which in themselves cannot injure intervening tissue, yet which combine at the focus to destroy nerve tissue.

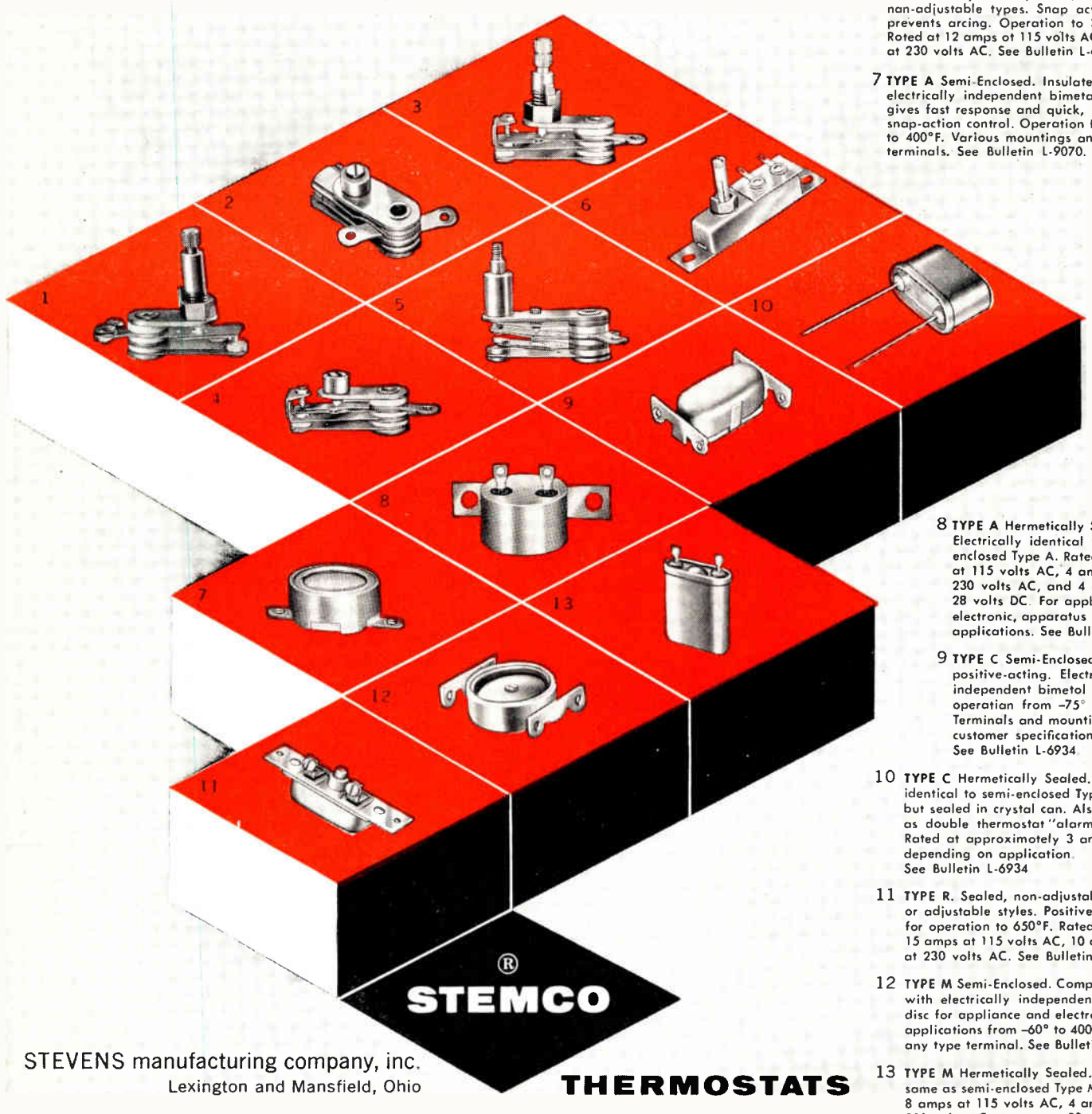
Researchers at the bioacoustics lab of University of Illinois have been able to control the process to such an extent that selected nerve tissues are destroyed without even breaking blood vessels in the region.

MORE NEWS on page 13

look to Stemco Thermostats first

for precise, sensitive temperature control

If your product requires precise, sensitive temperature control . . . if it's scheduled for volume production—look to Stemco thermostats first. Since Stevens produces the broadest range of bimetal thermostats in the industry, chances are you can use a standard production-line unit to satisfy all your special requirements exactly. This saves design, development and tooling expense . . . cuts down on lead time . . . gives you a better, proven thermostat at lower cost—sooner.



1 **TYPE S** Adjustable Pasitive-octing, with electrically independent bimetal. Adjusting stem and terminals ta custamer specificotion. See Bulletin F-2006.

2 **TYPE S** Nan-Adjustable. Electrically identical ta adjustable Type S. Single-stud mounting. Operates to 650°F. Roting: 15 omps at 115 volts AC, 10 amps at 230 volts AC. See Bulletin F-2006.

3 **TYPE SA** Adjustable. Snap-acting with electrically independent bimetal. Alsa single-pale, double-thraw. Adjusting stem and terminals to customer arder. See Bulletin L-6397-A.

4 **TYPE SA** Nan-Adjustable. Is electrically identical to adjustable Type SA. Non-inductive-load rating 15 amps at 115 volts AC, 10 amps at 230 volts AC. See Bulletin L-6397-A.

5 **TYPE SM** Monual Reset. Mechanically and electrically same as adjustable and non-adjustable Type SA except far manual reset feature. See Bulletin L-6397-A.

6 **TYPE W.** Adjustable *(shown)* ar nan-adjustable types. Snap action prevents arcing. Operation to 350°F. Roted at 12 amps ot 115 volts AC, 8 amps at 230 volts AC. See Bulletin L-6395.

7 **TYPE A** Semi-Enclosed. Insulated, electrically independent bimetal disc gives fast response and quick, snap-action control. Operation from -40° to 400°F. Various mountings and terminals. See Bulletin L-9070.

8 **TYPE A** Hermetically Sealed. Electrically identical to semi-enclosed Type A. Rated at 8 amps at 115 volts AC, 4 amps at 230 volts AC, and 4 amps at 28 volts DC. For appliance, electronic, apparatus applications. See Bulletin L-9070.

9 **TYPE C** Semi-Enclosed. Small, positive-acting. Electrically independent bimetol strip for operatian from -75° ta 300°F. Terminals and mountings to customer specifications. See Bulletin L-6934.

10 **TYPE C** Hermetically Sealed. Electrically identical to semi-enclosed Type C but sealed in crystal can. Also supplied as double thermostat "alarm" type. Rated at approximotely 3 amps, depending on application. See Bulletin L-6934

11 **TYPE R.** Sealed, non-adjustable *(shown)* or adjustable styles. Positive acting for operation to 650°F. Rated at 15 amps at 115 volts AC, 10 amps at 230 volts AC. See Bulletin F-2003.

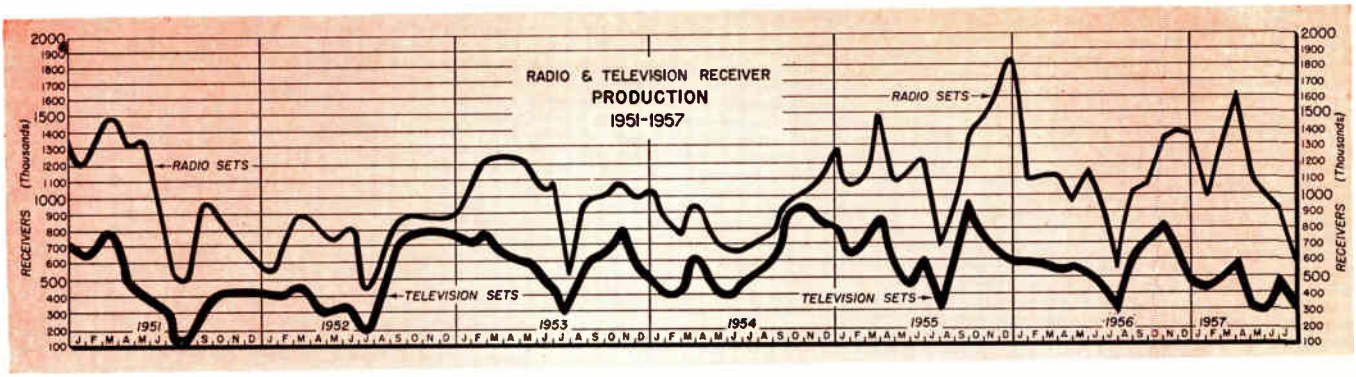
12 **TYPE M** Semi-Enclosed. Compact unit with electrically independent bimetal disc for appliance and electronic applications from -60° to 400°F. Virtually any type terminal. See Bulletin F-2009.

13 **TYPE M** Hermetically Sealed. Electrically same as semi-enclosed Type M. Rating: 8 amps at 115 volts AC, 4 amps at 230 volts AC, 4 amps at 28 volts DC. See Bulletin F-2009.

AA-2338

STEVENS manufacturing company, inc.
Lexington and Mansfield, Ohio

Circle 3 on Inquiry Card, page 101



FEDERAL R & D BUDGET EXPENDITURES
(in millions)

Fiscal year	Total	Major national security	Other
1958 est.*	$3,345	$2,793	$552
1957 est.*	2,981	2,561	465
1956*	2,538	2,202	336
1955	2,085	1,804	281
1954	2,085	1,806	279
1953	2,100	1,830	270

*Includes pay and allowance of military personnel assigned to R & D activities.

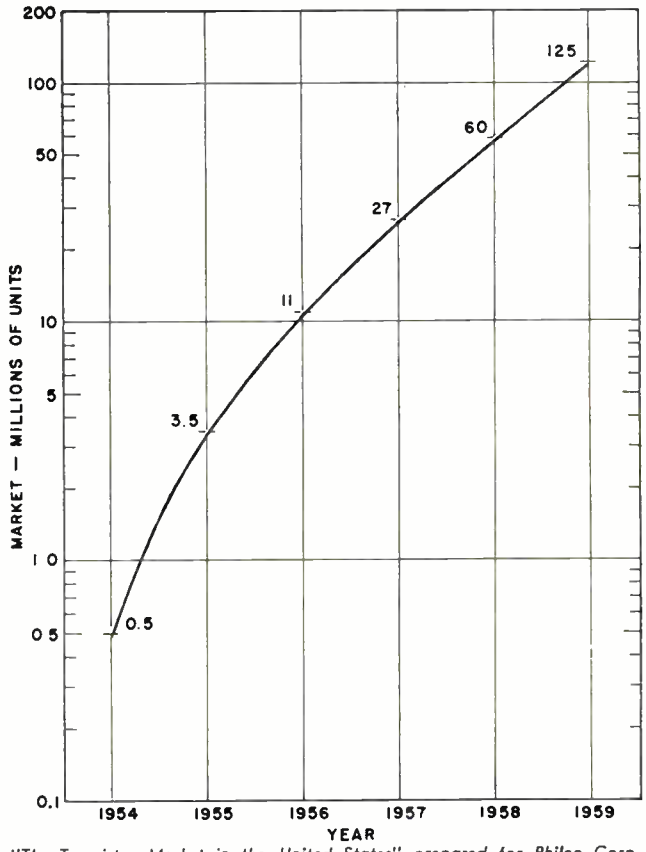
—The Federal Budget in Brief

AIR FORCE SUPPLIERS

Industry	Number of Prime Contractors	Number of Subcontractors
Electronics	351	1,600
Propulsion	16	16
Airframe & missiles	40	40
Mechanical, Electrical, Instruments	3,550	10,500
Landing Gear	5	17
Propeller	3	6
Photographic	25	40
Total	3,990	12,219

—Investor's Reader, No. 1, Vol. 29

PROJECTED TOTAL TRANSISTOR MARKET



"The Transistor Market in the United States" prepared for Philco Corp., Lansdale Tube Co., Div., by Stanford Research Inst.

DRY CELL BATTERIES

Quantity and value of shipments, 1956

Type	Total Quantity (1,000 cells)	Total Factory Value ($1,000)	Domestic Quantity (1,000 cells)	Domestic Factory Value ($1,000)	Export Quantity (1,000 cells)	Export Factory Value ($1,000)
General purpose	11,946	5,849	11,705	5,729	241	120
Flashlight cells	519,299	37,293	450,664	32,735	68,635	4,558
Lantern batteries	46,674	5,369	46,366	5,331	308	38
Hearing aid cells	50,240	2,667	47,264	2,522	2,976	145
Radio A, B and C cells	567,391	26,660	522,029	23,871	45,362	2,789
All other dry cells	3,168	552	3,168	552	.....	.....
Civilian types, Total	1,198,718	78,390	1,081,196	70,740	117,522	7,650
Military types	409,574	17,918	409,574	17,918	.....	.....
TOTAL	1,608,292	96,308	1,490,770	88,658	117,522	7,650

—"Facts For Industry," U. S. Department of Commerce.

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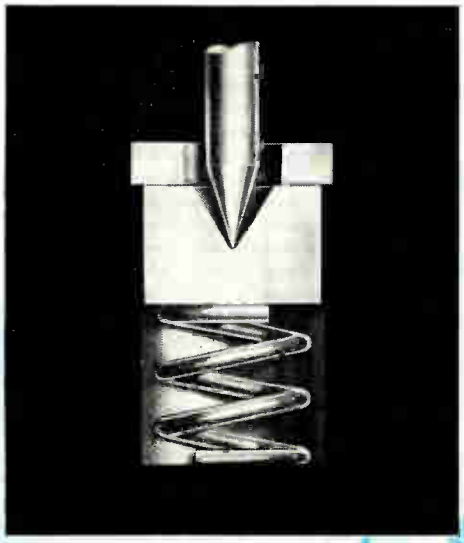
0.0000028 lb!



Tiny shock-absorbing springs, shown greatly enlarged at the left, provide a *second line of defense* against shock damage in Weston ruggedized panel meters. While the entire instrument movement is cradled on an effective overall shock mount of specially formulated rubber, these tiny shock absorbers, mounted in back of each jewel bearing, provide double protection at the critical points. The spring-backed jewel in ruggedized instruments is another Weston FIRST . . . one which assures continuous, dependable service wherever panel meters are subject to severe impact, vibration or shock.

EXPANDED FACILITIES NOW MAKE WESTON RUGGEDIZED PANEL METERS READILY AVAILABLE FOR MOST NEEDS . . . MANY TYPES AND SIZES FROM STOCK. Consult your nearest Weston representative, or write Weston Electrical Instrument Corp., Newark 12, N. J.

Weston ruggedized instruments are *approved* in all sizes—1 ½", 2 ½", 3 ½", 4 ½".

WESTON *Ruggedized* PANEL INSTRUMENTS

A DAYSTROM UNIT

LOW VALUE CAPACITORS

Simplest, most economical fixed composition types yet produced. Color-coded values from 0.10 to 10.0 μμf. Bulletin GA.

New! CERAMIC PERMANENT MAGNETS

The permanent magnets that are really permanent! Made from non-critical, low-cost ceramic powders. Write for new Stackpole Ceramagnet® Bulletin RC-10A.

CERAMAG® FERRO-MAGNETIC CORES

Characteristics of Stackpole Ceramag Cores are maintained with remarkable uniformity regardless of size or shape. Standard deflection yoke, "U," cup and threaded screw types. Complete facilities for special types. Ask for Bulletin RC-9A.

MOLDED COIL FORMS

Molded of high-resistance powdered iron with firmly-anchored, easy-to-solder wire leads. Bulletin RC-10C.

FIXED COMPOSITION RESISTORS

½-, 1- and 2-watt composition types in all standard RETMA ranges. Low noise level . . . unsurpassed humidity protection . . . easily-soldered, firmly-anchored leads.

VARIABLE COMPOSITION RESISTORS (Controls)

One of the largest most dependable lines including single, concentric shaft duals, midgets and types for transistorized equipment. Stackpole Bulletin RC-10B.

LINE SWITCHES

Types to provide practically any desired switching arrangement for Stackpole Variable Resistors. Ask for Bulletin RC-10B.

SLIDE SWITCHES

½ to 3 amp. UL approved types for maximum switching versatility and convenience in appliances, TV and radio sets, instruments, toys, etc. Bulletin RC-10D.

POWDERED IRON CORES

Insert, cup, sleeve, threaded, choke coil, sidemolded and plain core types. Also Stackpole preferred type "EE" Cores for maximum economy. Bulletin RC-10C.

A MAJOR COMPONENT SOURCE...for MAJOR

Bulletin RC-10B
Variable Resistors and Line Switches

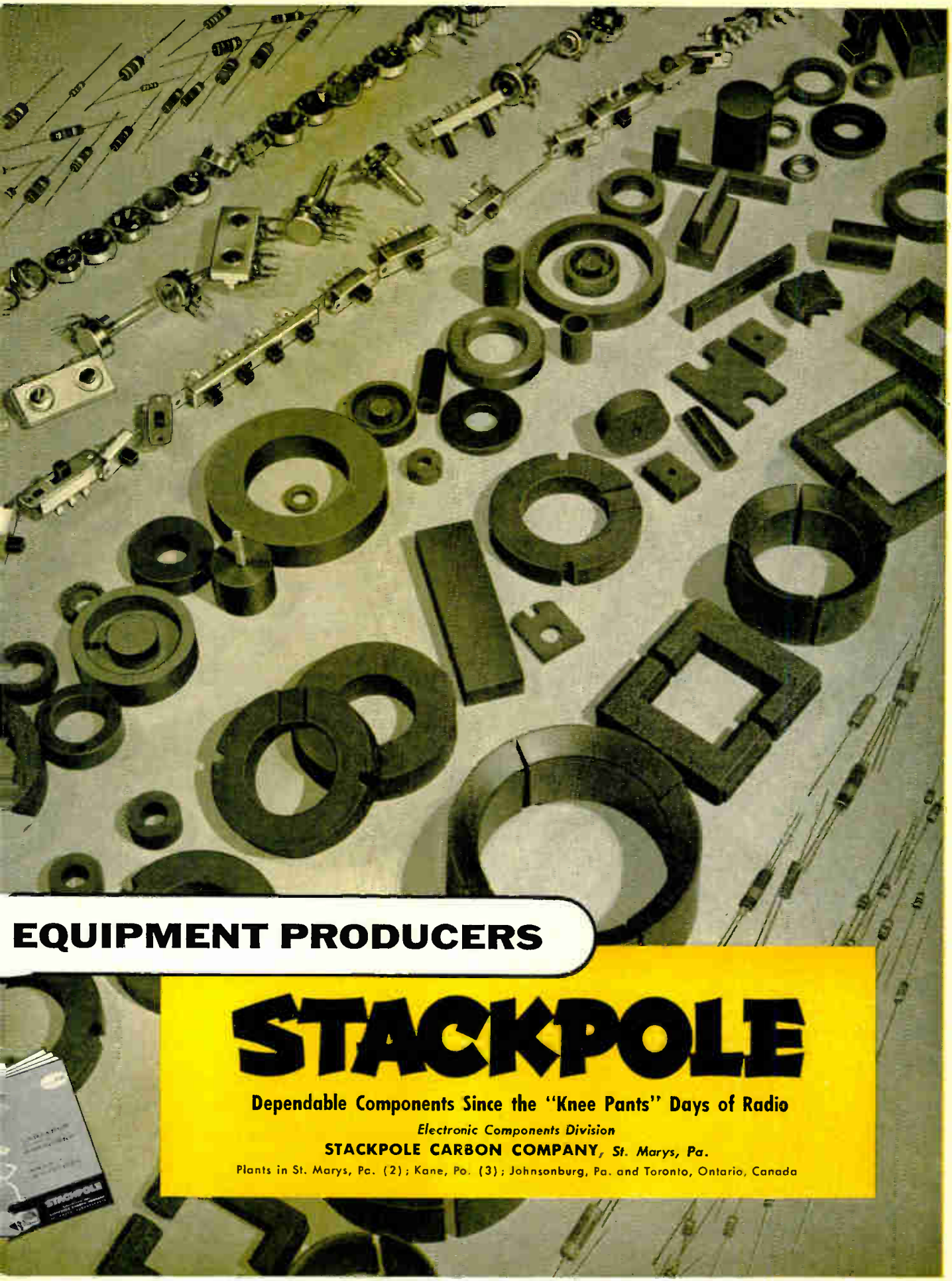
Bulletin RC-10C
Powdered Iron Cores and Coil Forms

Bulletin RC-9A
Ceramag® Ferromagnetic Cores

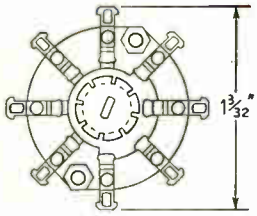
Bulletin RC-10D
Slide Switches

Bulletin RC-10A
Ceramagnet® Permanent Magnets

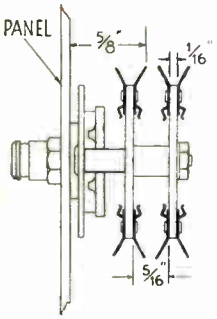
Bulletin GA
Low-Value Capacitors


EQUIPMENT PRODUCERS
STACKPOLE
Dependable Components Since the "Knee Pants" Days of Radio
Electronic Components Division
STACKPOLE CARBON COMPANY, St. Marys, Pa.
Plants in St. Marys, Pa. (2); Kane, Pa. (3); Johnsonburg, Pa. and Toronto, Ontario, Canada

NEW miniature switch...



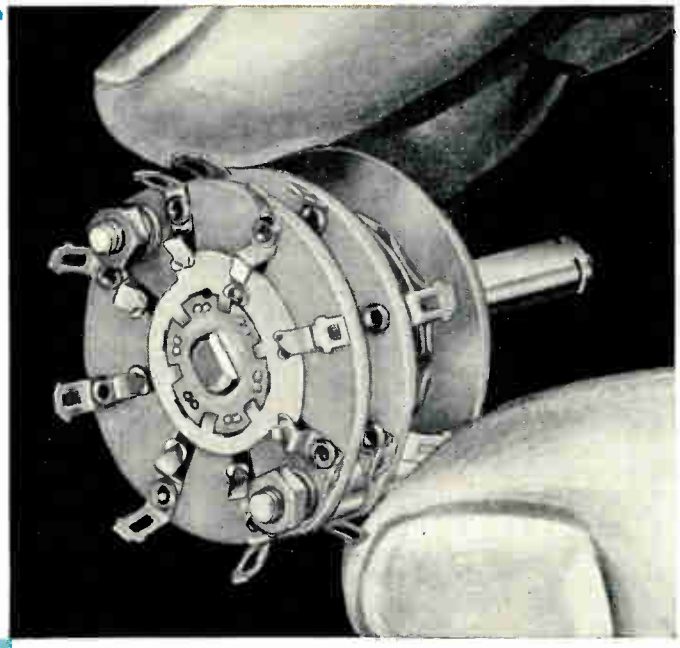
FITS IN 1-3/32" CIRCLE



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. V, Chicago 10, Illinois
Phone: MOhawk 4-2222

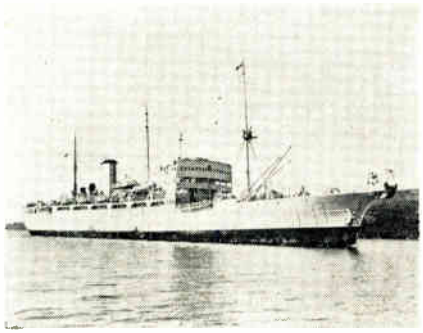
SWITCHES • ROTARY SOLENOIDS • CHOPPERS • SPECIAL ASSEMBLIES • VIBRATORS • TUNERS

As We Go To Press . . .

Submarine Cable To Link U. S. and Hawaii

H.M.T.S. Monarch, world's largest cable-laying ship, will play a vital role in the laying of a 2,400-mi. submarine telephone cable system this summer that will link Hawaii with the States.

Capable of carrying some 1,900



H.M.T.S. Monarch will lay Hawaiian cable.

mi. of cable, the Monarch laid the transatlantic submarine telephone cable system from Newfoundland to Scotland in 1955 and 1956, the first voice cable to span an ocean.

Project is joint undertaking of American Telephone and Telegraph Company and the Hawaiian Telephone Company.

Nuclear Reactor Uses 3-D Color TV System

AEC's nuclear test site at Idaho Falls, Idaho will use a GE-developed closed circuit color stereo video system. Purpose of the system is to permit use of color-coded reactor parts and to provide the necessary degree of precise depth perception for the use of remote-controlled manipulators.

The new system uses a shuttered pair of cameras and a synchronized polarizing drum in the receiver's optical system. Net result is two 45 - frame - per - second views presented on the same screen on a time shared basis and distinguished by different polarizations. The operator uses polarized glasses to give him stereovision.

Although the new system won't be used for home TV, GE sees many further uses in industrial and advertising closed circuit TV.

MORE NEWS ON PAGE 14

ELECTRONIC SHORTS

▸ **Electronic Industries Association will be the new name for RETMA as soon as the State of Illinois, where the association is incorporated, approves the charter revision. It is the association's view that the term "Electronic" is generally understood as descriptive of the growing variety of electronic products.**

▸ There is an increase of nearly 50% over fiscal 1956 in the number of government contracts set aside for exclusive award to small businesses for fiscal year 1957. Since the start of the set-aside program in August, 1953, nearly $2-billion in contracts have been reserved for exclusive award to this category.

▸ **CEM (Chemicals-Electronics-Metallurgy) Group is the latest formed in the atomic field. Emerson Radio & Phonograph Corp. in association with Revere Copper and Brass, Inc., and General Aniline & Film Corp., the constituents of the group, have submitted a voluntary proposal dealing with joint AEC-CEM development of a nuclear radiation reactor project. CEM has been studying the problems involved in applying radiation energies to industrial processes, and in finding ways to bridge the gap between promising laboratory experiments and commercial applications.**

▸ A new technique has now been developed for dynamically measuring electrical characteristics of transistors. Cubic Corp., the developers, explain that it enables the circuit designer to simultaneously examine a series of electrical parameters in the circuit laboratory. He will be able to try out hundreds of different types, under actual operating conditions, before choosing a specific unit for inclusion in a breadboard.

▸ **Meaningful tests of Pay-TV are not possible according to NARTB. The statement to the FCC said it was clear that unless the "tests" are of such magnitude and scale to belie the name, they won't do a thing except cost the public money and the Government a fruitless expenditure in man hours.**

▸ High school students are beginning to be reached by the nation-wide campaign to arouse their interest in engineering and technology. California State Polytechnic College reports that at one campus alone, some 225 students have already applied for admission. The acceptance rate is about 40%.

▸ ISM (Industrial, Scientific, and Medical) frequencies, bands in which **this type of equipment are permitted unlimited radiation, should be retained according to Dr. Ivan A. Getting, VP, Engineering and Research, Raytheon Manufacturing Company. He also recommended moderate increases in total band width involving microwave energy associated with such products.**

▸ The world's first industry-owned nuclear testing materials reactor got its start recently when ground was broken to start its construction at a site 29 miles southeast of Pittsburgh, Pa. WTR, Westinghouse Testing Reactor, will operate in the range of 20,000 kilowatts or above, and will be used to test materials under conditions similar to those in a power reactor.

▸ **Multiple branded TV picture tubes will help reduce inventory and storage needs of distributors and dealers. Sylvania Electric Products, Inc., has decided to multiple brand the popular tubes. Sixty of the industry's most frequently used tubes have been incorporated into only 26 of Sylvania's double or multiple branded types.**

▸ A super-refrigerator capable of producing temperatures which literally freeze molecular action will be installed at the Palo Alto research laboratories of the Lockheed Missile Systems division. The Cryostat will be used to produce liquid helium and to carry on the new scientific study of temperatures near absolute zero.

▸ **Training reactors for use by universities and industry will be designed and produced jointly by AMF Atomics Div and General Nuclear Corp. The new "Educator" reactor is an improved version of the Argonaut design developed by the AEC's Argonne National Laboratory.**

As We Go To Press . . .

New RETMA Standards Available to Industry

Five new RETMA recommended standards for the electronics industry are now available to industry. Non-members of the Association may obtain copies of the new standards through the RETMA Engineering Department, 11 West 42nd St., New York 36, New York (a minimum charge of $1 is made on all orders):

RS-185—Dimensional and Electrical Characteristics Defining Miniature Receiver Type Tube Sockets for Printed Circuits—$2.80.

RS-187—Vibrators for Auto Radio—$1.65.

RS-188—Standard Dimensional System for Automation Requirements—25 cents.

RS-190—Pin Straighteners and Wiring Jigs for Electron Tubes—50 cents.

RS-191—Measurement of Direct Interelectrode Capacitance—$1.50.

New Computer Center

European industry and technological research is now being served by the European Computation Center recently opened in Brussels, Belgium. This is the third such center opened by Electronic Associates, Inc., of Long Branch, N. J. The Computation Center specializes in education in analog computer techniques, analog computer consultation service, and rental of time on the computer systems installed at the center. Net effect of the computer service on industrial users will be annual savings of millions of dollars in engineering, production, and material costs.

Any Old Meteorites?

Missile researchers at Battelle Institute, Columbus, Ohio are sending out a call for meteorites to examine. They hope to learn more about what happens when a chunk of metal falls into the earth's atmosphere. This is no longer an academic question, since we hope to be sending missiles up several thousand miles in just a few months.

More News on page 16

Coming Events

A listing of meetings, conferences, shows, etc., occurring during the period September to December that are of special interest to electronic engineers

Sept. 4-6: Conference on Magnetic Amplifiers, sponsored by IRE & AIEE; at Penn Sheraton Hotel, Pittsburgh, Pa

Sept. 9-13: Instrument-Automation Conf. & Exhibit, by ISA; at Cleveland, Ohio.

Sept. 9-13: 3rd Annual Titanium Conf.; at New York University, New York City.

Sept. 16-19: 62nd Annual Conv., by International Municipal Signal Assn.; at Hotel Fountainebleau, Miami Beach, Fla.

Sept. 17-18: Electronic Control & Data Processing Symp., by RETMA; at Ambassador Hotel, Los Angeles, Calif.

Sept 23-25: 6th Annual Mtg., by Standards Engineers Society; at Hotel Commodore, New York.

Sept. 23-25: ASME Fall Mtg.; at Statler Hotel, Hartford, Conn.

Sept. 23-27: X-Ray Diffraction School, by Philips Electronics, Inc.; at Sir Francis Drake Hotel, San Francisco, Calif.

Sept. 24-25: Conf. on Industrial Electronics, by IRE & AIEE; at Morrison Hotel, Chicago, Ill.

Sept. 25-27: 6th Annual Meeting, sponsored by Standard Engineers Society; at New York City.

Sept. 27-28: 7th Annual Symp., by IRE (PGTBS); at Washington, D. C.

Oct. 4-9: 82nd Semi-annual Conv., by SMPTE; at Sheraton Hotel, Philadelphia.

Oct. 6-12: Semi-annual Meeting, by The Electrochemical Society; at Buffalo, N. Y.

Oct. 7-9: National Electronics Conf., sponsored by IRE, AIEE, RETMA & SMPTE; at the Hotel Sherman, Chicago.

Oct. 7-11: Fall General Meeting of AIEE; at Hotel Morrison, Chicago.

Oct. 9-11: 4th Symp. on Vacuum Technology; at Hotel Somerset, Boston, Mass.

Oct. 9-12: Audio Technical Session, sponsored by Audio Engineering Society; at N. Y. Trade Show Bldg., 8th Ave. & 35th St., New York.

Oct. 10-11: National Noise Abatement Symp., sponsored by Armour Research Found.; at the Sherman Hotel, Chicago.

Oct. 16-18: Conf. on Computers in Control, by AIEE; at Chalfonte-Haddon Hall Hotel, Atlantic City, N. J.

Oct. 16-18: IRE Canadian Conv., sponsored by IRE; at Toronto, Canada.

Oct. 18-19: 2nd Annual Symp. on Digital Computers, IRE; at O'Henry Hotel, Greensboro, N. C.

Oct. 21-26: International Conf. on Ultra High Frequency Circuits & Antennas, by the "Societe des Radioelectriciens"; at Ave Pierre-Larousse, Malakoff (Seine), France.

Oct. 21-26: IRE Conv., sponsored by Australian IRE; at the Hotel Australia, Sydney.

Oct. 24-25: Computer Applications Symp., by Armour Research Found.; at the Sherman Hotel, Chicago.

Oct. 27-29: Radio Fall Meeting, by IRE; at Sheraton Hotel, Rochester, N. Y.

Oct. 28-30: East Coast Conf. on Aeronautical and Navigational Electronics, by IRE; at Lord Baltimore Hotel & 7th Reg. Armory, Baltimore, Md.

Oct. 28-31: 1957 Trade Fair of Atomic Industry; at the New York Coliseum, N. Y. C.

Oct. 31-Nov. 1: Annual Conf. on Nuclear Science, by IRE; at Henry Hudson Hotel, N. Y. C.

Oct. 31-Nov. 1: Electron Devices Meeting, by IRE; at Shoreham Hotel, Washington, D. C.

Nov. 6-7; 3rd Annual Symp. on Aeronautical Communications, by IRE; at Hotel Utica, Utica, N. Y.

Nov. 8-10: Hi Fi Show; at New Washington Hotel, Seattle, Wash.

Nov. 15-16: New England Radio-Electronics Meeting, by IRE; at Mechanics Hall, Boston, Mass.

Nov. 25-26: IAS International Meeting, by IAS; at Canadian Aeronautical Inst., Canada.

Dec. 8-11: Eastern Joint Computer Conf., by IRE, ACM, and AIEE; at Park Sheraton Hotel, Washington, D. C.

Abbreviations:

ACM: Association for Computing Machinery
AIEE: American Inst. of Electrical Engrs.
ARRL: American Radio Relay League
ASME: American Soc. of Mechanical Engineers
IAS: Inst. of Aeronautical Sciences
IRE: Institute of Radio Engineers
ISA: Instrument Society of America
RETMA: Radio-Electronic-Television Manufacturers Assoc.
SAMA: Scientific Apparatus Makers Assoc.
SMPTE: Society of Motion Picture & TV Engineers
WCEMA: West Coast Electronic Manufacturers Assoc.

Cannon Electric reduces laminate rejections by 54%

Cannon Electric engineers tested many XXX-P laminates before they chose G-E Textolite 11570 for the insulators in their LK-A53 connectors. By using this laminate the percentage of rejections was reduced from approximately 55% to 1%. This insulator is the most difficult punching part at Cannon. The dimensions—1.998" in diameter, ⅛" thick, 49 holes .067" diameter and 4 holes .128 diameter. The report is superior punching with no cracking between holes, no delamination around holes, and no dimensional change in parts.

Textolite®
11570
COLD PUNCH LAMINATE

General Electric Textolite 11570 is a XXX-P, high IR paper-base laminate that can be punched clean in a temperature range of 80° F. to 130° F. This cold fabricating quality, plus outstanding product uniformity, eliminates dimensional variations from piece to piece . . . permitting the use of automatic assembly techniques. The superior electrical and mechanical properties of G-E Textolite 11570 offer many design opportunities to both electrical and electronic manufacturers.

General Electric Co.
Laminated Products Dept.
Sec. E1-97, Coshocton, Ohio

☐ *Please send me details of the Cannon Electric Company tests of G-E Textolite® 11570 laminate.*

☐ *Please have your representative call.*

Name .....

Title .....

Firm .....

Street .....

City ..... Zone ..... State .....

Progress Is Our Most Important Product

GENERAL ELECTRIC

Circle 8 on Inquiry Card, page 101

Electronic Industries' News Briefs

Capsule summaries of important happenings in affairs of equipment and component manufacturers

EAST

VAMISTOR MFG. DIV., WESTON ELECTRICAL INSTRUMENT CORP., is now occupying expanded quarters in a new building recently completed in Union, N. J.

UNIVERSAL TRANSISTOR PRODUCTS CORP. has been awarded contracts for 50,000 to a possible 62,500 transistorized units plus spare parts by the General Services Administration.

SPERRY GYROSCOPE CO. has received an order for engine vibration monitor systems from American Airlines.

SHIELDING, INC., enclosure manufacturers, have completed their move from Riverside to Riverton, N. J.

BURNELL & CO., INC., toroidal coil manufacturer, has moved to Pelham Manor, N. Y. The new plant occupies 33,000 sq. ft.

EPSCO, INC., has received a major contract for data processing equipment from the GE Missile & Ordnance Systems Dept.

CONTINENTAL CONNECTOR CORP. has completed its move to a 3-story building located at 34-63 56th St., Woodside, N. Y. All sales are handled by Electronic Sales Div., DeJur-Amsco Corp., Long Island City, N. Y.

WESTINGHOUSE ELECTRIC CORP.'s plant at East Pittsburgh, Pa., is the site of the state's first privately licensed heliport.

SYNTHETIC MICA CORP. has successfully completed the largest commercial melt of Synthamica, synthetic mica, yet attempted. Over 80,000 lbs. of raw material were used.

ASTRON CORP. has established a new division to handle government negotiations. Mr. Robert Black has been named as Government Contracts Manager.

UNIVERSITY LOUDSPEAKERS, INC., has received official approval by National Headquarters of Federal Civil Defense Administration for public address speaker equipment accessories manufactured by their Commercial-Industrial Div. for installations in CD systems.

NATIONAL VULCANIZED FIBRE CO. reveals that 3-dimensional patterns embossed on vulcanized fibre are increasing that material's use in applications demanding eye appeal as well as superior physical properties.

MINIATURE PRECISION BEARINGS, INC., has begun construction on its $300,000-25,000 sq. ft. addition at Keene, N. H. It is scheduled for completion by Jan. 1, 1958.

ELECTRONIC COMMUNICATIONS, INC., has organized a Reliability Assurance Section whose sole concern will be product reliability.

THE MARTIN CO., Orlando, Fla., announces that the Department of the Army will have mobilization cognizance over a new guided missile and small weapons systems which are being built there.

B. F. GOODRICH SPONGE PRODUCTS DIV. is producing a broadband microwave absorbent material with a 10 to 1 decrease in reflection of its standard 12CM for simulating free space conditions indoors.

TRI-POINT PLASTICS, INC., can now provide 5-day delivery of prototype printed circuits with a new, "acid-feed" etch system now in pilot plant operation.

MID-WEST

THE VICTOREEN INSTRUMENT CO. has received new orders totaling $886,000 from both the General Services Administration and the U. S. Navy.

CHICAGO TELEPHONE SUPPLY CORP. is now supplying variable resistor samples in a transparent heat-sealed polyethylene bag. A tag listing all pertinent data concerning the controls is placed inside and is easily read without opening the bag.

STROMBERG-CARLSON has been awarded 2 contracts totaling nearly $19-million by the Air Materiel Command. The principal contract is for passive electronic equipment.

SYLVANIA-CORNING NUCLEAR CORP. has broken ground for a new plant at Hicksville, N. Y., to manufacture nuclear fuel elements for atomic reactors.

AC SPARK PLUG DIV., GENERAL MOTORS, has been awarded a $38-million contract for inertial guidance systems used by the IRBM, "THOR."

SYNTHANE CORP., laminated plastics manufacturers and fabricators, has relocated its Detroit sales office to 920 East Lincoln, Birmingham, Mich.

DELCO RADIO DIV., GENERAL MOTORS, has manufactured its one millionth high power transistor. The production mark was achieved in less than a year of mass production.

MARIETTA CONCRETE CORP. has erected a precast concrete stave silo for TV station WEWS, Cleveland. Advantages include servicing-personnel safety and weather interference elimination.

INDUSTRIAL RADIO CORP., Chicago, has just been awarded a contract for 860 Pak-Fone Portable Radiotelephones by the U. S. Navy. This is the third consecutive year that Pak-Fones have been selected.

AUTOMATIC ELECTRIC in Chicago has moved to its new 1,520,000 sq. ft. factory, general office, and research and technical center in Northlake, Ill., suburban Chicago.

FOREIGN

AMPHENOL GREAT BRITAIN LTD. has been formed by Amphenol Electronics Corp., Chicago. The new subsidiary will manufacture and sell the entire line under an exclusive license in the United Kingdom and other Commonwealth nations, with the exception of Canada.

W. R. GRACE & CO., New York, and **PECHINEY,** French chemical and metallurgical concern, announced a formation of a new company to produce high-purity elemental silicon and other semi-conductors.

HUNTING ASSOCIATES LTD., Canada, and **PHOTRONIX INC.,** Columbus, Ohio, have teamed up to speed badly-needed highway surveys. The Canadian firm specializes in aerial surveys. The Ohio firm combines photogrammetry and electronics.

NORDEN-KETAY CORP. has concluded a licensing agreement with Societe Anonyme Precilec of Paris, France, for the manufacture and sale of Norden-Ketay synchro and servo mechanisms in France.

AMF ATOMICS has been awarded a contract by the Portuguese Government to design and build a nuclear research reactor at the new nuclear research center being constructed near Lisbon.

WEST

ALECTRA DIV. is the new name for Consolidated Electrodynamics Corporation's Electronic Industries Div. The name was changed to eliminate confusion caused by the existence of several other companies with names similar to Electronic Industries.

CONVAIR DIV., GENERAL DYNAMICS CORP., has confirmed that virtually automatic control systems—the most compact and accurate of their type yet developed—will direct the flight path of the first supersonic bomber, the B-58 Hustler, and accurate release of its throw-away "pods." Follow-on production of the primary navigation and guidance systems is assigned to Sperry Gyroscope Co.

LEAR, INC., has received a $5-million contract for 3-axis damping systems for the Lockheed F-104 Starfighters.

COLLINS RADIO CO. has signed a purchase agreement with American Airlines to supply over $1-million in airborne communication and navigation equipment for the 30 Boeing 707 and 35 Lockheed Electra aircraft on order for American's new jet fleet.

THE BRISTOL CO. has opened a new sales office at 2210 N. W. Roosevelt Ave., Portland, Ore. Lyle R. Koroch is the newly appointed Sales Engineer for the territory.

GULTON INDUSTRIES has acquired CG Electronics Corp., Albuquerque, N. M. The company will retain its corporate identity.

AEROVOX-PACIFIC has been formed with offices at 1100 Chestnut St., Burbank, Calif. It will handle product sales of Aerovox Cinema Engineering Div.

HOFFMAN LABORATORIES, INC., continue their expansion plans with formation of a new facility, the Electro-Mechanical Dept. Laurence Mendelsohn will be Vice President in charge of the new facility.

DOUGLAS AIRCRAFT CO. has been awarded a $38-million contract by the USAF for its C-133 cargo plane.

CONSOLIDATED ELECTRODYNAMICS CORP.s mobile instrument exhibit, is featured in "Operation Data," which brings the latest developments in electronic instrumentation to the major industrial plants and aircraft installations in the U. S. and Canada.

ELECTRO-MEASUREMENTS, INC., is recovering rapidly from the fire of July 18th which destroyed the engineering and production facilities. Operating units which have been temporarily relocated, will re-occupy the plant about Oct. 15th.

OPTRON CORP., 3526 State St., Santa Barbara, Calif., is the new name and address for The Optronic Co. of San Jose, Calif.

LAMINAIR INC. has opened its new plant at 18530 South Broadway, Gardena, Calif. The firm will specialize in aircraft and missile structural and radio frequency fiberglass laminates.

ELECTROSOLIDS CORP., manufacturer of electronic components for Project Vanguard, has acquired a 4½ acre plant site in the DeSoto and Lassen section of Canoga Park, Calif.

RYAN AERONAUTICAL CO. has placed into service a new half million dollar Engineering and Research Center.

PD-9 provides instant adjustment and soundless mobility for dolly shots, with Power Driven up and down camera movement. This new concept, Model PD-9, allows the cameraman to devote maximum attention to his subject without removing his hands from the camera controls. Available in two models—PD-9C for color and PD-9M for monochrome.

ALL NEW MOTOR DRIVEN TV PEDESTAL

PD-9

The Houston Fearless Line of TV and Motion Picture Studio Equipment Also Includes This Variety of Products:

Standard Television Pedestals—Used in most of the leading television stations throughout the country. Three different versions available.

Panoram Dolly—For complete camera mobility, smooth pan effects, angle shots, running shots, tilts, dolly shots and countless special effects.

All-Metal Adjustable Tripod—Ideal for use with 35mm cameras in the studio or field.

Tripod Dolly—Designed to provide convenient mobility for tripod-mounted television and motion picture cameras.

Cradle Heads—Perfect balance and remarkable ease of horizontal and vertical panning for monochrome and color television cameras.

Remote Control Units—For Mounting TV cameras in inaccessible places and operating them completely from a small portable camera control.

Remote Control Microwave Parabola—Easy control of the direction or degree of azimuth and tilt from the television transmitter room at distances of over 1500 feet.

For complete information regarding model PD-9 and any or all of the Houston Fearless TV and Motion Picture Equipment, send in the attached coupon.

HOUSTON FEARLESS Dept. EI 9
11801 W. Olympic Blvd. Los Angeles 64, Calif.

Please send me complete information on:

- ☐ PD-9 TV Pedestal
- ☐ Standard Pedestals
- ☐ Panoram Dolly
- ☐ All-Metal Tripod
- ☐ Cradle Heads
- ☐ Remote Control Units
- ☐ Remote Control Microwave Parabola
- ☐ Tripod Dolly

Name _____

Company _____

Position _____

Address _____

City _____ Zone ____ State _____

Tele-Tips

PLANNING to award a plaque to Arthur Godfrey for his service to amateur radio, National Co. learned that Godfrey had "enough plaques to shingle the roof of my barn." Not to be denied, they presented him with an inscribed aluminum roofing shingle.

WHAT would it mean if you didn't know? We asked some of our non-technical friends to give us their version of commonly used words in the electronic dictionary. Here's what we got back.

admittance—to plead guilty
anode—a poem
bistable—allowing two horses in one stable
delay line—polite refusal
dipole—where witches were burned
ion—act of observing
ohm—where British engineers live
pick-up tube—with a handle on it
push-pull—a 2-man saw
semiconductor—part-time ticket collector
shot effect—blood
transducer—"masher" on a train

As a way of thinking this method presents certain pitfalls, but we promise to print any contributions received from EI readers.

HIGH-FLYING RADIOSONDE left an Air Weather group in the Azores shaking their heads. After soaring to 102,000 feet—20 miles up—the balloon burst and 14 minutes later the radiosonde slammed to earth—100 feet from the point of release!

TINY RADIO TRANSMITTERS will be used by the Navy to solve one of Nature's most perplexing mysteries—how penguins succeed in hatching their eggs on a bare sheet of Antarctic ice. The temperature sensitive transmitters will be attached to the eggs and the signals recorded on equipment placed two miles away. Scientists fear only one hitch—the penguins may become suspicious of the eggs and ignore them.

(*Continued on page* 20)

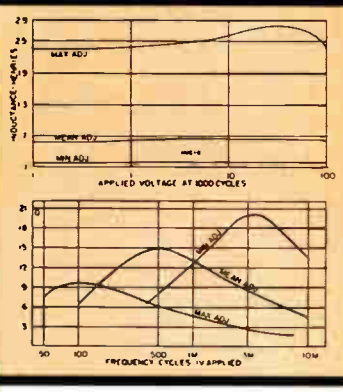
Hi-Q Inductors . . . . FROM STOCK

As largest producers in this field for over two decades, UTC inductors cover virtually every need for both fixed and variable units of exceptional stability. Hermetic units have been proved to MIL-T-27A, eliminating costs and delays of initial MIL-T-27A testing.

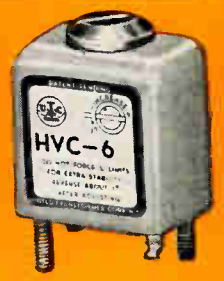
For complete listing of our 700 stock items (300 hermetic) write for catalog.

HVC Hermetic Variable Inductors

A step forward from our long established VIC series. Hermetically sealed to MIL-T-27A...extremely compact...wider inductance range...higher Q...lower and higher frequencies...superior voltage and temperature stability. Case 25/32 x 1⅛ x 1 7/32, 2 oz.



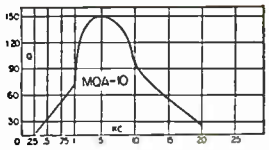
Type No.	Min. Hys.	Mean Hys.	Max. Hys.
HVC-1	.002	.006	.02
HVC-2	.005	.015	.05
HVC-3	.011	.040	.11
HVC-4	.03	.1	.3
HVC-5	.07	.25	.7
HVC-6	.2	.6	2
HVC-7	.5	1.5	5
HVC-8	1.1	4.0	11
HVC-9	3.0	10	30
HVC-10	7.0	25	70
HVC-11	20	60	200
HVC-12	50	150	500



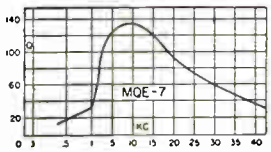
HVC

MQ drawn case structure

	Length	Width	Height	Oz.
MQE	1/2	1-1/16	1-7/32	1.5
MQA, MQD	11/16	1-9/32	1-23/32	4
MQB	1-5/16	2-9/16	2-13/16	14

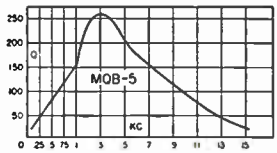


MQA
19 stock values from 7 Mhy. to 22 Hy.



MQE
15 stock values from 7 Mhy. to 2.8 Hy.

MQB
12 stock values from 10 Mhy. to 25 Hy.



MQD

New extreme stability inductors for 12KC to 130KC range. Typical Q is 170 @ 50KC. 6 stock values from 2 mhy. to 20 mhy.

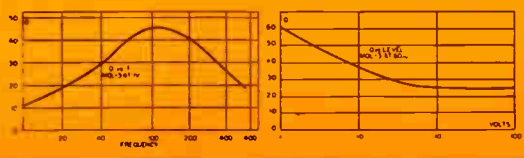
MQ Series Compact Hermetic Toroid Inductors

The MQ permalloy dust toroids combine the highest Q in their class with minimum size. Stability is excellent under varying voltage, temperature, frequency and vibration conditions. High permeability case plus uniform winding affords shielding of approximately 80 db.

MQL Low Frequency High Q Coils

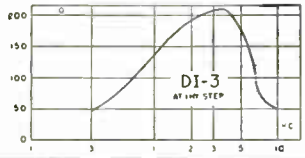
The MQL series of high Q coils employ special laminated Hipermalloy cores to provide very high Q at low frequencies with exceptional stability for changes of voltage, frequency and temperature. Two identical windings permit series, parallel, or transformer type conections. 1-13/16 dia. x 2½" H.

MQL-0	.25/1 Hys.
MQL-1	2.5/10 Hys.
MQL-2	5/20 Hys.
MQL-3	50/200 Hys.
MQL-4	100/400 Hys.
MQL-5	625/2500 Hys.



DI Inductance Decades

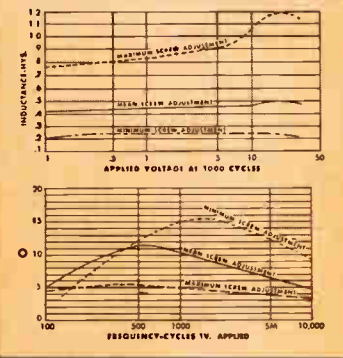
These decades set new standards of Q, stability, frequency range and convenience. Inductance values laboratory adjusted to better than 1%. Units housed in a compact die cast case with sloping panel ideal for laboratory use . . . 4½ x 4⅜ x 2⅜ high.



DI-1 Ten 10 Mhy. steps.
DI-2 Ten 100 Mhy. steps.
DI-3 Ten 1 Hy. steps.
DI-4 Ten 10 Hy. steps.

VIC case structure

Length	Width	Height	Oz.
1-1/4	1-11/32	1-7/16	5-1/2



Type	Mean Hys.	Type	Mean Hys.
VIC-1	.0085	VIC-12	1.3
VIC-2	.013	VIC-13	2.2
VIC-3	.021	VIC-14	3.4
VIC-4	.034	VIC-15	5.4
VIC-5	.053	VIC-16	8.5
VIC-6	.084	VIC-17	13.
VIC-7	.13	VIC-18	21.
VIC-8	.21	VIC-19	33.
VIC-9	.34	VIC-20	52.
VIC-10	.54	VIC-21	83.
VIC-11	.85	VIC-22	130.

VIC Variable Inductors

The VIC Inductors have represented an ideal solution to the problem of tuned audio circuits. A set screw in the side of the case permits adjustment of the inductance from +85% to −45% of the mean value. Setting is positive.

Curves shown indicate effective Q and L with varying frequency and applied AC voltage.

SPECIAL UNITS TO YOUR NEEDS
Send your specifications for prices.

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EXPORT DIVISION: 13 EAST 40th STREET, NEW YORK 16, N. Y. CABLES: "ARLAB"

Tele-Tips

(*Continued from page* 18)

AN EI BOUQUET goes to the enterprising TV dealer who came up with this unique gimmick for selling color TV receivers. In the most prominent spot in his store he set up a large board. On it he lists the name and address of each customer who buys a color TV receiver, and next to the name a record of the number of service calls on each receiver. The effect on prospective customers is two-fold: it tells him which of his neighbors own color receivers, and also how many service calls he can expect when he buys a color set.

AMATEUR RADIO is enjoying the biggest boom of its existence. Of the 150,000 licensed "hams" in the country approximately 15,000 are electrical engineers and an additional 60,000 are employed in the general field of telecommunications.

PERSONNEL RADAR. A small radar set, costing about $700, is being tested in England for use in detecting burglars. The set covers an area of approximately 10,000 sq. ft. The first set is now being tested at the British National Gallery, and police and insurance underwriters are reportedly considering possible applications.

RADIATING APPARATUS is often checked by FCC engineers before being manufactured to reduce the number of interference complaints. Some turn out to be rather queer pieces of gear. Tops was the unit manufactured by a firm, no longer in business, which claimed medicinal value by "magnetizing the iron in the blood."

RADIO PAGING SYSTEMS are finding increasing application in hospitals to replace the old p.a. systems. Instead of transmitting messages the radio system sends out a "beep beep" which is received in a small unit carried by the person for whom the message is intended.

SHORT LENGTH-
SMALL NECK DIAMETER-
MINIATURE BASING-

Off-center neck design for sector-scanning applications.

SAVE SPACE AND WEIGHT IN AIRBORNE RADAR

Miniaturized 3" to 12" diameter radar tubes save space and weight in military and commercial installations. Ideal for use in airborne radar or *any* installation requiring high performance with miniaturization.

Du Mont miniaturized radar tubes feature short overall length and small neck diameter. Nine-pin miniature design saves base and socket weight. Reasonable power requirements aid in reduction of associated circuitry size and weight.

Detailed specifications upon request . . .

DU MONT
RADAR TUBES

TABLE OF IMPORTANT SPECIFICATIONS

Type	Diameter	Length	Focus	Deflection	Neck Diameter	Voltage	Deflection Angle	Screen
B1173	3"	5⅛"	Elect.	Mag.	⅞"	7KV	70°	Alum.
K1517	3"	6⅜"	Elect.	Mag.	⅞"	8KV	Off Center Neck	Alum.
5BCP—	5"	7"	Mag.	Mag.	⅞"	8KV	70°	Reg.
B1174	5"	6⅝"	Elect.	Mag.	⅞"	8KV	70°	Alum.
B1142	7"	8½"	Mag.	Mag.	⅞"	8KV	70°	Reg.
B1175	7"	7 13/16"	Elect.	Mag.	⅞"	10KV	70°	Alum.
B1191	10"	10⅝"	Elect.	Mag.	⅞"	10KV	70°	Alum.
B1132	10"	12½"	Elect.	Mag.	1 1/16"	10KV	78°	Reg.

Industrial Tube Sales, Allen B. Du Mont Laboratories, Inc., 2 Main Ave., Passaic, N. J., U.S.A.

Want a standard power reactor from 50 to 2000 watts? Put your finger on CONTROL

No need to put up with extra costs for special design of saturable reactors. No reason for waiting for special units to be designed to meet your individual requirements. CONTROL offers two complete lines of power reactors. You pick them from our catalog. We take sub-assemblies from our shelves, add control windings to your specifications, and deliver complete units—fast.

CONTROL reactors are ready in eleven sizes in both 120 and 240 volt ranges. Our unique catalog R-10 gives you complete physical and operating characteristics. It tells you, for instance, that six ampere-turns control nearly 2,000 watts in the largest size, and that only two ampere-turns are needed for the 50-watt smallest size, illustrating the extremely high gain of these units.

Want to know about cut-off ratios? CONTROL reactors run at least 40 to 1. Want to know about construction? Cutaway shows you the tough, rugged design that insures "forever" operation with no servicing or maintenance, if operation is normal.

Yes, there's a real improvement here for harassed engineering departments. Standardization means reliability and quality at a competitive price. Write for Catalog R-10 today and read all about it. *CONTROL, Dept. E-42, Butler, Pennsylvania.*

Reliability begins with CONTROL

A DIVISION OF MAGNETICS, INC.

Books

Acoustical Engineering

By Harry F. Olson, Ph. D. Published 1957 by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. 718 pages, xix pages. Price $13.50.

In all of the diverse areas covered, rapid advances have made much new material and many revisions necessary. Two large chapters deal with complete sound producing systems and communications systems. The most recent developments are all described including those: in underwater acoustics, systems for locating and detecting crafts and obstacles, and for depth soundings; in ultrasonics, industrial techniques for cleaning machine parts, for drilling and detecting flaws; in architecture, methods of obtaining excellent acoustics under severe artistic considerations; in music, new musical instruments.

Throughout the book consistent and logical use of analogies between electrical, chemical, and acoustical systems is made, for a reduction of a vibrating system to the analogous electrical network has been found a valuable tool in its analysis. Detailed presentations of theory and practice are given for all important transducers, and the material on speech, music and hearing correlates objective and subjective acoustics. As an aid in development and design, a large number of useful formulas, tables, and graphs are included together with acoustical elements, radiating systems, mechanical vibrating systems.

Here for radio, television, sound motion picture and recording engineers, architects, and musicians, is an invaluable reference that reflects the most up-to-date information available today.

Physical Techniques in Biological Research, Volume II; Physical Chemical Techniques

Edited by Gerald Oster and Arthur W. Pollister. Published 1956 by the Academic Press Inc., Publishers, 111 Fifth Ave., New York 3. 502 pages, xv pages. Price $12.80.

The second volume in this series is concerned with those physical chemical techniques which have been most widely employed in the investigation of molecules of biological significance. In each chapter the author outlines the theoretical basis of the methods, describes the apparatus and manipulations employed, and illustrates the applications of the technique by examples of particular interest to biological chemists. Hence, each chapter is a comprehensive introduction to the field and, in conjunction with the extensive bibliography, should inform the reader of the scope of the technique and its potentialities for his particular research.

(*Continued on page* 30)

A LEADER IN THE FIELDS OF

ASW and AEW DISPLAY SYSTEMS

AIRBORNE NAVIGATIONAL COMPUTERS

MILITARY PLOTTERS

ELECTRONIC COUNTERMEASURES

GUIDANCE SYSTEMS

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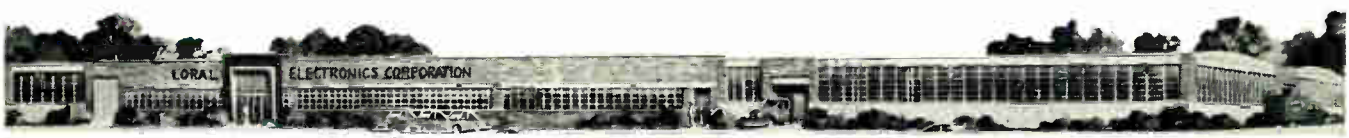
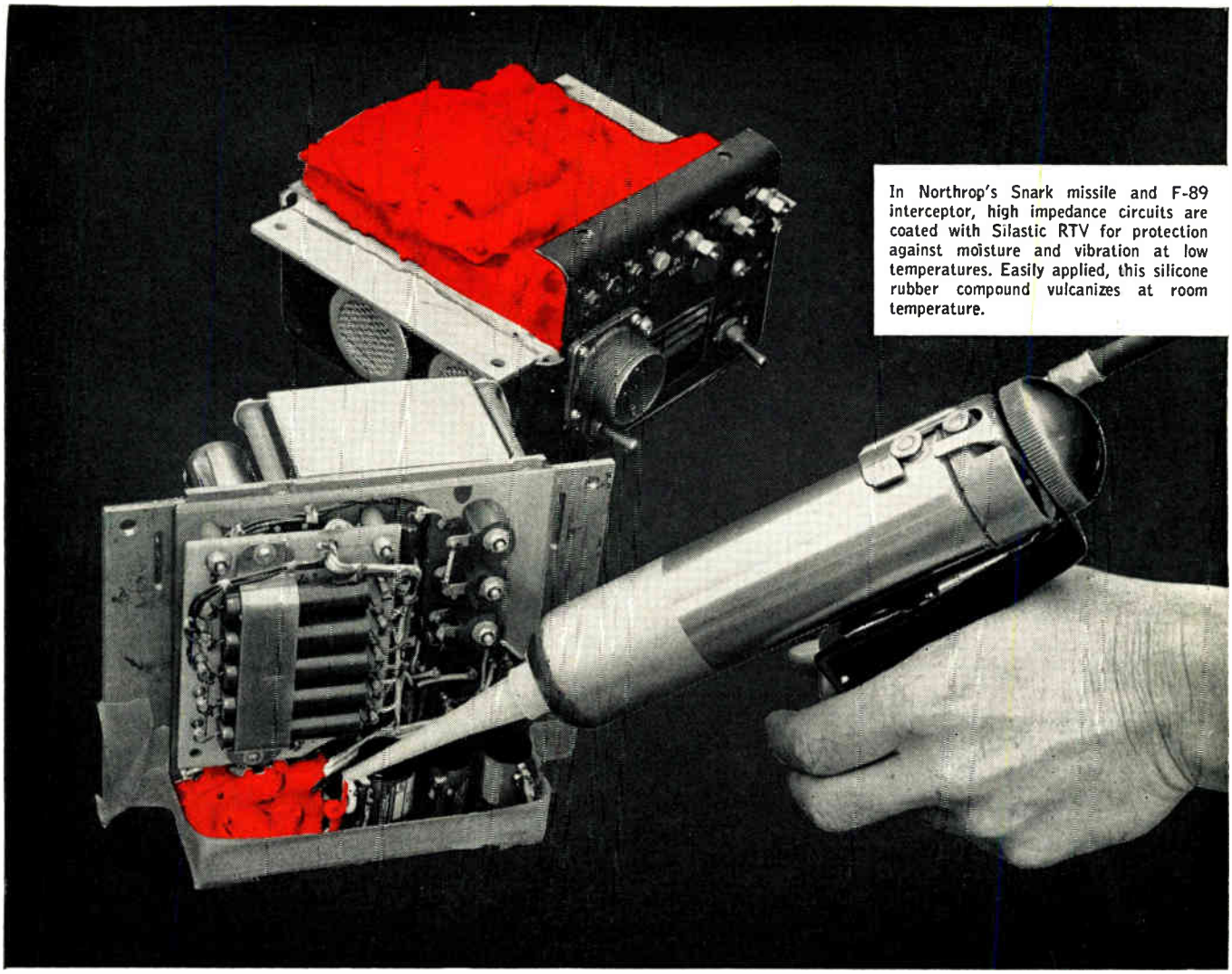


NEW LORAL PLANT, OVER 100,000 SQ FT. OF AIR CONDITIONED WORKING SPACE DEVOTED TO CREATIVE DEVELOPMENT AND PRODUCTION



In Northrop's Snark missile and F-89 interceptor, high impedance circuits are coated with Silastic RTV for protection against moisture and vibration at low temperatures. Easily applied, this silicone rubber compound vulcanizes at room temperature.

SILASTIC
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RTV seals, cushions delicate circuits

Sensitive electronic components can be both cushioned and sealed against moisture by encapsulating with Silastic RTV*, Dow Corning's silicone rubber that vulcanizes at room temperature. A single coating provides protection, and in addition improves electrical properties of the unit, especially surface resistivity. Silastic RTV cures in 24 hours, and remains resilient from —100 F to 350 F. Write for complete data.

Typical Properties of Silastic for Encapsulating and Potting

• Temperature range, °F	—100 to 350 F
• Dielectric strength, volts/mil	300 to 500
• Surface resistivity at 50% relative humidity, ohms	2.8×10^{15}
• Dielectric constant, 10^2 cycles per second	2.95 to 3.05
• Dissipation factor, 10^2 cycles per second	0.01
• Moisture absorption after 7 days at room temperature, %	+3 to +5

Get latest data on Silastic

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If you consider ALL the properties of a silicone rubber, you'll specify SILASTIC.

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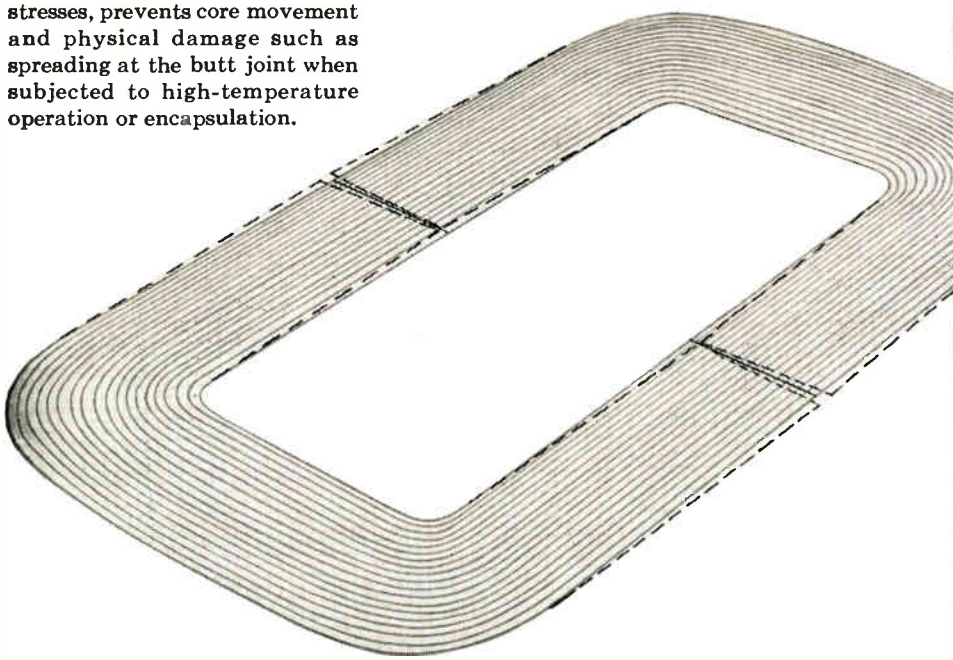
"Normalizing" relieves internal stresses, prevents core movement and physical damage such as spreading at the butt joint when subjected to high-temperature operation or encapsulation.



"Normalizing" Hipersil® Cores holds magnetic values constant

Westinghouse has licked the bugaboo of heat in transformer treatment and operation. "Normalizing," a process exclusive with Hipersil cores, relieves internal stresses in the core structure.

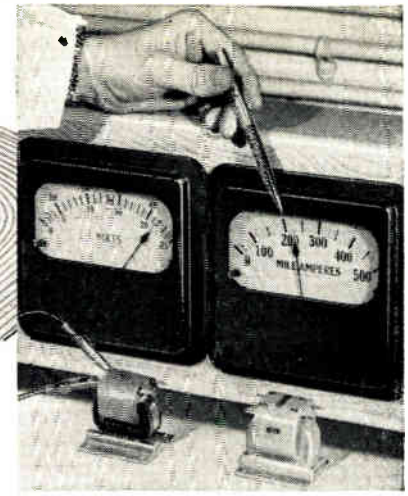
Both exciting current and inductance "stay put" when a transformer is built around a "normalized" Hipersil core. Thus, magnetic values remain constant (within practical limits) even when the transformer is cast or encapsulated in high-temperature resin, or operated at high temperatures.

Electronics industry demands are ideally met with Hipersil cores. Smaller, lighter transformers result from such revolutionary core properties as oriented grain direction, with 100% coincidental flux; lowest possible core volume for high-temperature transformers; highest permeability, lowest loss; and 100% flux-carrying activity. These values, plus the extra magnetic stability added by "normalizing" make Hipersil the preferred core for more efficient, compact transformers . . . at lower cost.

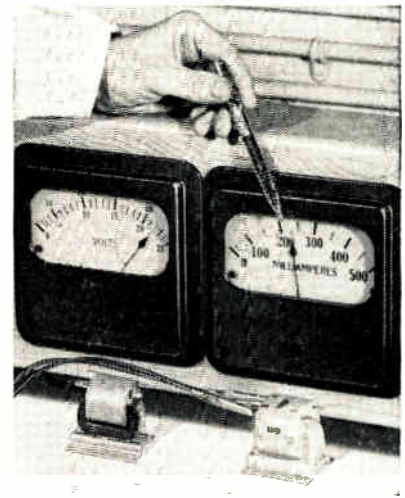
Also available from Westinghouse: a complete line of both Hipermag* and Hiperthin* cores for every electronic application.

For extra profits from your production, send for the *Type "C" Hipersil Core Design and Application Manual.* Write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

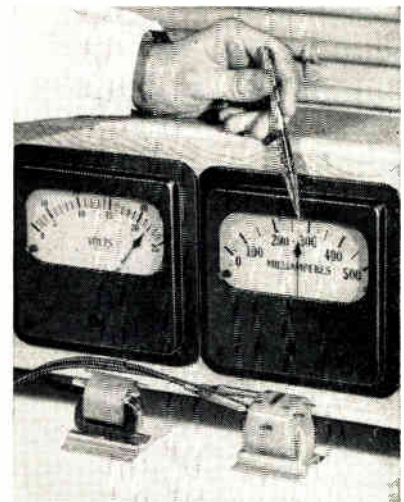
*Trade-Mark
J-70799



Both "normalized" and un-"normalized" cores record the same exciting current before encapsulation in high-temperature resin.



"Normalized" Hipersil core shows exciting current unchanged after encapsulation.



Un-"normalized" core, with the same applied voltage, records considerably higher exciting current after encapsulation.

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first *in Audio*

first *in Video*

and first *in Instrumentation*

The "Magnetophon" German Tape Recorder—first high fidelity recording machine, subsequently improved and used to record and broadcast Bing Crosby's radio programs for over one year. The predecessor of all American Tape Recorders.

Mincom pioneered and perfected tape recording techniques for the radio and recording industry

...First Transcontinental Broadcast of a Musical Program (Bing Crosby Show) from Magnetic Tape...May 1948

Mincom pioneered the recording and reproduction of off-the-air television from magnetic tape

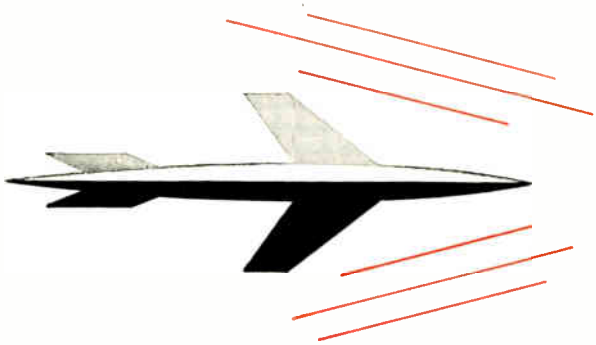
...First Demonstration of Video Tape Recording...November, 1951

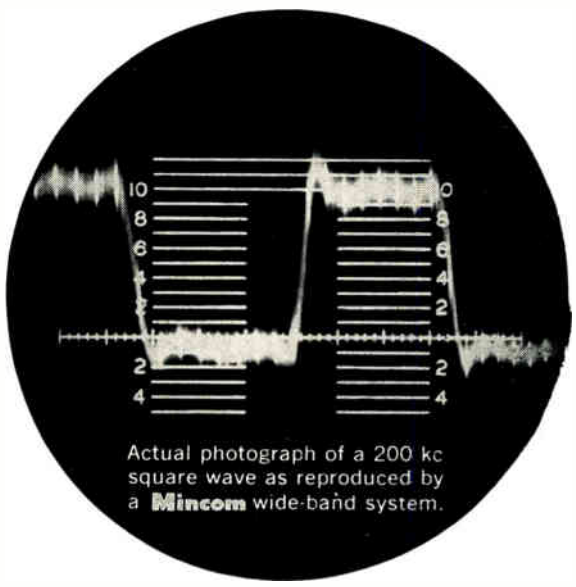
Mincom pioneered and perfected the tight-loop drive for instrumentation recording on magnetic tape

...First Tight-Loop Drive Recorder...August, 1952

And now— **Mincom** has perfected wide-band magnetic tape systems which can be used for: Radar Recording • Wide-band Telemetering • Waveform analysis • Spectrum Monitoring and Closed Circuit Television Recording

Recording capability: from DC to 2.5 Megacycles





Actual photograph of a 200 kc square wave as reproduced by a **Mincom** wide-band system.

Write for complete specifications

PRODUCT OF 3M COMPANY RESEARCH

Mincom DIVISION

MINNESOTA MINING & MANUFACTURING COMPANY

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Books

(*Continued from page 24*)

Books Received

Marconi 1957

Published 1957 by Marconi's Wireless Telegraph Co., Ltd., Chelmsford, Essex, England. 577 pages, vi pages.

A catalog showing a complete range of radio equipment.

Atoms and Energy

By Professor H. S. W. Massey, F. R. S. Published 1956 by Philosophical Library, Inc., 15 E. 40th St., New York 16. 174 pages. Price $4.75.

The Electrical Production of Music

By Alan W. Douglas, M.I.R.E. Published 1957 by Philosophical Library, Inc., 15 E. 40th St., New York 16. 223 pages. Price $12.00.

Tubes for Computers

Published 1956 by Philips Technical Library, Eindhoven, Holland. 52 pages. Price $1.50. To be ordered from your bookseller.

Registry of Industrial Systems

Published 1957 by Communication Engineering Book Co., Radio Hill, Monterey, Mass. 153 pages, paper bound. Price $5.00.

Lead In The Ceramic Industries

Prepared by Dr. John H. Koenig. Published 1956 by The Lead Industries Assoc., 60 E. 42nd St., New York 17. 48 page loose-leaf volume. Price $1.00.

Silicone Rectifier Handbook

Published 1956 by Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Indiana. 36 pages, paper bound. Price $.25.

Transistor Manual

Published 1956 by General Electric Co., Semiconductor Products Dept., Syracuse, N. Y. — pages. Price $.50.

Metallurgia, Volumes 1-15, 1929-1937

Published 1957 by Johnson Reprint Corp., 111 Fifth Ave., New York 3. Cloth bound set $316.50, paper bound set $300.00. Single volumes, cloth bound, each $21.40. Single volumes, paper bound, each $20.00.

Automatic Technology and its Implications, A Selected Annotated Bibliography

Published 1956 by U. S. Dept. of Labor, Bureau of Labor Statistics, 341 9th Ave., Room 1025, New York 1. 78 pages. Price $.45.

Westinghouse Ready Guide

Published 1956 by Westinghouse Electronic Tube Div., Dept. T-286, Route 17, Elmira, New York. 44 pages, paper bound. Price $.35.

Electron Tube Life and Reliability, Chapter VI

By Marcus A. Acheson. Published 1956 by Sylvania Electric Products, Inc., 1740 Broadway, New York 19. 20 pages, paper bound.

L-C Oscillators

By Alexander Schure, Ph.D., Ed. D. Published 1957 by John F. Rider Publisher, Inc., 116 W. 14th St., New York 11. 66 pages, vi pages, paper bound. Price $1.25.

Foundations of Radio

By M. G. Scroggie, B. Sc. M.I.E.E. Published 1957 by Philosophical Library Incorporated, 15 E. 40th Street, New York 16. 349 pages. Price $10.00.

ALL VIDEO TRANSMISSION TEST

STANDARDS in a suitcase

The Original Full Rack and the Portable Unit Produce the same Precise Test Signals

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Model 1003-B

Video Transmission Test Signal Generator

★ Completely self contained ★ Portable
★ Multi-frequency burst ★ Stairstep ★ Modulated stairstep
★ White window ★ Composite sync ★ Regulated power supply.

New Telechrome Video Transmission Test Equipment is available as a completely portable 19¼" standard rack mounting unit.

Exemplary these test signals generated by Telechrome equipment are transmitted Coast-to-Coast by NBC, CBS, ABC, the Bell System, Canadian Bell and leading independent TV stations throughout the U.S. and Canada. Hundreds of systems affiliating TV stations and telephone TV centers also check incoming video signals.

The compact, inexpensive, portable Model 1003-B is all that is required to generate signals for local and remote performance checking of your entire video, cable, or micro-wave facilities.

DELIVERY 30 DAYS

Literature on the above and more than 200 additional instruments for monochrome and color TV by TELECHROME are available on request.

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1001-A OSCILLOSCOPE EXPANDER—Plug-in type for instantaneous 1 to 5 volts photo-recording from any 5" oscilloscope.

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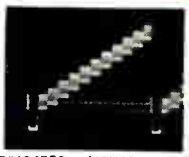
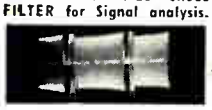
LOW & HIGH FREQUENCY CHARACTERISTICS. Determine ringing, smears, steps, low frequency tilt, phase shift, mismatched terminations, etc. in TV signals or systems.

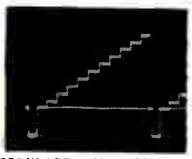


STAIRSTEP SIGNAL modulated by crystal controlled 3.579 mc for differential amplitude and differential phase measurement. Checks amplitude linearity, differential amplitude linearity and differential phase of any unit or system.
Model 1003-C includes variable duty cycle stairstep (10-90% average picture level).

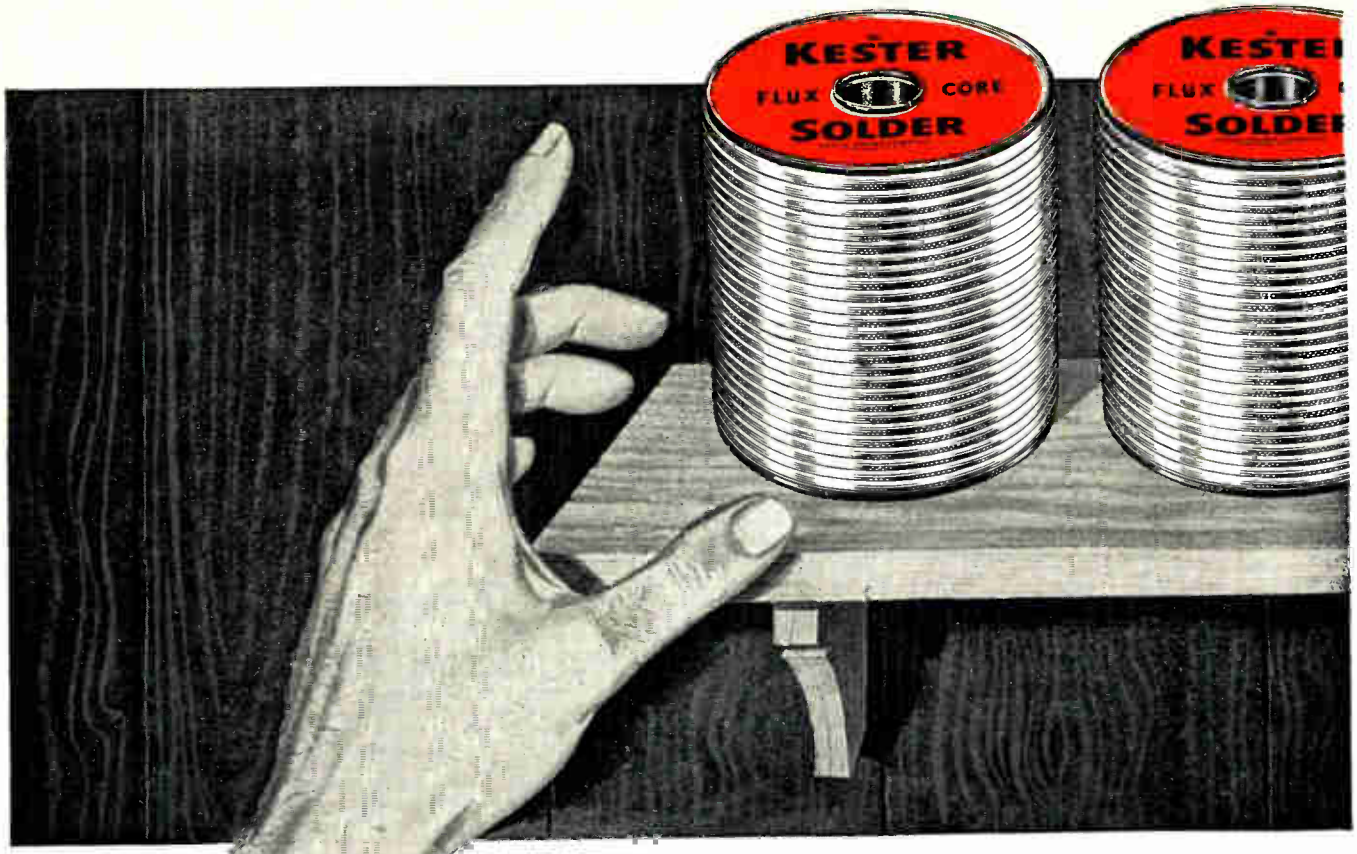
Model 608-A HI-LO CROSS FILTER for Signal analysis.



MODULATED STAIRSTEP signal thru high pass filter. Checks differential amplitude.



MODULATED STAIRSTEP signal thru low pass filter. Checks linearity.



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INDUSTRY-TESTED AND PROVED FOR OVER 50 YEARS...

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Electron Tube News
-from SYLVANIA

Meeting Industry's New Challenges—Everywhere in Electronics

IN COMPUTER TUBES . . .

Sylvania releases another new computer tube, the 7044, featuring high perveance

Advanced duo triode computer tube released by Sylvania, type 7044, features high perveance and dissipation capabilities and for many applications is a replacement for type 5687. Optimized design featuring leakage slots and the best alloys to preclude interface resistance contribute to a long and stable life.

Type 7044 supplements Sylvania's extensive line of tubes for computer applications which includes types 5844, 5963, 5964, 5965, 6211, 6350, 6814, 7AK7, 6145, 6888 and 5915A.

CHARACTERISTICS

RATINGS:

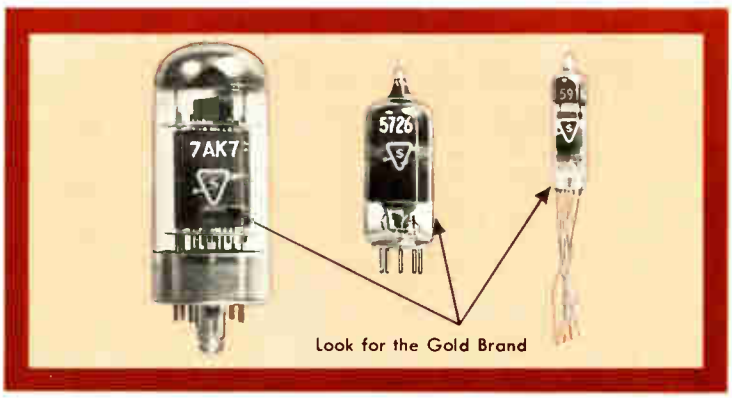
Heater Voltage	(Series)	12.6 Volts
	Parallel	6.3 Volts
Heater Current	(Series)	450 Ma
	Parallel	900 Ma
Plate dissipation per section		4.5 Watts
Total plate dissipation		8.0 Watts

TYPICAL CHARACTERISTICS:

Plate Voltage	120 Volts
Grid Voltage	−2 Volts
Plate Current	36 Ma
Transconductance	10,000 umhos
Amplification Factor	19
Plate Resistance	1,900 Ohms
Grid Voltage for Ib = 200 ua (Eb = 150V)	−12 Volts
Plate Current (Eb = 90 V Ec adjusted for Ic = +250 ua)	50 Ma

IN RELIABLE TUBES . . .

Sylvania's Gold Brand means extra dependability and reliability



Now all Sylvania reliable receiving tubes are distinguished by the famous Gold Brand that already identifies the premium dependability of Sylvania subminiatures. The Gold Brand assures you of airborne and computer tubes with extra accuracy and dependability.

Sylvania Gold Brand tubes meet extra critical specifications throughout the entire tube-making operation. This extensive quality control is possible because Sylvania itself furnishes nearly every tube part. As a result, extra-critical specifications can be applied to the production of components throughout the manufacturing of tubes.

IN TV PICTURE TUBES . . .

New Sylvania non-ion trap electron guns for 90° and 110° deflection with electrostatic focus.

New non-ion trap electron guns reduce tube length, eliminate external ion trap magnet

Sylvania, trendsetter in electron tube design, offers two new improvements for television picture tubes:

- **For 110° deflection—a small neck, non-ion trap gun with electrostatic focus**
- **For 90° deflection—a standard neck non-ion trap gun with electrostatic focus.**

Both new guns permit reductions in overall tube length of up to a full inch. They also make possible important cost savings by eliminating the need for external ion trap magnets.

The small neck gun for 110° deflection is available in the conventional base design with flexible stem leads or in the rigid pin base design with nylon cap.

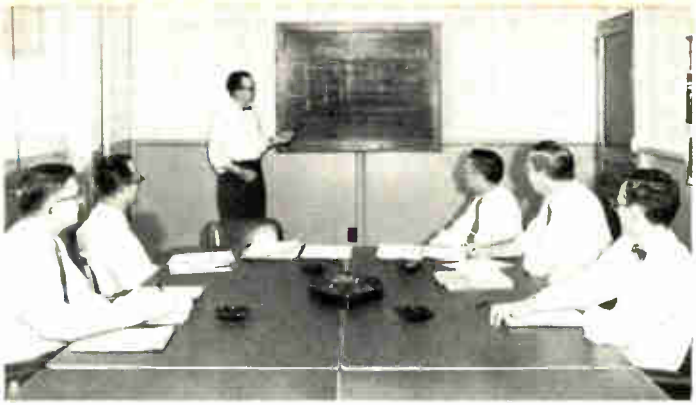
Meeting Industry's New Challenges—

IN DYNAMIC TESTING . . .

Sylvania expands its Dynamic Testing Program to include every key TV type

Sylvania's expanded dynamic testing program now covers every important family of tube types used in today's critical TV receiver circuits. Individual Sylvania receiving tube types are evaluated in actual circuit environments that simulate current TV set designs. This extra quality check substantially reduces line rejects for receiver manufacturers and gives greater reliability and improved TV set performance at lower cost.

Sylvania's Joint Engineering and Manufacturing Committee, JEMC, meets weekly to keep testing specs current. The group, made up of key engineering and manufacturing management personnel, establishes specifications that assure better performance levels under actual operating conditions.



JEMC group, comprised of top engineering and production personnel in Sylvania's receiving tube operations, sets standards for the Dynamic Testing Program.

Sylvania tubes undergo arc tests in TV receiver circuits as part of its extensive Dynamic Testing Program.

IN ADVANCED DESIGN . . . new filament designed for 1B3GT and its new short version, type 1G3GT

New heater design shown at right

Sylvania introduces a new coil filament design that improves the performance and extends the life of the standard 1B3GT. This new development replaces the conventional filament shield with a hooked coil design that reduces shorts and arcing and increases emission.

Sylvania's new 1G3GT, a miniaturized version of the 1B3GT, incorporates the new filament coil design, is a full ½ inch shorter in overall length, and exhibits the same characteristics as the 1B3GT.

IN 110° DEFLECTION TUBES . . .

New TV Deflection Pentode

Sylvania offers a new tube development, type 12DW5, to meet the requirements for large-screen 110° vertical deflection. It also has application in 110° off-the-line circuits.

This new beam power amplifier with a T 6½ bulb size, is an original Sylvania design. It is already creating interest in the TV industry for many 1958 receiver designs by leading television manufacturers.

For series-string circuits, the new 12DW5 features high peak-positive plate voltage, high zero bias current and adequate plate and screen dissipation. To supplement the 12DW5, Sylvania offers the 6DW5 with a 6.3-volt, 1.2-ampere heater characteristic.

Vertical Deflection Ratings (Pentode Connected)	
Plate Voltage	330 Volts Max.
Grid No. 2 Voltage	220 Volts Max.
Peak-Positive Pulse Plate Voltage (absolute max.)	2200 Volts
Plate Dissipation	11 Watts Max.
Screen Dissipation	2.5 Watts Max.
Zero Bias Characteristics (Instantaneous Values)	
Plate Voltage	60 Volts
Grid No. 2 Voltage	150 Volts
Grid Voltage	0 Volt
Plate Current	260 Ma
Grid No. 2 Current	20 Ma

Everywhere in Electronics

—IN GUIDED MISSILE TYPES

. . . Structural advantages earmark Sylvania tubes expressly designed for guided missile use

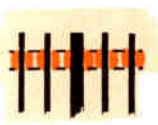
Possibly the biggest single factor behind the wide acceptance of Sylvania's Guided Missile subminiature tubes is the fact that each type was designed from start to finish under a new philosophy born of thorough investigation of Guided Missile requirements.

From closer control of raw materials to tighter parts tolerances and new manufacturing techniques, nothing was spared to design and produce the most missile-worthy tubes available.

Wider grid-to-cathode spacing

Consistent with tube functioning requirements optimum grid-to-cathode spacing provides greater protection against flicker shorts and minimizes vibrational noise.

Adequate mica bearing surfaces



Tight, solid fitting is achieved between mica and cathode and mica and grid side rods through close parts tolerances and optimized bearing surface between the parts and mica.

Shortest mica-to-mica spacing

Shortened mount adds structural rigidity and relocates natural resonances beyond the frequency range encountered in missile operations.

Plate tabs and bent stems

Whenever possible, plate tabs are used and stem leads are bent, eliminating extra connectors and welds. A more rigid mount and improved reliability are achieved.

Lowest mica-to-header spacing

This structural advantage is inherent in the button-header design which makes possible shorter spacings without interfering with tube assembly.

Special bulb glass

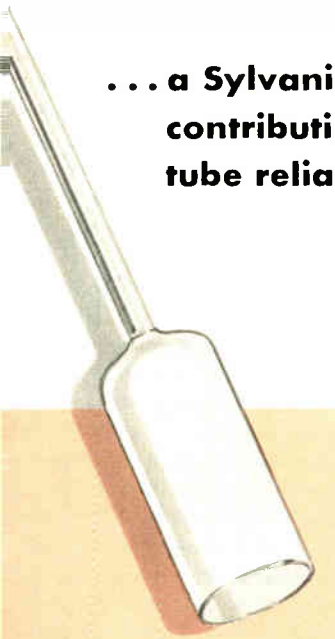
Special new glass is employed in the guided missile tubes. The new hard glass makes possible bulb temperatures of 250° C. at a plate voltage of 250 volts.

"NEW CONCEPT" BULB

. . . a Sylvania refinement contributing to greater tube reliability

The new concept bulb is a typical Sylvania refinement which places greater controls over raw materials and physical tolerances.

From header to top seal, the new concept bulb is controlled for uniform wall thickness. The combination of more uniform bulb and closer mica spacing tolerances provides a tighter fitting, more rugged mount.



Uniform wall thickness is maintained through "new concept" bulb fabricating techniques.

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BUSINESS REPLY CARD
(First Class Permit No. 46687, New York 19, N. Y.)

SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway
New York 19, N. Y.

Meeting Industry's New Challenges —Everywhere in Electronics

IN 12-VOLT HYBRID TYPES . . .

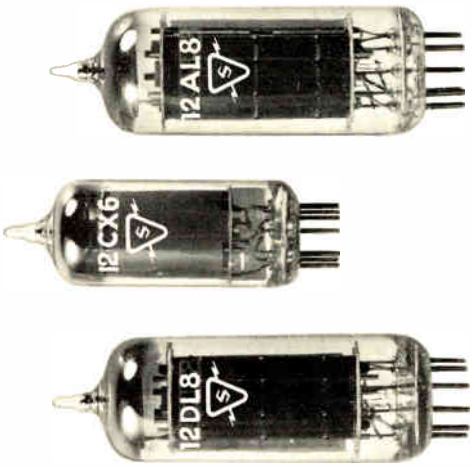
Sylvania's three new tubes, 12CX6, 12AL8 and 12DL8, meet needs of 1958 auto radio designs

Three new 12-volt hybrid receiving tubes from Sylvania are becoming the mainstays in 1958 auto radio designs. They are types 12CX6, 12AL8 and 12DL8.

Type 12CX6, a new rf-if pentode, is a Sylvania original design that is becoming one of the most popular auto tubes in 1958 lines. It has high transconductance of 3,100 micromhos and high plate resistance which is relatively unaffected by variation in the automobile supply voltage.

The 12AL8 is a medium mu triode and space-charged tetrode. It can be used as an audio amplifier and a transistor driver, or a trigger tube in remote control sets.

The 12DL8 is a new duo diode and space charge tetrode for transistor driver service and other applications.



Three new 12-volt hybrid tubes from Sylvania for 1958 auto radio designs.

IN SPECIAL CRT'S

Expanding CRT program produces Type 5UP1— more to come as development continues

Sylvania announces the availability of the Type 5UP1 general-purpose cathode-ray oscilloscope tube. It's among the first in Sylvania's plans to enter the special CRT program on a full-scale basis. Already in various stages of development and planned for early production are such cathode-ray types as the 3JP7, 3RP1, 5AHP7A, 7ABP7A and 12ABP7A.

To meet its projected goals, completely separate development and production facilities have been established to meet industry's special needs.

SYLVANIA

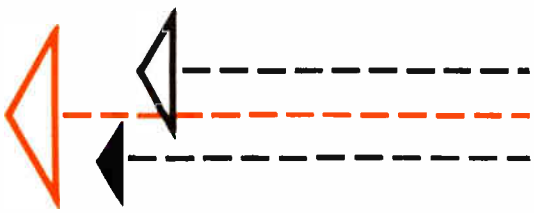
Please send additional information on the items checked below.

- ☐ Computer type 7044
- ☐ Type 1G3GT
- ☐ Hybrid auto radio types 12CX6, 12AL8, 12DL8
- ☐ Special purpose cathode-ray tubes
- ☐ Non-ion trap TV picture tubes
- ☐ Type 12DW5—6DW5
- ☐ Guided Missile types

Name_____

Address_____

Company_____



Use this handy business reply card to request additional information on these important new Sylvania developments

having your ups and downs?

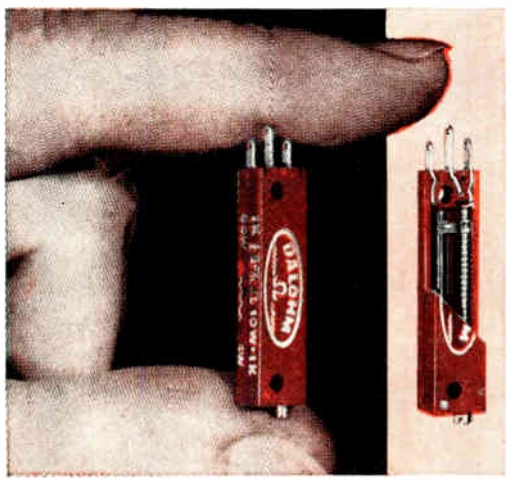
. . . if they involve POTENTIOMETERS

DALOHM has the answer!

All Dalohm components are carefully designed and skillfully made to assure you of supreme quality and dependability, plus the widest versatility of application. These recent additions to the Dalohm line already have met with wide acceptance and enthusiasm:

DALOHM Ω ®

You can depend on DALOHM



Mil-E-Trized A10-W TRIMMER POTENTIOMETER

Wire Wound, High Temperature, Humidity-Proof, Ruggedized

This Dalohm Trimmer is designed to meet the ever-increasing requirements of such specifications as MIL-E-5272A and MIL-R-12934. It provides precision adjustments in critical electronic circuits under extreme environmental conditions. It has an extended winding surface and assures high precision resolution without sacrificing sub-miniature design. Size is .220 x .310 x 1.250; weight is 2.25 grams.

- Resistance values 10 ohms to 100,000 ohms; standard tolerance 5%; power rating 0.8 watt; temperature coefficient of wire 0.00002/Deg. C. Other resistances, tolerances, leads available on special order.
- Completely sealed; housing of thermo-setting, glass filled material with heat resistance of 200° C continuous. Precious metal plating on all terminals; air evacuated and filled with silicone grease.
- Unique new type sliding contact; unique safety clutch.
- Unit holds set resistance values.
- Mounting flexibility provided for either stacked or multiple arrangements.

Write for Bulletin R-32B

Mil-E-Trized DP-12 POTENTIOMETER

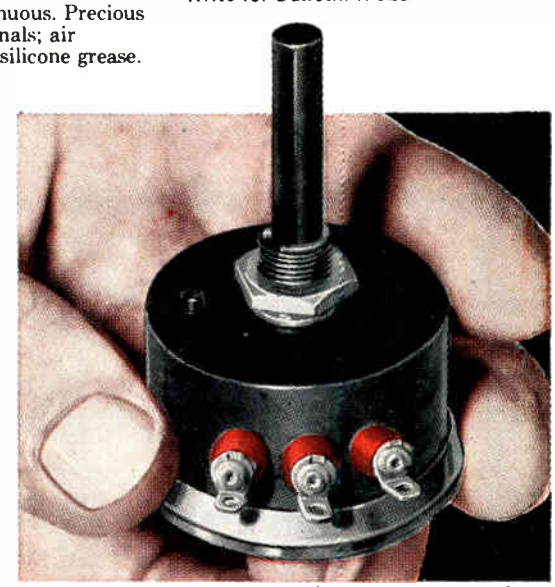
Built to Surpass JAN-R-19

Hermetically Sealed, Moisture-Proof, Ruggedized

Completely protected from arctic cold or tropic damp, from shock, vibration, salt-laden air and ultra-high altitude. Powered at 4 watts, the DP-12 has a power rating of 100% at 40° C, derated to 0 at 125° C. Housing and shaft of black anodized aluminum with back plate of corrosive resistant aluminum. Unit designed for back panel mounting with integral threaded base.

- Operating temperature range—55° C to 125° C. Minimum rotational life is 25,000 mechanical cycles.
- Standard resistance range 100 ohms to 40K ohms with standard tolerance of 5%. Other ranges and tolerances available on special order.
- Precision winding gives excellent linearity with 3% maximum deviation.
- Temperature coefficient of wire 0.00002/Deg. C on values of 500 ohms and up; 0.00050/Deg. C on values below 500 ohms.
- Sensitive shaft adjustment.

Write for Bulletin R-31



JUST ASK US!

Write for the complete Dalohm catalog of precision resistors, potentiometers, and collet-fitting knobs.

If none of our standard line fills your need, our staff of able engineers and skilled craftsmen, equipped with the most modern facilities, is ready to help you solve your problem in the realm of development, engineering, design and production.

Just outline your specific situation.

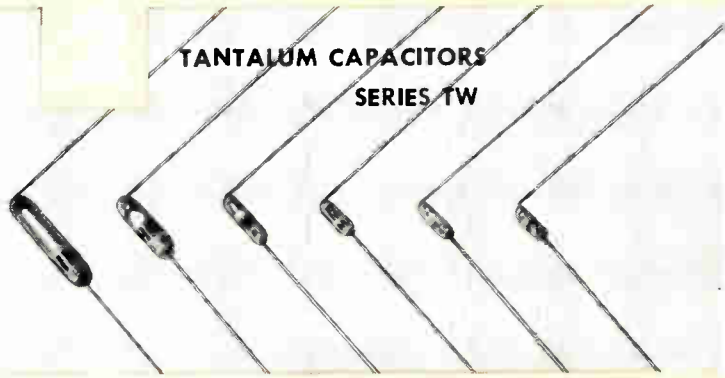
DALE PRODUCTS INC.

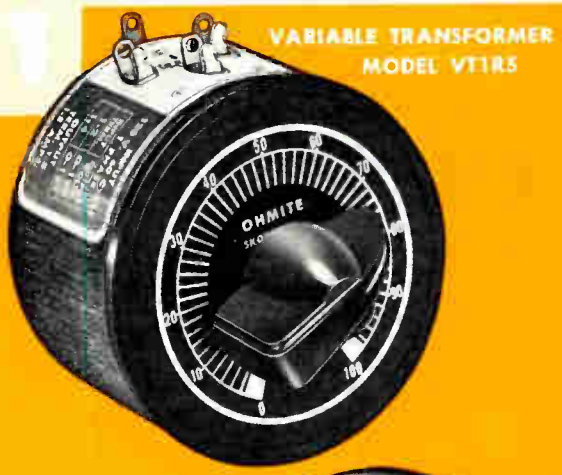
1304 28th Ave.
Columbus, Nebraska, U.S.A.

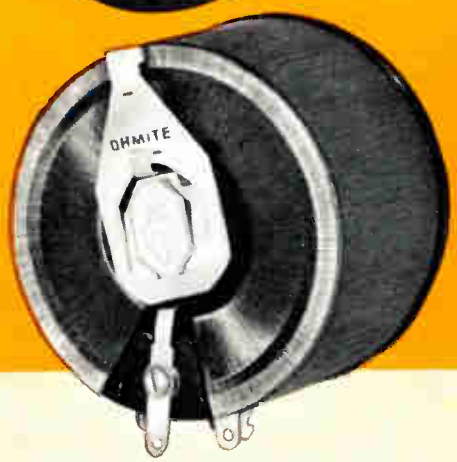
- **Export Dept:** Pan-Mar Corp. 1270 Broadway, New York 1, N.Y.

2 new components from OHMITE®

subminiature wire-type tantalum capacitors and variable transformer

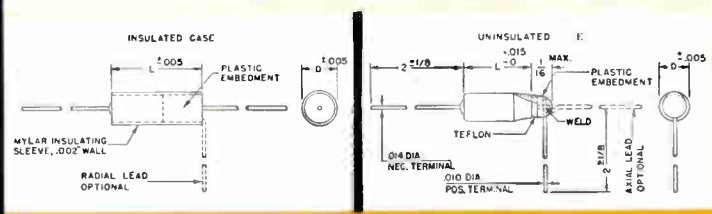






GREATER CAPACITANCE PER UNIT VOLUME

The new Series TW Ohmite subminiature Tan-O-Mite® TANTALUM CAPACITORS are wire-type units that feature greater capacitance per unit volume, lower leakage current and power factor, and small capacitance drop at extremely low temperatures as compared to other types of electrolytics. Ultrasmall for low-voltage DC transistorized electronic equipment, these new tantalum capacitors have *high stability, high capacitance, long shelf life,* and excellent performance under temperature extremes of −55° C to +85° C. They are available in six *subminiature sizes:* 0.1 to 60 mfd. over-all capacitance range.



SIZE	UNINSULATED		INSULATED	
	D (inches)	L (inches)	D	L
T	.075 (5/64)	.156 (5/32)	.082	.203
S	.075 (5/64)	.187 (3/16)	.082	.234
M	.095 (3/32)	.172 (11/64)	.100	.218
A	.095 (3/32)	.250 (1/4)	.100	.312
B	.125 (1/8)	.312 (5/16)	.134	.375
C	.125 (1/8)	.500 (1/2)	.134	.562

Smallest size is .075 (5/64) x .156 (5/32) inches; the largest is .125 (1/8) x .500 (1/2) inches. Five stock sizes are available in a wide range of capacitances, voltages. Units insulated with a tough Mylar® plastic sleeve can be furnished. *Write on company letterhead for Bulletin 148B.*

MORE CAPACITY FOR EQUAL SIZE

The rating of 1½ amperes represents a continuous rating at any brush setting. This "bonus" in current capacity is the result of a unique core design by Ohmite. The new Ohmite VARIABLE TRANSFORMER model VT1R5 features: Long-wearing, nonoxidizing, rhodium-plated coil contact surface, a ceramic hub that mounts the contact arm, and provides 3000 VAC insulation between parts at line potential and shaft assembly; positive brush to center-lead connection because brush pigtail shunt is bonded into solid copper-graphite slip ring. Input voltage is 120 V, 60 cycle; output voltage is 0-120 V—0-132 V. Mounted by ⅜"-32" bushing and nut. *Write for Bulletin 151.*

BE RIGHT WITH

OHMITE®

RHEOSTATS • RESISTORS • RELAYS • TAP SWITCHES
TANTALUM CAPACITORS • VARIABLE TRANSFORMERS

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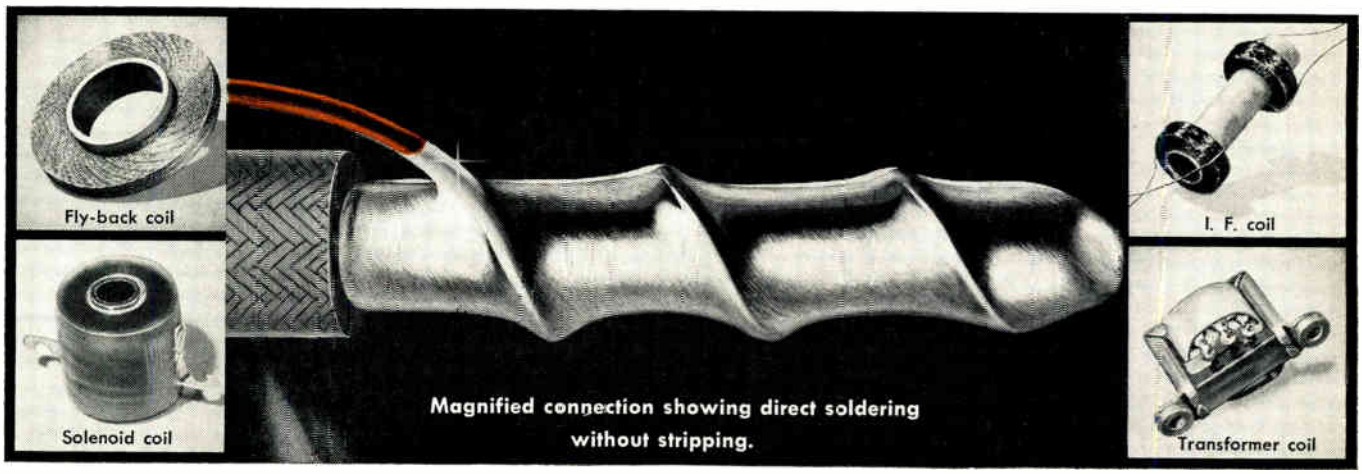
Circle 27 on Inquiry Card page 101

PHELPS DODGE SODEREZE®

ENDS STRIPPING, CLEANING—

CUTS SOLDERING COSTS !



Sodereze*—Phelps Dodge polyurethane magnet wire—provides:

1. Low temperature soldering—no damage to copper conductor.
2. A balance of physical, chemical and electrical properties permitting replacement of existing film wires.
3. Resistance to heat and solvent shock for safer wax or varnish treatment.

Any time magnet wire is your problem, consult Phelps Dodge for the quickest, easiest answer!

**Standard color, red.*

FIRST FOR LASTING QUALITY— FROM MINE TO MARKET!

PHELPS DODGE COPPER PRODUCTS CORPORATION

INCA MANUFACTURING DIVISION

FORT WAYNE, INDIANA

Industry News

A. Warren Urich has been named Comptroller of the Frank R. Cook Co., Denver avionics manufacturing firm.

William S. Wheeler has been named Manager of the Chicago Military Electronics Center of Motorola, Inc. Mr. Wheeler succeeds Arthur Jones who has resigned.

W. S. Wheeler

S. S. Wilson

S. S. Wilson has been appointed Executive Vice President and General Sales Manager of Sel-Rex Corp., Nutley, N. J.

William S. Dickey has been promoted to Supervisor at the Southwestern Laboratories branch of Armour Research Foundation.

W. J. McGinnitty has been appointed Executive Assistant to the President of Hallamore Electronics Co., a division of Siegler Corp.

A. George Ewing has advanced to Manager of the newly-formed Production Engineering Div. at Lenkurt Electric Co.

Arnold Wihtol is the new Manager of Manufacturing of Varian Associates' Tube Div.

C. W. Creaser, Jr., was named Vice President-Sales of D. S. Kennedy & Co. and Dr. Robert E. Cheatham was appointed Director, Plastics Div.

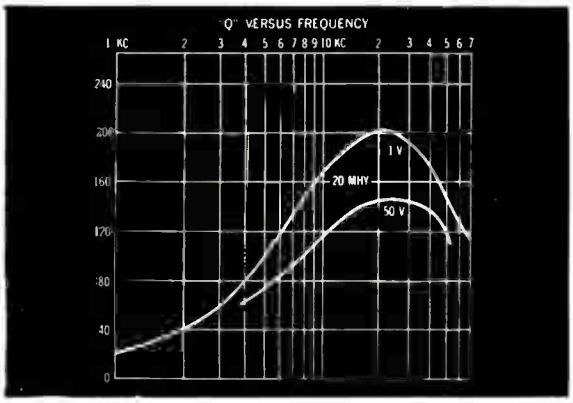
Frederick R. Einsidler will now serve as Manager of the AMF Co.'s Brooklyn Engineering Lab. Robert K. Winkleblack is the new Assistant Manager of the company's Nuclear Engineering Lab.

William S. Ivans, Jr., will now serve as Vice President in charge of Engineering for Kin Tel, a division of Cohu Electronics, Inc. Mr. Ivans was formerly Chief Electronics Engineer of Convair.

Leon L. Adelman is now Eastern Division's Sales Manager for Conrac, Inc.

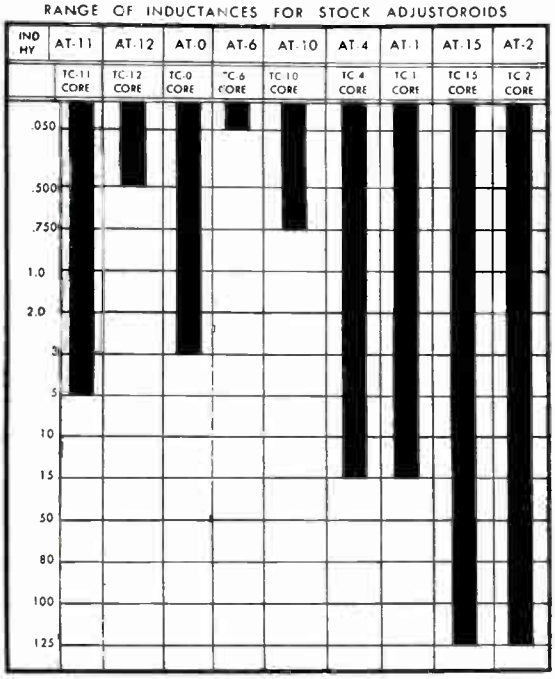
(*Continued on page* 46)

variable "L" by BURNELL



Typical Q vs. frequency characteristics of AT-10.

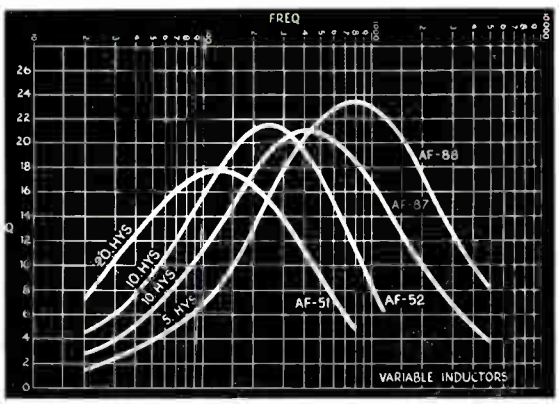
RANGE OF INDUCTANCES FOR STOCK ADJUSTOROIDS



For nominal D. C. R. values refer to Burnell catalog No. 103.

COMPLETE TECHNICAL INFORMATION UPON REQUEST

® copyrighted, patent applied for



Typical Q vs. frequency characteristics of Variable Inductors.

ADJUSTOROIDS®

The Adjustoroid, a low cost adjustable toroid, exclusively developed by Burnell & Company, Inc., contains an actual complete toroid which relays all the excellent characteristics of the non-adjustable types. Adjustment is obtained by a completely stepless function with magnetic biasing.

The nominal inductance value for an Adjustoroid is the **maximum** value, and the inductance range is the nominal value minus approximately 10%.

Hermetically sealed to meet Government MIL specifications. Many types of networks in tuned circuits are being produced which employ the Adjustoroid in completely hermetically sealed packages.

Intermediate inductance values as well as special taps and extra windings available on special order with minimum delay.

For additional technical data on Adjustoroids, refer to equivalent toroid in catalog.

AT-0, AT-6, AT-10, AT-4

AT-1, AT-2, AT-11, AT-12

ADJUSTOROID & VARIABLE INDUCTOR DIMENSION CHART

	LENGTH/DIA.	WIDTH	HEIGHT
AT-0, AT-6	1-1/16"		1"
AT-10, AT-4	1-19/64"		1-1/4"
AT-15	1-31/32"		1-7/8"
AT-11, AT-12	45/64"	45/64	3/4"
AT-1	1-3/4"	1-3/4"	1-1/4"
AT-2	2-3/4"	2-3/4	2-1/4"
AF-51, AF-52	1-19/64"		2"

and now . . .

NEW SUBMINIATURE VARIABLE INDUCTORS

AF-87 AF-88

AF-87 (30-500 cycles) maximum Q at 400 cycles

AF-88 (50-1000 cycles) maximum Q at 800 cycles

Burnell subminiature variable inductors are especially designed for low frequency applications or where proportionately high inductance values are required. Except for low frequency, high inductance values, subminiature inductors are similar to Adjustoroids and measure 1¼" in height and 45/64" in width and depth. Variable inductors are available in all inductance values up to 80 Hys.

BURNELL & CO., INC.

10 Pelham Parkway, Pelham Manor, New York

Pacific Division: 720 Mission St., S. Pasadena, Calif.

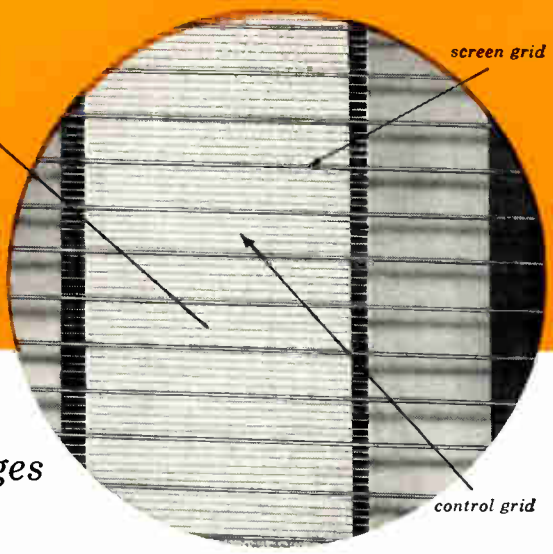
Dept. T-107

no other transmitting tube but the

Amperex 6939

gives you

5.5 watts useful power in load (ICAS)
up to 500 Mc at maximum ratings
in a miniature envelope

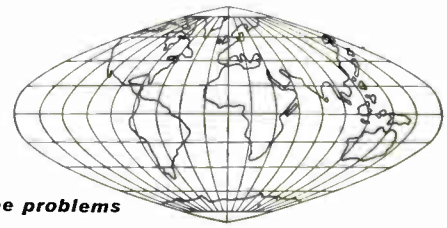


unsurpassed for low-power UHF transmitter applications . . . saves entire stages in original equipment design

AMPLIFIER, CLASS C, FM	*Operating Conditions*	
	C.C.S.	I.C.A.S.
Frequency	500 Mc/s	500 Mc/s
Plate Voltage	180 V	200 V
Screen Grid Voltage	180 V	200 V
Control Grid Bias	−20 V	−20 V
Plate Current	2x27.5 mA	2x30 mA
Screen Grid Current	11 mA	13 mA
Control Grid Current	2x1 mA	2x1 mA
Driving Power	1.0 W	1.0 W
Plate Input Power	2x5 W	2x6 W
Plate Dissipation	2x2.1 W	2x2.25 W
Screen Grid Dissipation	2 W	2.6 W
Output Power	5.8 W	7.5 W
Useful Power in Load	4.5 W	5.5 W

The Amperex 'FRAME-GRID' CONSTRUCTION insures extreme accuracy of interelectrode spacing, the secret of the 6939's brilliant performance. The relatively massive metal frame acts as a heat-sink, safely limiting control-grid temperature.

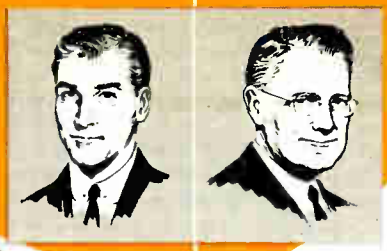
Write for detailed data sheets to Communications Tube Division, Amperex Electronic Corporation, 230 Duffy Avenue, Hicksville, L. I., New York.



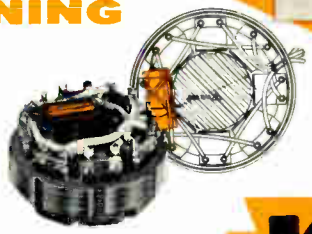
ask Amperex

. . . for applications engineering assistance on your communications tube problems

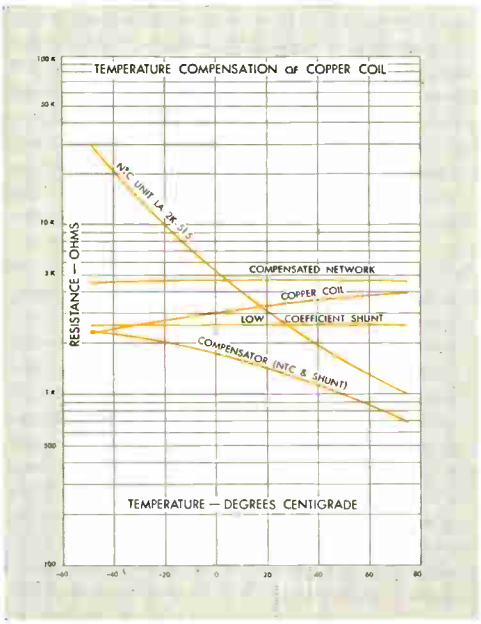
This **Design Engineer** had a temperature-compensating resistor in his **PLANNING**



This **Manufacturer** has a temperature-compensating resistor in his **PRODUCT**



BOTH CAME TO Keystone FOR THE CORRECT THERMISTOR RECOMMENDATION



CALCULATIONS

Temp °C	Coil R Ohms	Keystone Part LA-2K-515 Ohms	LTC Shunt Ohms	NTC & Shunt Ohms	Total R Ohms
—50	2265	30000	↑	2290	4555
—25	2576	11700		2050	4626
0	2888	5300		1690	4578
25	3200	2700	2480	1290	4490
50	3512	1550		955	4467
75	3824	950	↓	687	4511

Initial wattage @ —50°C = 0.00437 watt
" " @ 75°C = 0.0125 watt

HERE'S HOW KEYSTONE HANDLES A TYPICAL COIL COMPENSATOR SELECTION PROBLEM— AND HOW WE CAN HELP YOU SOLVE YOURS!

The Problem:

Provide temperature compensation of a copper coil with resistance 3200 ohms at 25°C over the temperature range of −50°C to +75°C. Coil current is 5 milliamperes. Desire total compensated resistance of approximately 4500 ohms.

The Solution:

(a) Calculate coil resistance for 25 degree temperature increments throughout the temperature range.

(b) Select Keystone NTC unit having a resistance change slightly greater than that of the coil at the hot end of the prescribed temperature range (i.e. from +50°C to +75°C).

This will result in good compensation with minimum added resistance. The graphed solution illustrates Keystone thermistor, LA-2K-515, with a change in resistance about twice that of the coil over the hot temperature increment. In general, the thermistor which is chosen depends upon specified requirements relating to permissible added circuit resistance.

Selection of the proper thermistor physical size depends upon required time of response, space limitations, and circuit current. For the problem in consideration, one watt size "LA"—5/32" diameter by ½" length—appears satisfactory.

(c) Good compensation of coils over wide temperature ranges generally requires use of a low temperature coefficient shunt across the thermistor unit to provide a fairly linear NTC response throughout the temperature range. Hence, select the proper shunt value to provide the required resistance change and calculate the response at intermediate temperatures.

(d) Add coil resistance and compensating resistance at each temperature. The total resistance of the compensated network should be constant within a small percentage.

(e) Calculate initial wattage developed across the thermistor unit at the low and high end of the temperature range. For self-heating to be negligible, initial wattage should be a small percentage of the maximum wattage rating of the unit.

(f) For best response under actual circuit conditions, the thermistor should be mounted in proximity with the coil so that they track each other with relation to any temperature changes.

Keystone
CARBON COMPANY
Resistor Division
ST. MARYS, PA.

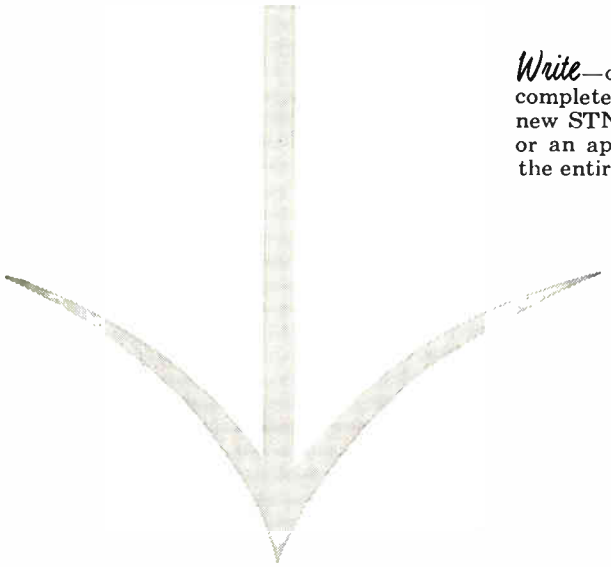
If you have a temperature compensation or other application suggesting the use of thermistors, we invite you to have your problem reviewed by Keystone engineers. Write us, without obligation of any kind.

Circle 32 on Inquiry Card, page 101

New!
Mallory STNT

... a subminiature tantalum capacitor for transistorized circuits— another Mallory first

4 to 40 mfd.
3 to 50 volts working
.145″ in diameter
.250″ in length
tantalum construction
−55 to +85° C ratings
metal cased
axial leads



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- Atomic Applications
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- High Frequency Insulators
- Mounting Plates
- Spacers
- Standoffs
- Supports
- Switchbacks
- Terminal Boards
- Transformer Bushings
- Trimmers
- Tube Parts

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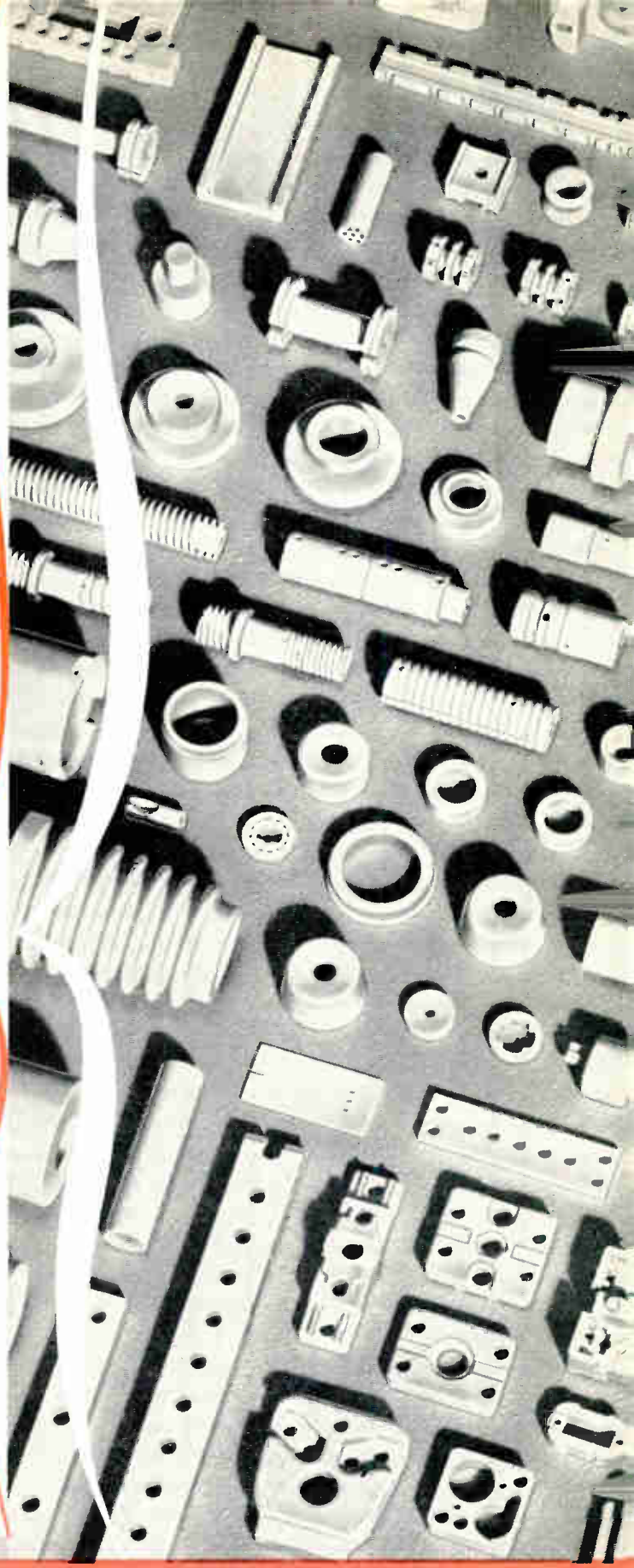

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Circle 34 on Inquiry Card, page 101

Industry News

(*Continued on page* 40)

Robert E. Rawlins was elected President of Dynac, Inc., an affiliate of Hewlett-Packard Co.

David C. Arnold has assumed the duties of Texas Division Director of Research and Development of the Collins Radio Co.

Dr. W. H. Brandt has been named Director of Advanced Systems Engineering for the Westinghouse Sunnyvale Mfg. Div.

John R. Lenox has been elected Vice President in charge of Operations of Datamatic Corp.

Ray W. Kidder is now Director of Engineering for Electra Mfg. Co., manufacturer of deposited carbon resistors and ceramic disc capacitors. Mr. Kidder was formerly with Texas Instruments, Inc.

R. W. Kidder

T. C. Fry

Dr. Thornton C. Fry has joined Univac Engineering as Vice President and Director. Dr. Fry was formerly assistant to the President of Bell Telephone Laboratories.

John E. Lillich has become Manager of Product Engineering in the Electronic Components Sales Dept. at Corning Glass Works.

Albert Binash is now Sales Supervisor in charge of the Elgin National Watch Co., Electronics Div., American Microphone Product Line.

Robert A. Lebowitz has been appointed Assistant to the Manager of Manufacturing at Polytechnic Research & Development Co., Inc., manufacturers of microwave and electronic test instruments.

John W. Decker has joined Synthane Corp. as Assistant Sales Manager, Detroit office. Mr. Decker was formerly Sales Representative for Neilson Chemical Co.

announcing

GEC VIDICON

a superior television pickup tube

Your GEC Vidicons will reach you in factory condition because of GEC-built shockproof packaging.

Now you can get sturdy GEC Vidicons built for hard handling and usage. Also, you are assured exceptionally long service life by precision manufacture under controlled conditions in GEC's ultra-modern new plant. Both the Industrial 6198A and Broadcasting 6326A types (improved design with side tips eliminated) are available for immediate delivery. See your parts distributor or write directly to GEC.

Write for new data sheet . . .

GENERAL ELECTRODYNAMICS CORPORATION

4430 FOREST LANE | GARLAND, TEXAS

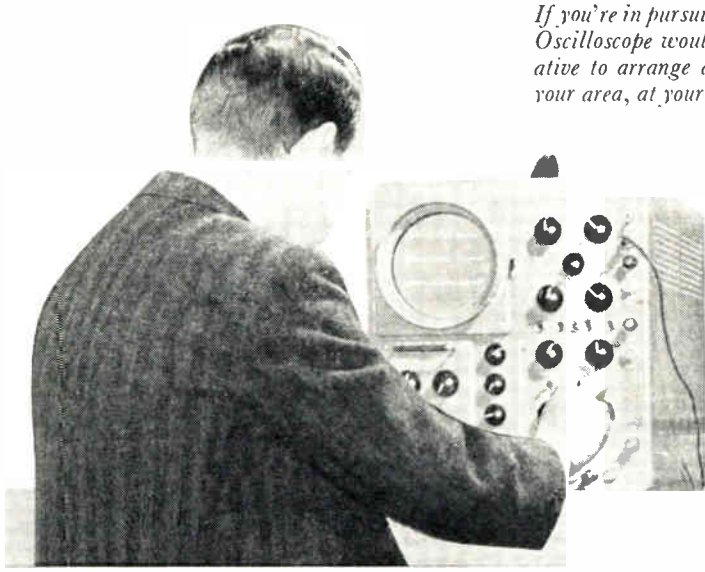
Introducing Number 1 of a Factual Series about the Hughes MEMO-SCOPE* *Oscilloscope*

MAN-DAYS SAVED

in research and testing involving transients

We are pleased to report a major breakthrough by a Hughes product that will significantly reduce the monotonous man-days spent pursuing elusive transients. Practically a promise of all things to all men in research and testing procedures involving traces, this new instrument of benefaction is the Hughes MEMO-SCOPE* Storage-Type Oscilloscope. A transient recorder with a "memory" it can retain single or successive writings for an *infinite length of time or until intentionally erased.*

Heretofore, the tedious trial and error methods and repetitious hair-trigger photography necessary to "capture" transients on conventional scopes has mercilessly wasted time, film and precious effort, not to mention ruffling dispositions. But, never again. Now, you may instantly "freeze" any number of selected wave forms in brilliant clarity on the face of a MEMO-SCOPE Oscilloscope —study, compare and analyze them at leisure. Or if desired, take convenient photographs with just one camera setting—one exposure—for each permanent record required. Superbly engineered and completely electronic, MEMO-SCOPE Oscilloscope involves no slide wires, no bothersome paper and ink problems.



If you're in pursuit of an elusive transient, ask yourself if a MEMO-SCOPE *Oscilloscope wouldn't best serve you. Better yet, ask a Hughes representative to arrange an eye-opening demonstration. He'll gladly do so—in your area, at your convenience and with no obligation.*

Make your request to:
HUGHES PRODUCTS
MEMO-SCOPE OSCILLOSCOPE
International Airport Station
Los Angeles 45, California

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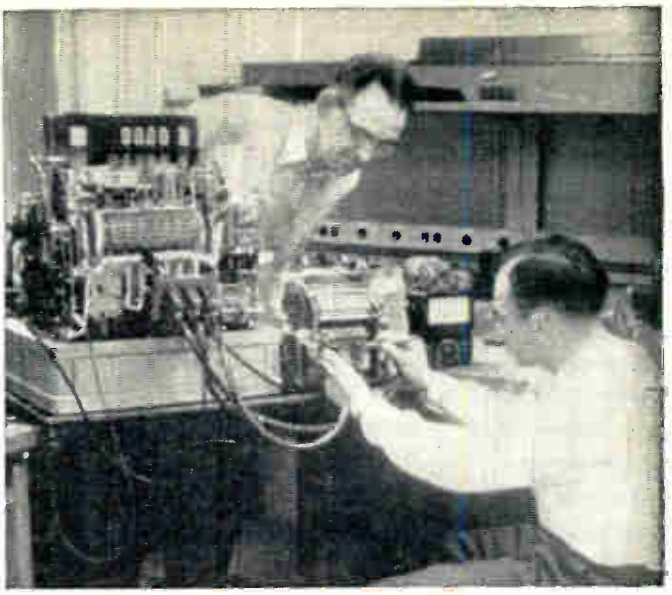
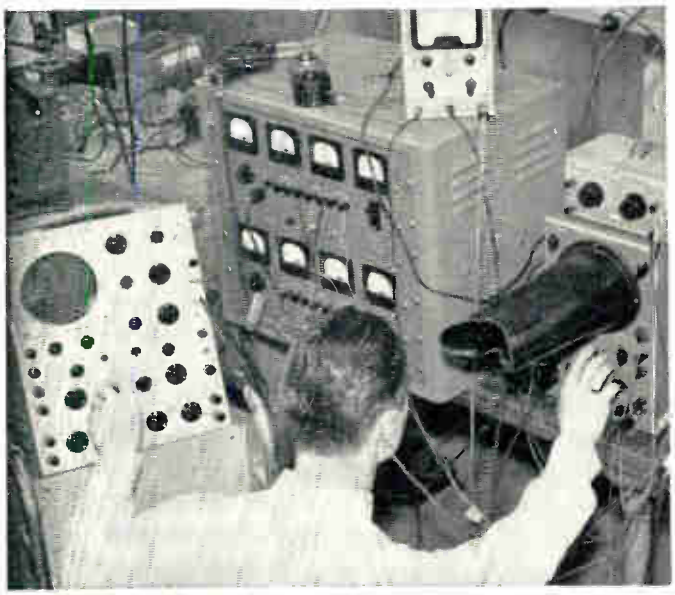
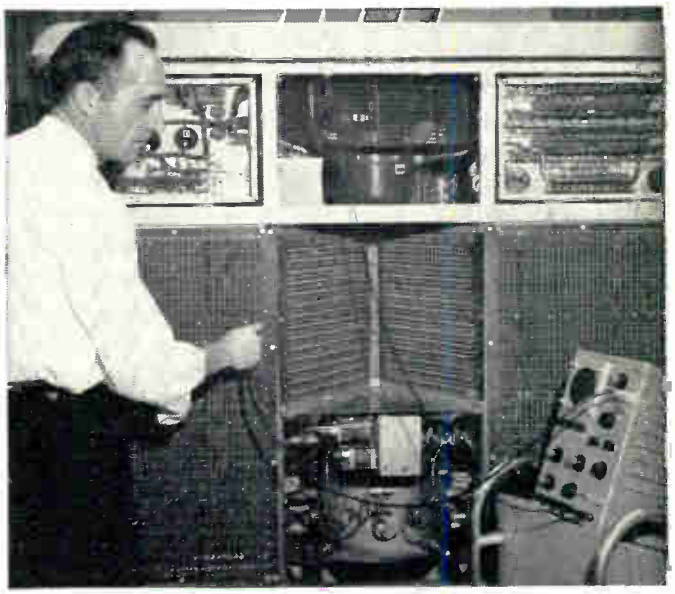
MECHANICAL ENGINEERS are using their skills in the design and development of new mechanisms required for business machines and for those mechanical products which are associated with electronic data processing equipment.



ELECTRO-MECHANICAL ENGINEERS are constantly faced with the problems of capturing information from the various input devices and converting this information into a usable form for subsequent use in data-handling equipment.



ELECTRONIC ENGINEERS enjoy an unparalleled freedom in the development of new types of circuitry and components which are necessary to maintain leadership in the competitive field of record-keeping automation.



COMPUTER ENGINEERS backed by the company's computer research since 1938 are developing an economical, flexible digital computer to meet the requirements of all record-keeping applications.

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If you are looking for a challenging opportunity with an established company which has tripled its sales in ten years—one that offers excellent starting salaries as well as permanent positions . . .

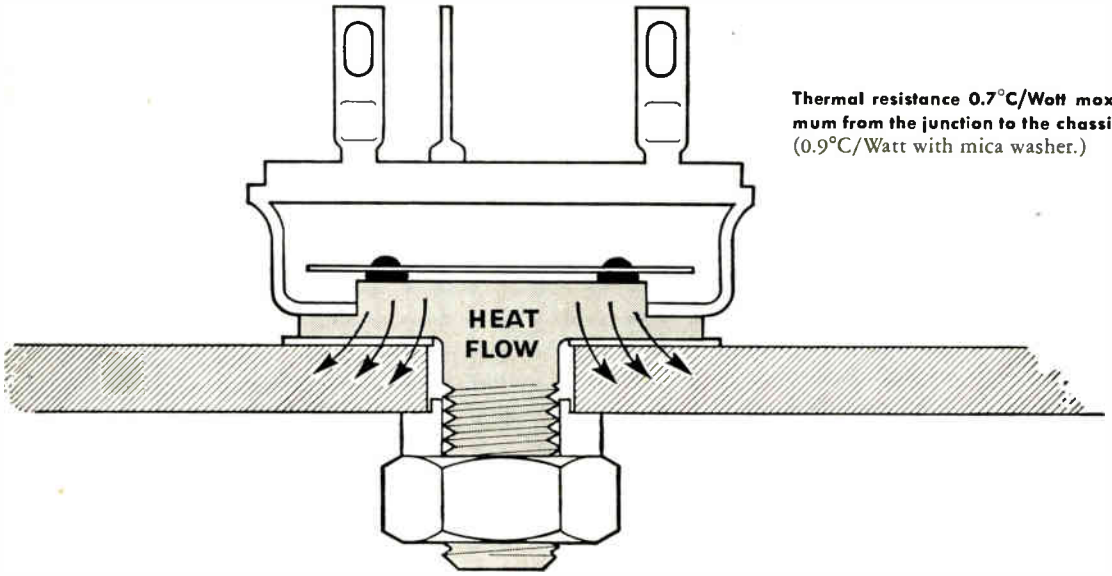
Act at once! Send resumé of your education and experience to Employment Department, Technical Procurement Sec. L, The National Cash Register Company, Dayton 9, Ohio.

NCR

THE NATIONAL CASH REGISTER COMPANY

Lowest Thermal Resistance of any Transistor!

Honeywell's New H10 Weld-Seal



Thermal resistance 0.7°C/Watt maximum from the junction to the chassis. (0.9°C/Watt with mica washer.)

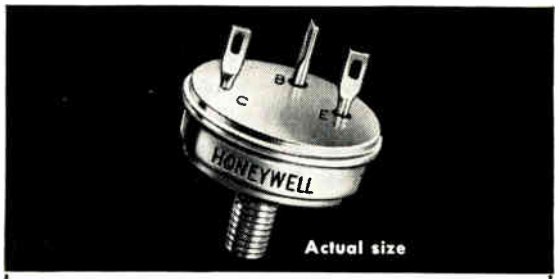
- Long thermal time response of junction temperature and low thermal resistance make overload possible for a longer period of time without permanent damage to transistor.
- Allows delivery of 10 watts to a servo motor in an ambient of 85°C.
- Handles 15 amps.

HONEYWELL'S NEW H10 Weld-Seal has a larger collector area for more rapid heat dispersion. *You get the lowest thermal resistance of any transistor!*

And you get the other advantages for which all Honeywell Weld-Seal transistors are famous—high and uniform power gain over a wide range of collector currents, long life, outstanding stability and economy.

Honeywell's H10 is hermetically sealed by welding—so you can build ruggedness and durability into your equipment.

Take advantage of this new and improved transistor. Check to the right for the Honeywell office nearest you and write or phone for complete information today!



Typical H10 Operating Characteristics

Transcanductance: .9 at 10 amps.
Current gain: 18 at 10 amps.
Maximum collectar current: 15 amps.

In applications where the capacity and capabilities of the H10 transistor are not necessary, the high gain H7 transistor provides outstanding operating characteristics. Write or phone for specifications.

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Circle 39 on Inquiry Card, page 101

A Big Little Pulser . . .

GR Type 1217-A Unit Pulser, $235

Photo courtesy Richard D. Brew and Company, I

Low Cost *Small Size* *General Ease of Operation*
Wide Range, both in Pulse Width and Repetition Rate
Good Pulse Shape even at short pulse durations
Hard-Tube rather than Gas-Tube operation makes high repetition rates possible — permits bright and easily discernable oscilloscope traces at fast sweep speeds
Built-in Time Delay allows the leading edges of pulses to be visible on most oscilloscopes
Several Unit Pulsers can be easily combined to form an economical generator of composite signals

. . . These are but a few of the outstanding features built into the General Radio Unit Pulser to make it one of the most versatile pulse generators available today. In short, the Pulser has been designed to meet the need for a low-cost, general-purpose instrument of laboratory-quality.

Typical of Pulser users is Richard D. Brew and Company, Inc., Concord, New Hampshire, manufacturer of ultrasonic, lumped-constant and distributed-constant delay lines. They use the Pulser both in development and production testing. The varied requirements of these measurements call for flexible test equipment, and Brew, like many others, has discovered that the Unit Pulser's built-in features give "built-in versatility" at no extra cost.

Repetition Rate: 30 and 60 cycles; 100 c to 100 kc in X1, X2, and X5 steps; 15 c to 100 kc continuous with external drive (25v rms is sufficient for locking)

Pulse Duration: 0.2 μsec to 60,000 μsec

Pulse Shape: Positive and negative pulses available; rise time 0.05 μsec, fall time 0.15 μsec; pulse top is flat to within 5% of maximum amplitude; overshoot is adjustable

Amplitude: Continuously variable; 20 volts maximum open circuit for either polarity; negative pulse of 50 volts if positive terminal is grounded

Output Impedance: 200 ohms, positive pulses; 1500 ohms, negative pulses

Price: **1217-A Unit Pulser, $235**
1203-B Unit Power Supply, $40

Type 1219-A Unit Pulse Amplifier, $200: Provides a maximum of 55 watts peak power at a wide range of impedances; current pulses up to 600 ma, and voltage pulses in excess of 250 volts at pulse durations as small as 0.1 μsec and repetition frequencies up to 2 Mc.

Write for the Pulse Equipment Bulletin for full information.

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All G-R Products are now covered by a *2-Year Warranty*

Circle 40 on Inquiry Card, page 101

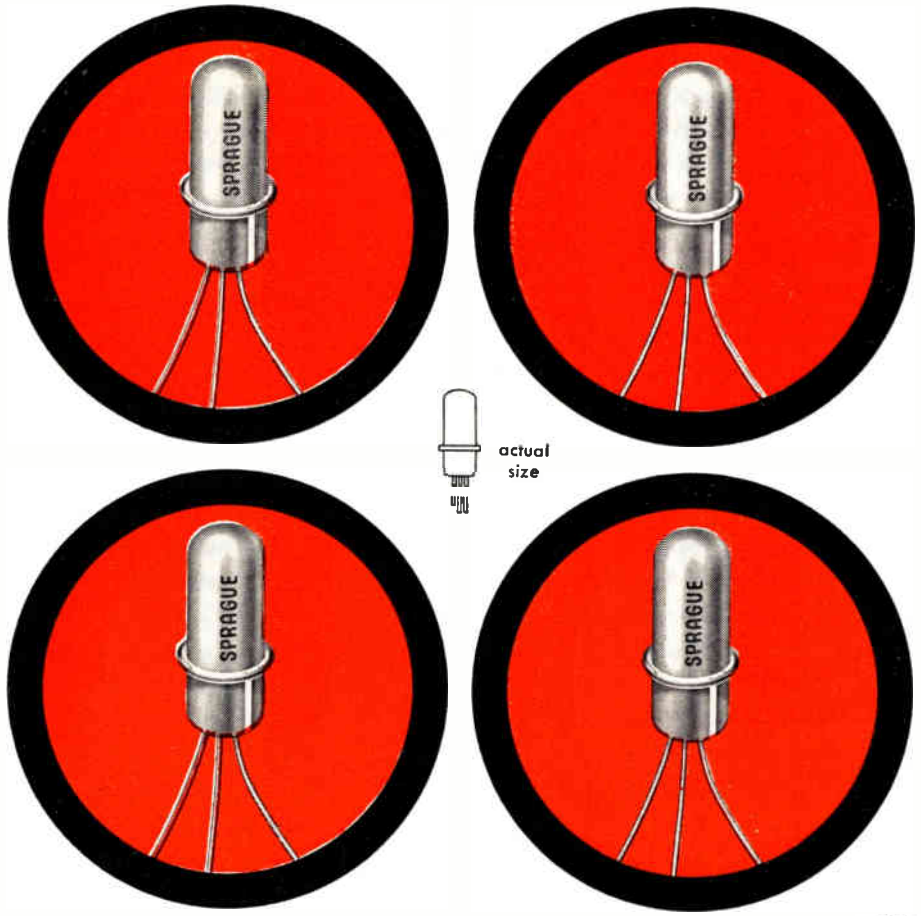
surface barrier transistors from SPRAGUE

2N344/SB101
for Medium Gain Amplifiers

	Min.	Typ.	Max.
h_{fe}	11	23	83
f_{max}	30	45	—

2N345/SB102
for High Gain Amplifiers

	Min.	Typ.	Max.
h_{fe}	25	40	110
f_{max}	30	45	—



2N346/SB103
for High Frequency Oscillators

	Min.	Typ.	Max.
h_{fe}	10	—	—
f_{max}	60	90	—

2N240/SB5122
for Computer Switching

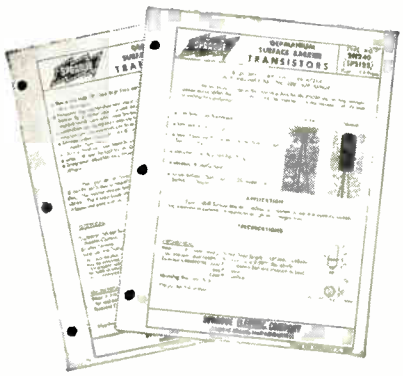
	Min.	Max.
h_{fe}	16	—
f_{max}	30	—
T_s	—	80

IN VOLUME PRODUCTION *Now!*

For general high frequency applications, and for high speed computer switching circuits, design around Sprague surface barrier transistors. They are available now in production quantities from a completely new, scrupulously clean plant, built from the ground up especially to make high quality semi-conductor products.

The four transistor types shown are the most popular. Orders for these units are shipped promptly. What's more, surface barrier transistors are reasonably priced. High quality and excellent electrical characteristics make them an economical solution to many difficult circuit requirements.

Sprague surface barrier transistors are fully licensed under Philco patents. All Sprague and Philco transistors having the same type number are manufactured to the same specifications and are fully interchangeable. You have *two* sources of supply when you use surface barrier transistors!



WRITE FOR COMPLETE ENGINEERING DATA SHEETS ON THE TYPES IN WHICH YOU ARE INTERESTED. ADDRESS REQUEST TO THE TECHNICAL LITERATURE SECTION, SPRAGUE ELECTRIC CO., 233 MARSHALL ST., NORTH ADAMS, MASS.

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ROBERT E. McKENNA, Publisher • BERNARD F. OSBAHR, Editor

Polarize the Plugs!

The recent unfortunate death of 6-year old Howard Erenstein Jr. by electrocution is an incident which industry should not pass over or dismiss. The boy died when he came in contact with a metal TV cabinet and a grounded metal kitchen cabinet.

Transformerless receiver designs employing a "hot" chassis or "floating" ground bus have been used in radio for many years. In TV this design is fairly recent and has been resorted to because of the necessity to reduce manufacturing costs to keep pace with continual price-cutting merchandising tactics.

During the radio years most of the cabinets employing this design were made of wood or plastic. This actual contact with a "hot" chassis was confined largely to the cabinet mounting screws and to the control shafts (if the knobs were missing). But even in those years it was fairly common to get reports of blown fuses and of housewives getting shocked or frightened as they moved a radio onto a refrigerator, sink, or other metallic cabinet.

In TV, this situation is greatly compounded. For one thing, plastic cabinets are not too practical and wooden cabinets are too expensive. Metal cabinets are strong, cost less, and hence are more frequently employed. This in turn means that a "hot" chassis must be insulated from the metal cabinet.

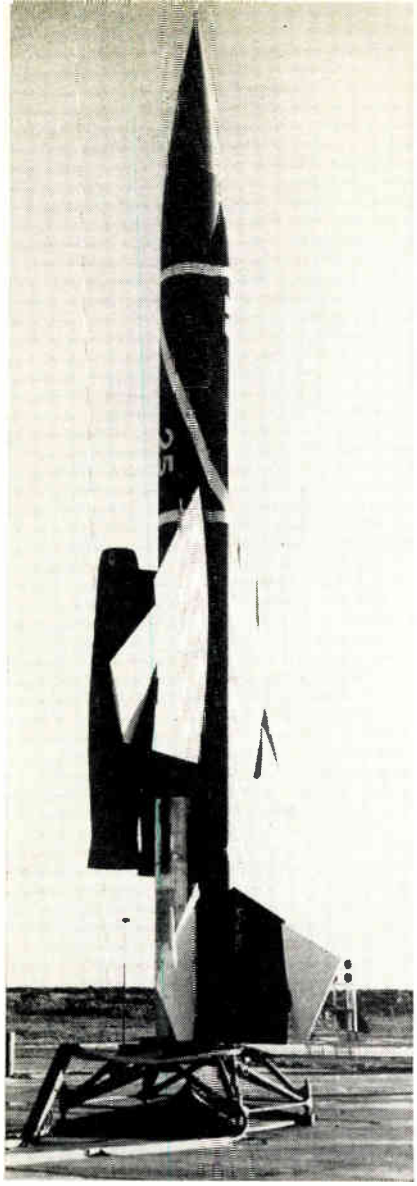
Such a design would probably be all right if operated in a fixed location where chances of grounding through body contact would be highly improbable. But with the modern sales on portability, such designs are an open invitation to disaster. This invitation is enhanced through usage (when broken knobs, cover plates etc. are not replaced) and after each service call (because the repairman becomes responsible for maintaining the insulation between chassis and cabinet).

Electronic appliances are not alone in offering this hazard to humans. Rather, every electrical appliance used in homes to-day offers similar dangers. Likewise with electrically powered tools. Nearly every home to-day boasts a few of these. Year by year we strive to expand the sales of these items and we seek to continually build more and more new homes to use them in. And so year by year the menace of more deaths by such means grows.

On the other hand, such accidental electrical shock could be minimized if all appliance plugs and all home or plant receptacles were polarized so that all exposed metal could only be at ground potential. This would be a vast safety undertaking but it could and should be done through the cooperative efforts of our engineering and trade societies (RETMA, NEMA, IRE, AIEE) in conjunction with building trades groups. Incidentally, a compatible polarized system was worked out years ago but it has never been practically enforced!

SIC's New Manual

In a June editorial we called attention to the new Standard Industrial Classification Manual issued through the Budget and raised the question as to usefulness of SIC codings in classifying the many segments of the electronic industries. This new manual is now available through the Supt. of Documents, Washington, D. C. at a cost of $2.50 per copy. The listings in Major Group 36 will be a keen disappointment to electronic producers. We repeat that we believe all manufacturers would do well to make SIC an important part of their business and take immediate steps organizing a formulating group to bring future SIC listings into truer industry focus.



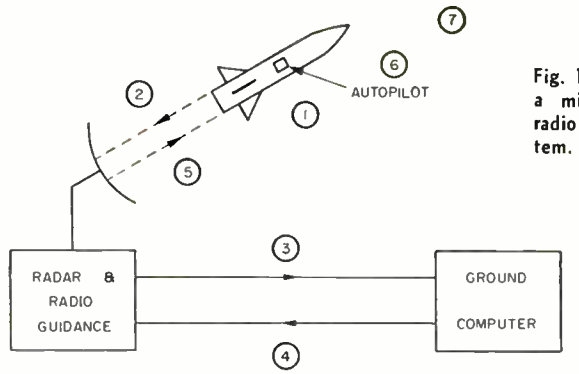


Fig. 1: Operation of a missile radar & radio guidance system.

1. AUTOPILOT HOLDS ROLL AND YAW ANGLES TO ZERO; CAUSES MISSILE TO FOLLOW PRECALCULATED PATH IN PITCH.
2. RADAR TRACKS MISSILE; MEASURES RANGE AND AZIMUTH AND ELEVATION ANGLES.
3. INFORMATION SENT TO GROUND COMPUTOR.
4. COMPUTOR CALCULATES CORRECTION SIGNALS AND SENDS THEM TO RADIO GUIDANCE
5. CORRECTION SIGNALS TRANSMITTED TO MISSILE.
6. AUTOPILOT CAUSES MISSILE TO MANUEVER TO REDUCE CORRECTION SIGNALS TO ZERO.
7. GUIDANCE ENDS WHEN MISSILE LEAVES ATMOSPHERE. MISSILE HEADING CONTROLLED BY PRECALCULATED PITCH PROGRAM UNTIL REENTRY.

Missile Control Demands

Stabilization and Guidance

To score, missile angle control about 3 axes, roll, pitch, and yaw, must be accurately maintained by the autopilot; aiming signals must be developed and introduced by the radio guidance system. A hypothetical system is designed, developed, and tested; problems encountered are fully treated.

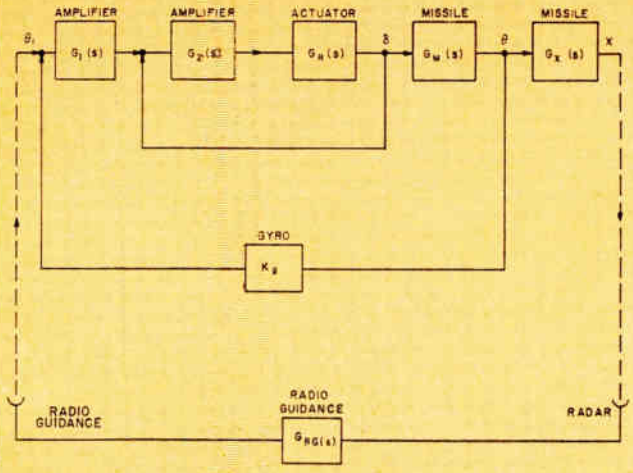


Fig. 2 (left): Block diagram of the hypothetical system considered in this article.

Fig. 3 (below): One of the 3 autopilot loops used to control pitch, yaw, and roll.

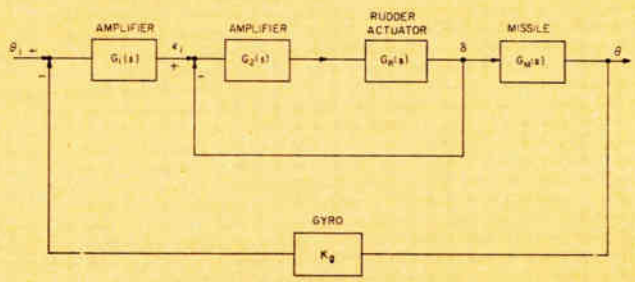
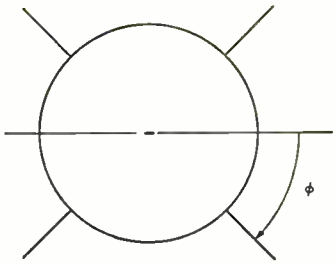


Fig. 4: Rear view of missile. Roll angle is simplest angle transfer function.



ϕ – ROLL ANGLE

δ_R – ROLL RUDDER ANGLE

I_R – ROLL MOMENT OF INERTIA

$K_{CR} = C_{MR}\, AD\, q + K_{JR}$
– ROLL TORQUE CONSTANT

$K_{DR} = C_{M_{\dot\phi}}\, AD^2\, q/V$
– ROLL DAMPING CONSTANT

$$I_R\, s^2\phi = K_{CR}\,\delta_R - K_{DR}\, s\phi$$

$$G_M(s) = \frac{\phi}{\delta_R} = \frac{K_{CR}}{(I_R s + K_{DR})}$$

SUBSTITUTE $\omega_{CR}^2 = \frac{K_{CR}}{I_R}$

AND $\omega_{DR} = \frac{K_{DR}}{I_R}$

$$G_M(s) = \frac{\omega_{CR}^2}{s(s + \omega_{DR})}$$

By GEORGE REEHL

Analytical Engr.-Attitude Control Systems
Missile and Ordnance Systems Dept.
General Electric Co.
3198 Chestnut St., Phila. 4, Pa.

Part One of Two Parts

THIS article presents an introduction to some problems involved in guided missile control system design. The discussion will be restricted primarily to the feedback system aspect, not the design of components or sub-systems. Actuators and radar systems will be considered as blocks with transfer functions.

Since missile control systems are of necessity feedback systems, the analytical techniques of servomechanism design are useful here. Many of the problems encountered are similar to other servo design work. However, there are problems in missile control systems that do not occur in other feedback systems. These special problems arise from the fact that the missile itself is a part of the feedback system. Its dynamic response must, therefore, be included in the analysis and design.

There are many different types of missiles, characteristics differ with application. One common grouping method depends on the relative location of launcher and target, e.g., surface-to-surface, surface-to-air, air-to-air, and air-to-surface missiles.

Missiles can also be classified according to the type of guidance used, which depends on range, accuracy, and specific application. Design details and special problems vary with the different types. However, most of the basic design principles and problems are essentially the same, e.g., transfer functions are of the same form regardless of missile type.

All missile control systems have 2 basic functions: one, through stabilization, to prevent the missile flying off in random directions; the other, by developing and introducing guidance signals, to cause the missile to hit its target. The missile control system can therefore be divided into 2 parts corresponding to these 2 functions. The autopilot, or angle control system, performs the first function; the guidance system performs the second.

The best way to introduce the problems of missile control system design is to discuss one hypothetical system in some detail. We shall consider a surface-to-surface missile with a relatively simple control system, complex enough, though, to illustrate a number of the basic problems. We shall provide angle control about the 3 missile axes: the roll axis, the pitch axis, and the yaw axis. The roll axis is along the longitudinal axis. The other 2 are perpendicular to the longitudinal axis; the pitch axis normally perpendicular to the trajectory plane, the yaw normally in the trajectory plane.

Hypothetical Control System

The operation of our hypothetical control system is illustrated in Fig. 1. It includes a missile-borne autopilot system and a radio guidance system. The autopilot system is designed to cause the missile to fly, on a precalculated trajectory, through the target, if all conditions are nominal. In general, the missile would not fly the nominal trajectory if controlled only by the autopilot system. Errors would be caused by variations in atmospheric conditions, tolerances on engine thrust, aerodynamic parameters, autopilot characteristics, etc. The radio guidance system measures

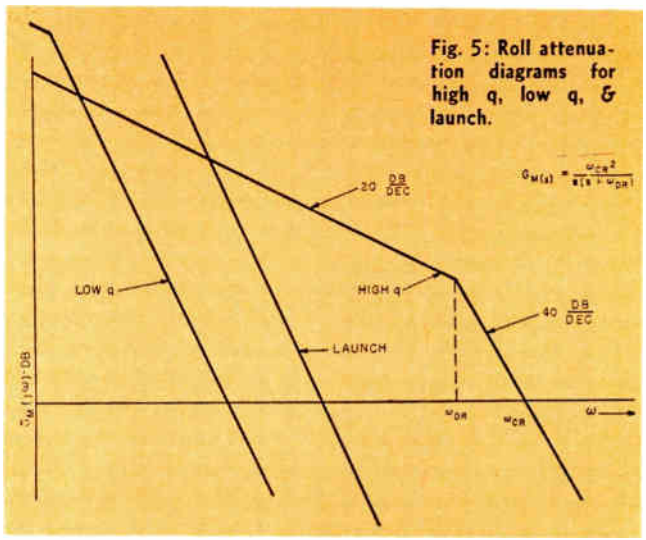


Fig. 5: Roll attenuation diagrams for high q, low q, & launch.

Missile Control *(Continued)*

these errors and transmits signals to the missile to override the pre-set autopilot program and to correct these errors.

We consider the missile has left the atmosphere when aerodynamic forces become too small for effective maneuvering. In this system, however, we will control the attitude of the missile until re-entry by means of the autopilot. This is done so the missile will re-enter the atmosphere approximately nose first, preventing it from breaking up. The aerodynamic control forces will be large enough to produce the small turning rate necessary to keep the missile approximately lined up with its velocity vector even though these forces are too small for maneuvering.

There are several ways in which control torques can be applied to a missile. Probably the most common of these is the use of air rudders turned by servo actuators. Steering forces can also be obtained by rotating the rocket engine or by turning carbon jet vanes mounted so that they deflect part of the jet stream of the rocket engine. In our system, we want to continue control after the engine is shut down. We shall therefore use air rudders for control. Small jet vanes will also be required for control shortly after launching, when aerodynamic forces are too small.

A block diagram of the system under consideration is shown in Fig. 2. This is a relatively complicated servo system. Actually, there are 3 channels, only one of which is shown in Fig. 2. This figure would represent either the pitch or yaw channel, these 2 being essentially identical. The roll channel does not include any radio guidance and thus consists only of the autopilot loop, i.e., the part between θ_i and θ. We can look at this system 1 channel at a time, since cross-coupling and interactions between channels are usually quite small.

The radio guidance loop is closed through $G_{RG}(s)$ by means of the radio signals indicated in Fig. 2 (dotted lines). The error X is measured by the radar, on the right, and correction signals are transmitted to the autopilot on the left. The transfer function $G_{RG}(s)$ represents the gain and stabilizing characteristics of the radio guidance signal. This block actually includes much complicated equipment. In general, whatever type of guidance is used, the equipment required to measure the missile's position in space and to calculate correction signals is invariably the most complex part of the missile control system.

Autopilot System

The autopilot system for stabilizing the missile is quite similar to an airplane autopilot. The 3 angle error signals are derived from 2 free gyros. These signals are applied to a 3 channel servo amplifier which controls 4 rudders. One pair of rudders is used for pitch control, the other for roll and yaw. The latter are turned in the same direction for yaw control and in opposite directions for roll. Fig. 3 shows a block diagram of one autopilot loop. The 3 autopilot loops are similar except for some transfer functions. For instance, although the missile transfer

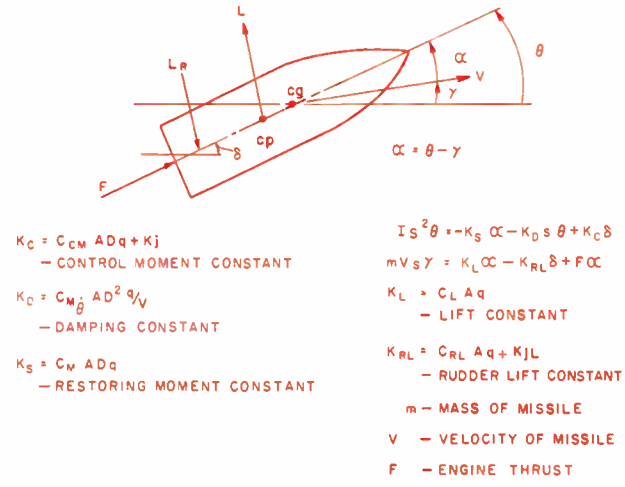


Fig. 6: The heading, path, and attack angles for the missile in horizontal flight.

function $G_M(s)$ is the same in pitch and yaw due to the symmetry of the missile, it is quite different in roll.

Fig. 3, shows one way in which the autopilot loop can be stabilized. It includes an internal rudder loop obtained by feeding back a signal proportional to the rudder angle δ. (Note that each autopilot loop actually includes 2 rudder loops. This gives a total of 4 since yaw and roll are controlled by the same 2 rudders.) The rudder loop is stabilized by $G_2(s)$. The rudder transfer function $G_R(s)$ includes the effect of aerodynamic loading which varies during flight. The effect of the closed rudder loop is to give a rudder angle δ approximately proportional to the signal ϵ_1, from the first amplifier and to make this response essentially independent of rudder loading. The autopilot loop is then stabilized by the amplifier transfer function $G_1(s)$.

Each of the 3 autopilot loops has a somewhat different input θ_i. The roll loop input is zero, since the function of the roll channel is merely to hold the roll angle to zero. The yaw loop input is the yaw (or azimuth) radio guidance error signal which will be zero, if the yaw autopilot keeps the missile in the correct azimuth plane. The pitch input signal is the sum of the pitch program signal and the pitch radio guidance error signal. The pitch program is precalculated to place the missile on the right trajectory for nominal conditions. The pitch radio guidance then corrects for errors resulting from conditions being other than nominal.

Missile Transfer Functions

To derive the missile transfer functions needed for control system design, we must make the following assumptions:

1. Aerodynamic forces are all linear functions of the angles involved. This is generally a good assumption for small angles.

2. The time variation of missile characteristics is slow compared to the response time of the control system. Thus, we can analyze the system, for a point on the trajectory with missile characteristics constant,

and cover the whole trajectory by a series of such points.

3. All cross-coupling effects between channels are negligible. This means we can analyze the system one channel at a time.

Roll Transfer Function

The simplest missile angle transfer function is for roll, shown in Fig. 4. This figure shows a rear view of the missile at a roll angle ϕ. The transfer function is obtained from the equation of moments about the longitudinal axis in terms of Laplace transform variable s. The moments are the control moment proportional to roll rudder deflection δ_R and the damping moment proportional to roll rate. K_{DR} and the first part of K_{CR} result from aerodynamic forces and are functions of the dimensionless co-efficients C_{MR} and $C_{M}\phi$, the cross sectional area A, diameter D, velocity V, and dynamic pressure q defined by

$$\rho = \frac{1}{2}\rho V^2 \qquad (1)$$

where ρ is the air density. K_{JR} is the jet vane roll torque constant. The coefficients C_{MR} and $C_{M\phi}$ are determined from calculations and wind tunnel tests and q and V are determined from trajectory calculations. The dynamic pressure may vary as much as several thousands to one during a flight. C_{MR} and $C_{M\phi}$ also vary with Mach number, but this variation is small compared to the q variation.

Examples of roll attenuation diagrams are shown in Fig. 5. Referring to the diagram for high q, we see a —20 db/dec. slope at low frequencies with a break to —40 db/dec. at frequency ω_{DR}. The cross-over frequency of the —40 db/dec. line is ω_{CR}. As q decreases at high altitudes, the attenuation diagram changes as shown by the low q diagram. During a typical flight ω_{CR} might vary from about 0.5 to 30 rad./sec. The third diagram in Fig. 5 corresponds to conditions immediately after launch when ω_{DR} is zero and ω_{CR} is due entirely to jet vane torques.

Pitch and Yaw Transfer Function

The pitch and yaw transfer functions are essentially the same and are somewhat more complicated

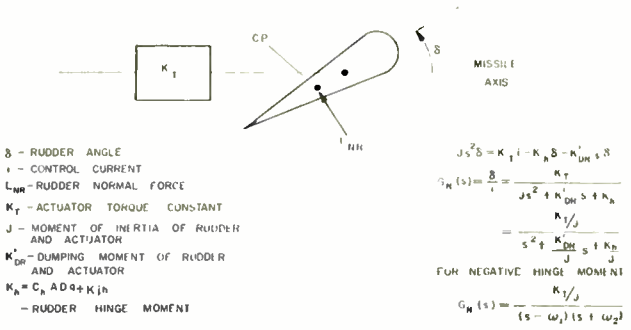


Fig. 8: Rudder actuator transfer function.

than roll. As an example, let us consider the pitch transfer function with the missile flying horizontally, Fig. 6. The 3 angles shown are the missile heading angle 0, the path angle γ, and the angle of attack α which is the difference between the other two. The transfer function is derived from the moment equation and the equation of forces perpendicular to the velocity vector.

The moments acting on the missile are the control moment proportional to the rudder deflection δ, the damping moment proportional to the missile angular rate, and the restoring moment proportional to angle of attack α. K_j is the control moment constant of the jet vanes. The restoring moment results from the fact that the center of pressure, which is the point at which the lift force can be considered to act, is not coincident with the center of gravity. Normally the c.p. is behind the c.g. which gives a statically stable missile with positive K_S. If the c.p. is ahead of the c.g., K_S is negative and the missile is aerodynamically unstable. This means it has a natural tendency to fly backwards. While it is theoretically possible to stabilize such a missile, the practical control problems are considerably more difficult. Thus missiles are usually designed to be aerodynamically stable.

The forces perpendicular to the velocity vector include the lift force proportional to angle of attack, the rudder lift force proportional to rudder deflection, and a component of the engine thrust propor-

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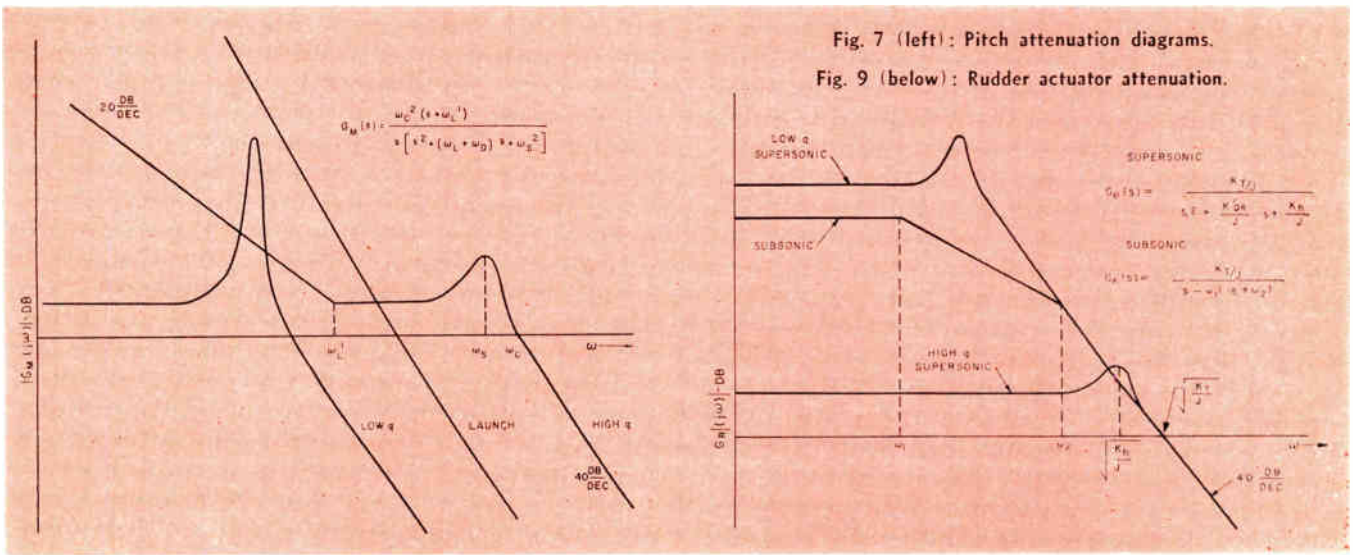
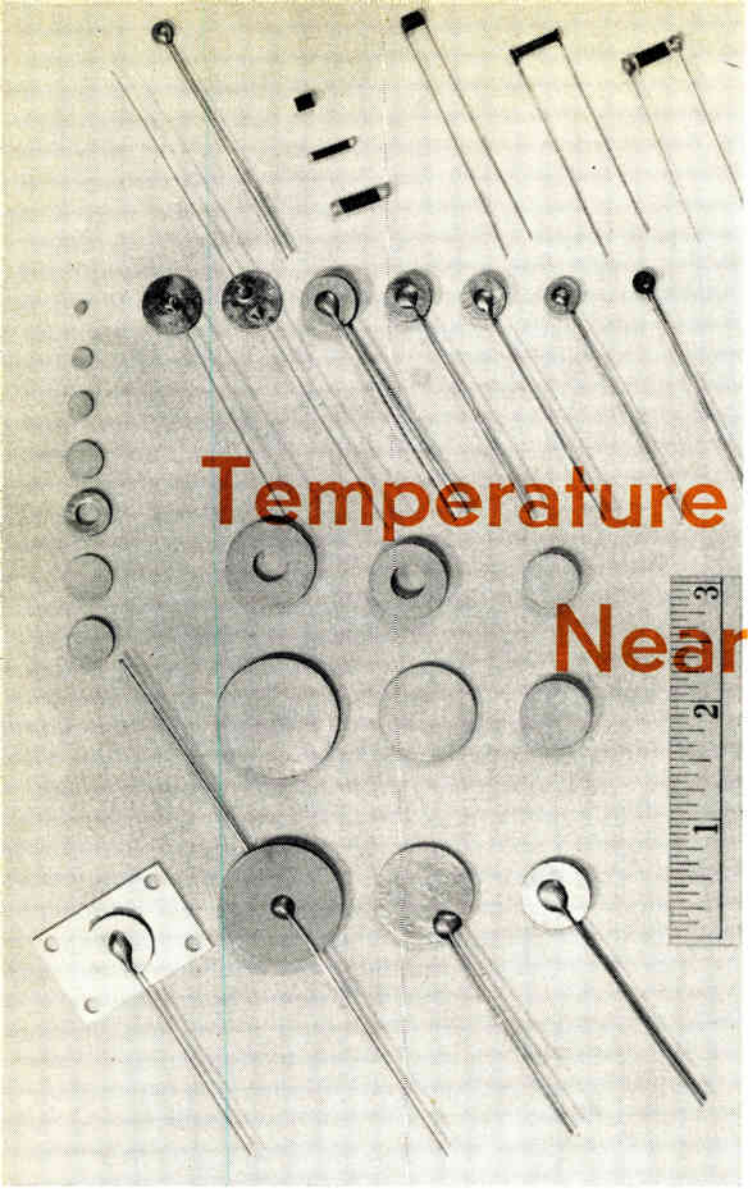


Fig. 7 (left): Pitch attenuation diagrams.
Fig. 9 (below): Rudder actuator attenuation.



Temperature Measurements Near Absolute Zero

Increased interest in near-zero temperatures has spurred research into thermometry below 4°K. The author reports progress in this range, and predicts future developments in low temperature thermometry.

Developmental elements for measuring very low temperatures.

ELECTRONIC DEVICES, till now, have always been operated at temperatures either near or somewhat above ambient. However, an alert observer in technological fields will be aware of the fact that the gates are now thrown open to a new frontier in electronics: Ultra-low temperatures. There are new materials and new devices in development which may display most desirable properties and perform miraculous tasks.

Superconductivity

The resistivity of most pure metals drops in nearly linear fashion with temperature, down to very low temperatures, with a temperature coefficient of the order 1/273.

For certain metals however, such as cadmium, tin, mercury, and lead, resistivity abruptly drops several decades at a temperature which is characteristic for each of the metals, for instance 0.6°K for cadmium, 4.2°K for tin, 4.1°K for mercury and 7.2°K for lead. By re-heating, normal resistivity reappears at exactly the same temperature, the transition temperature. This "superconductivity" has been known for about 50 years.

The residual resistance in lead below the transition temperature is so small that a magnetically induced current in a ring of lead continues to flow for several hours without appreciable dampening.

At very low temperatures it is most practical to measure temperature in degrees Kelvin from the absolute zero point (—273.15°C). This is also advisable for theoretical reasons. First of all, resistance versus temperature relations can be expressed in a simple form by using absolute temperatures. Furthermore, the relative increments of the absolute temperature reflect more distinctly the remarkable changes in physical properties such as volume, pressure, specific heat, thermal and electrical conductivity, and others. This becomes still more evident at temperatures below 1°K. Phenomenologically this small temperature range has been very much extended by the adiabatic magnetic cooling method. Our approach to the absolute zero point, at first to 1/10, later to 1/100 and finally to a few thousands of one degree has disclosed new effects in such variety that some physicists support a plan to replace the ordinary linear degree Kelvin scale below 1°K with a logarithmic scale.

In many electromagnetic devices resistance is an undesirable but inevitable property, producing uneconomical energy dissipation and losses. Thus, the discovery of superconductivity was hailed with en-

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Keystone Carbon Co., Saint Marys, Penna.

thusiasm by electrical engineers, though no immediate practical use could be made of it because of the extremely low temperatures involved. This difficulty was one of the great incentives to look for other materials with higher transition points than those observed in the classical superconductors. At first, alloys of these metals were found with higher transition points, for instance 97% lead with 3% arsenic (8.4°K) and 57% lead with 43% bismuth (8.8°K). Later, other superconducting metals were discovered with still higher transition points, for instance niobium with 9.2°K. The latter has already found practical application for an electromagnet with a superconductive field coil. A field strength of 7 Kilo-Oersted could be produced with 4300 turns of 44 gauge niobium wire (1/500 inch diameter) which could carry a current of 1.8 amps when made superconductive by cooling with liquid helium (4.2°K).

Though the incentive to find materials with much higher transition points was tremendous, progress was slow for a long time. A great step ahead was the discovery that certain compounds have substantially higher transition points than elements. A systematic study of a series of compounds as hydrides, carbides, and silicides was rather successful. At the present time, niobium hydride with 15°K and vanadium silicide with 17.2°K have the highest transition points. It is now possible to produce superconductivity in these materials by cooling with liquid hydrogen boiling under reduced pressure, while prior to this discovery, the more expensive liquid helium was necessary.

Very Low Temperatures

The operation of electronic devices at very low temperatures involves sensing elements to measure and control these temperatures. The classical and most accurate instrument for this purpose is the helium-gas thermometer. It is based on the principle that the pressure of a given volume of an ideal monoatomic is strictly a linear function of the absolute temperature in degree Kelvin. Helium approximates an ideal gas in a high degree, if used at temperatures above its boiling point.

An unknown temperature T measured with the helium-gas thermometer is defined by the equation 1:

$$T = 273.15 \times \frac{P_t}{P_{273.15}} \qquad (1)$$

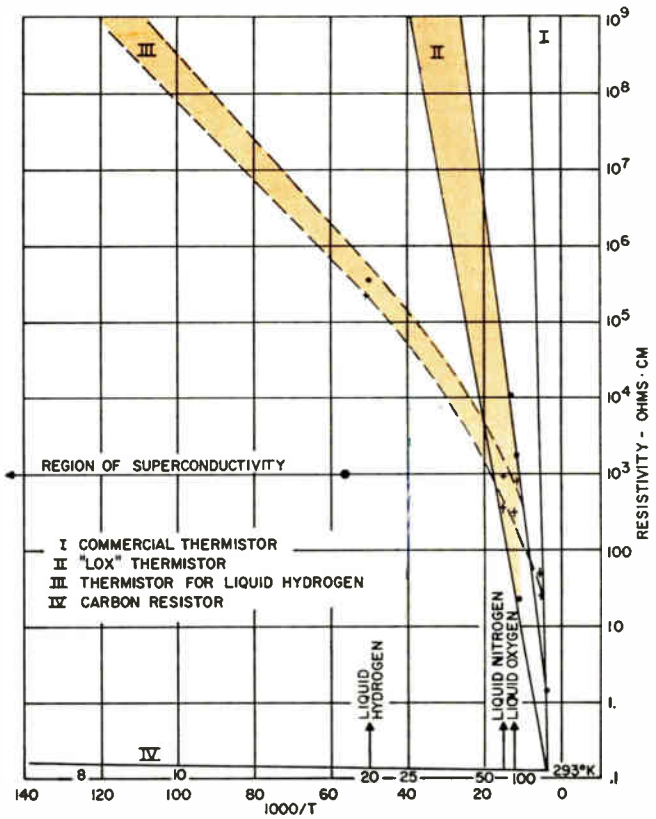
The gas thermometer has a few disadvantages. It is breakable, involves a pressure indicator and does not directly produce electrical signals. Therefore, suitable substitutes for the gas thermometer would be most welcome for electronic circuits. The disadvantages of the classical electrical devices to measure low temperatures, the resistance thermometer and the thermocouple have been discussed in a previous article.[1] In both cases, the electrical effect produced by a temperature change is so small that very sensitive meters and methods have to be applied. In that earlier article, thermistors were described which can be operated down to —200°C = 73.15°K without attaining high resistivities. The temperature coefficient of metals normally used in resistance thermometers is of the order of +0.2 to +0.4% per degree, while normal thermistors have a negative temperature coefficient which is ten times greater. Thermistors with temperature coefficients of this order reach high values of resistivity at —183.3°C (Type 1, Fig. 1). Therefore, a new type of thermistor was developed, with a temperature coefficient of —1.0 to —1.3% per degree at room temperature (Type 2, Fig. 1).

These thermistors were mainly created for applications in liquid oxygen at —183.3°C (89.85°K). For this temperature range a broad variety of resistivities from 200 to 3500 ohm centimeter has been developed. Thermistors can be made from these materials with a standard tolerance of ±10% of their resistance value at —183.3°C. Their temperature coefficient at this temperature is of the order of —18% per degree.

The exponential increase of the resistivity in

(*Continued on page* 106)

Fig. 1: Resistivity vs. reciprocal absolute temperature for various types of temperature sensitive resistors.



What's New . . .

The "Spacistor"

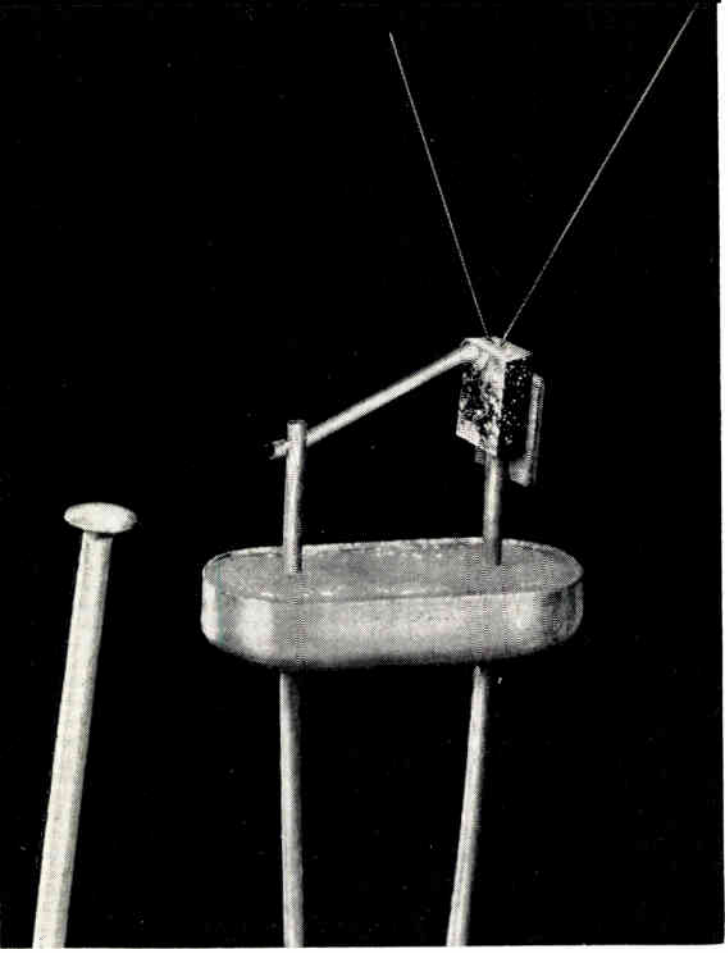


Fig. 1: This experimental "Spacistor" extends semiconductor techniques into the high impedance and high frequency range. Here, the device is compared with a pin for size.

DEVELOPMENTAL models of a new semiconductor device, the "Spacistor," have been announced by Raytheon Manufacturing Company. The new device is particularly significant because it completes semiconductor coverage of vacuum tube functions. Unlike the transistor, the Spacistor is a high impedance device potentially capable of use as a voltage amplifier. Voltage gains of 3000 have already been achieved. Theory predicts ultimate usefulness of the Spacistor may extend as high as 10,000 MC.

Basically, the new device is a reverse-biased p-n junction having two additional contacts in the space-charge region. Through one of these, an ohmic contact, electrons are injected into the space-charge region. The injection current is modulated by a second contact, an alloyed p-type region. The function of this modulator contact is analogous to the grid in a vacuum tube, both because it modulates the flow of electrons, and because it shields the injecting contact from

(*Continued on page* 140)

Flat Tape Cable

THE introduction by Tape Cable Corporation, 790 Linden Ave., Rochester, New York, of a flat, multi-conductor, ribbon-like electrical cable, "Tape Cable" has opened up new concepts in the field of electrical design.

The cable is a ribbon-like, flexible film of transparent polyester insulation in which are imbedded flat copper conductors only .0015 inch thick. The conductors are parallel and accurately positioned. The result is a cable having minimum cross sectional area, minimum interconductor capacitance, high tear strength, high flex life, and high resistance to chemical attack.

The standard conductor is .0015 inch by .030 inch, giving a high conductor density of 1160 conduc-

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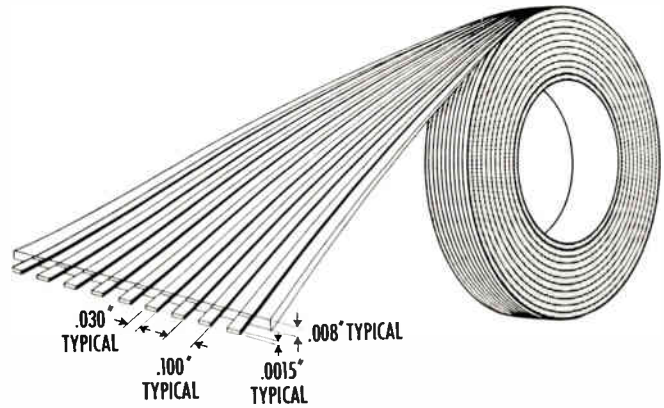


Fig. 1: Conductors in the new Tape Cable have .100-inch centers in accordance with recommended RETMA grid pattern for printed wiring. Standard Cables have 9, 14, 17, 21, 27, 30, 36, 40, or 50 conductors.

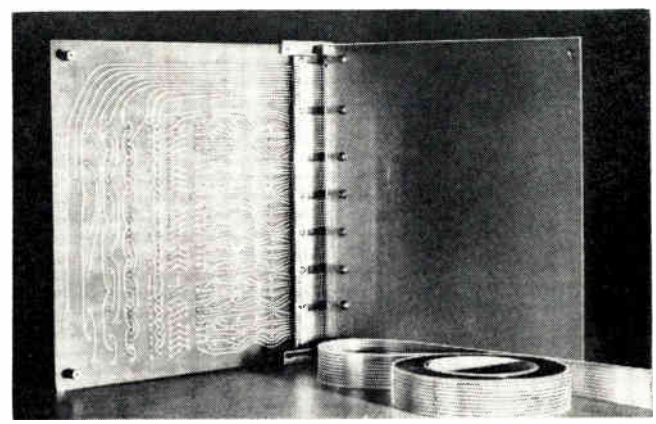
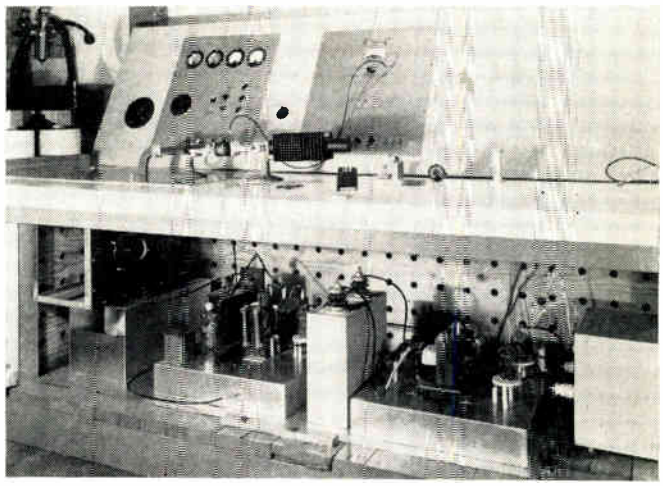


Fig. 2: Highly flexible Tape Cable interconnects chassis "leaves" in this book-type circuit made for U. S. Govt. by Stromberg-Carlson Co., a division of General Dynamics Corp.

Microwave Test Generator



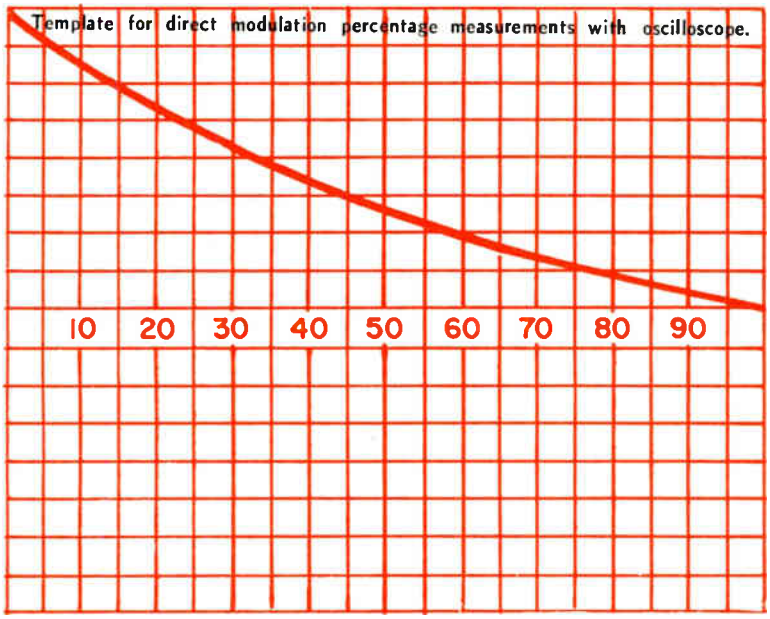
This is the new microwave test signal generator designed for testing high-power equipment at Kearfott.

Production and research in the microwave and ferrite components field has led to construction of an R-F Test Signal Generator at the High-Power Laboratory of Kearfott Co., Inc., Van Nuys, California. Among the important features of the generator are:

Frequency range (tunable)	8500 to 9600 Mc/sec.
Power output	350 KW peak power
Output connector	RG 51/u waveguide
Duty cycle	.001
P.R.F.	415 pps or 2000 pps
R-F Pulse width	2.5μ sec @ 415 pps .5μ sec @ 2000 pps

During construction, operational convenience and accessibility was of prime importance so no attempt was made toward compact construction or unit miniaturization. The Kearfott High Power Laboratory has made this set available for testing purposes to other users of microwave components, either using Kearfott personnel or their own. Details are available at the Kearfott plant in Van Nuys, Calif.

Modulation Measurement



When numerous modulation percentage measurements are made on an oscilloscope, considerable time can be saved by the use of a device that permits direct reading of modulation percentage from an oscilloscope presentation.

The percentage of modulation can be computed from the formula:

$$\% \text{ mod} = \frac{\max - \min}{\max + \min} \times 100,$$

where max and min are the maximum and minimum envelope dimensions. Rearranging the formula yields:

$$\frac{\min}{\max} = \frac{100 - m}{100 + m}$$ where m is the % modulation.

A plot of the ratio of $\frac{\min}{\max}$ as the ordinate, and % modulation as the abscissa is shown.

The graph can be plotted or transcribed on transparent material, by inking or scribing. When the resulting template is placed on

(*Continued on page* 142)

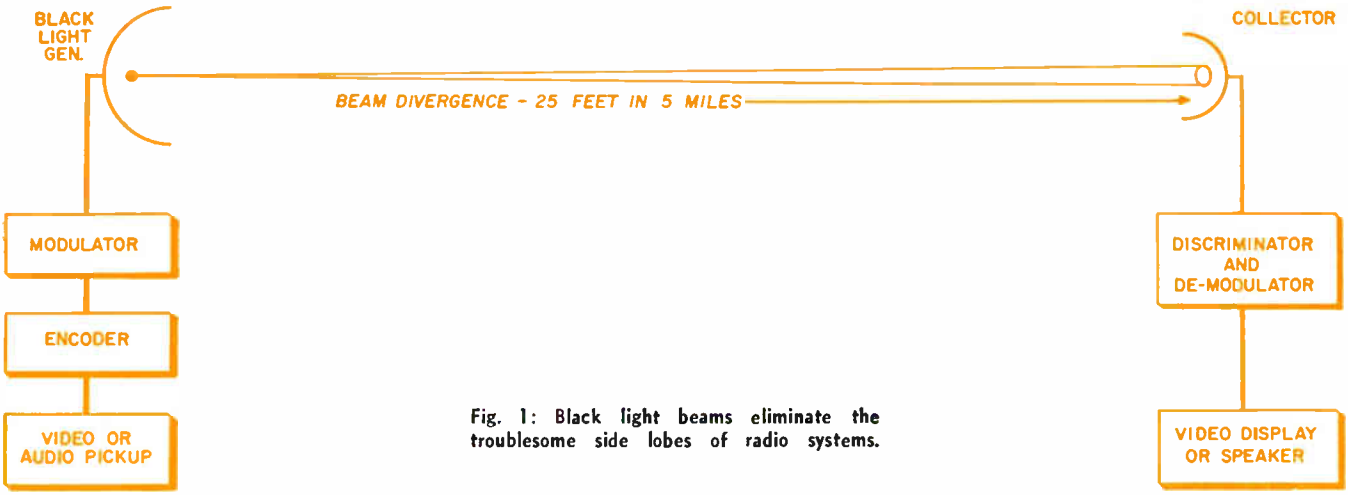


Fig. 1: Black light beams eliminate the troublesome side lobes of radio systems.

Military Uses of Black Light

The ultra-violet radiations, or "black light," offer unique advantages over infrared for communications and control. Progress has been made in narrow beam transmissions as well as restricted area broadcasts of voice, code, and video.

By J. R. ALBURGER
Shannon Luminous Materials Co., Hollywood, California

THE techniques for making individuals or armies hard to find pose many interesting problems. Naturally, you can dig the well known hole and pull it in after you, but this denies mobility, and mobility is essential to accomplishment of military purposes. Fascinating problems appear when you try to move large numbers of men and great amounts of equipment without being detected.

A natural approach to concealment is to work under cover of darkness. But this immediately raises additional problems in logistics. Perhaps the basic problem involved is one of selective communication in the broad sense which includes not only the transmittal of orders, but the ability to handle materiel, machines, and aircraft, all of which must be accomplished without outside detection.

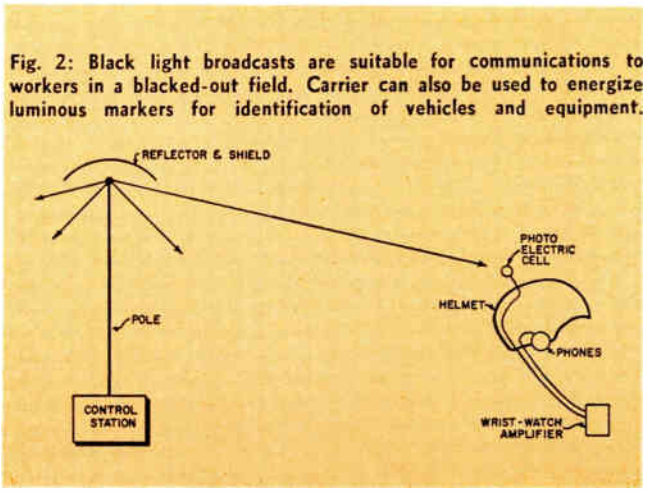


Fig. 2: Black light broadcasts are suitable for communications to workers in a blacked-out field. Carrier can also be used to energize luminous markers for identification of vehicles and equipment.

Black Light Operations

It is quite obvious that where communication and operational procedures are to be carried out under visual blackout, the wavelengths of radiation employed must be outside the visible spectrum. Radio and radar have disadvantages due to the difficulty of restricting the radiation to a well defined area. Infra-red has very interesting possibilities and was successfully employed in World War II in the well known "snooperscope." The difficulty with infra-red usage lies in the fact that such wavelengths cannot be converted directly into visible light, some sort of electronic amplifier device being required.

There is one area of radiation wavelengths which not only offers advantageous energy relationships, but lends itself to a multitude of unique control procedures. These radiations are commonly known as ultra-violet, or "black light." Black light has many potent possibilities and many problems which could stand a bit of creative thinking.

Communication By Black Light

Black light communication has an advantage over radio—it can easily be confined to a given area. A source of ultra-violet can be mounted on a pole and easily shielded so as to irradiate only an airstrip for example, or an earth moving operation, or the deck of a ship. A further useful feature of ultra-violet is that it can be converted to visible light by means of simple luminous paints, pigments, or dyes for illumination or detection.

It has been said that there is no code or security combination in communication which cannot be broken. Success in security measures lies in making the code sufficiently difficult to detect or solve that time becomes a favorable factor. Some progress work has already been made in devising systems for point-to-point communication or limited area broadcasts which afford maximum security. Such communication can of course include voice, code, or video transmission.

Black light optics have been built which can project a narrow beam with a divergence of only 25 feet in five miles, and with no side lobes such as appear in radio transmission. This in itself represents good security, but in addition, non-detectable methods of black light modulation have been developed. In particular, one system of modulation employs a technique wherein no carrier can be detected and in which the desired intelligence can be masked by non-essential frequencies. Signals appear in the black light beam as a broad array of side band frequencies which have no meaning unless properly discriminated. The probability of an unwanted listener finding the precise key to demodulation within a given time interval and in the midst of masking frequencies can be made extremely small.

The research scientist is finding it difficult to come up with achievements which haven't already been described in the comic strips or science fiction magazines. The difficulty seems to be that it is easy to think up a new idea, but very hard to transform the idea into a practical, workable product. For example, there is nothing very new or remarkable about the idea of modulating a source of ultra-violet light at voice frequencies, and picking up the radiated signals by means of a helmet-mounted photocell, a wristwatch amplifier, and a hearing aid receiver. Nothing remarkable, except that up to now there has been little serious application of engineering skills to solve the technical problems involved. The electronic engineer will immediately see endless possibilities for communication techniques involving sub-carrier systems of modulation, frequency coding and pulse-gating for security purposes, etc. Much of this is now held up by the lack of an efficient, portable black light lamp.

Aircraft Control

During World War II, the technique of landing aircraft on carriers under blackout conditions by using black light to illuminate the landing signal officer was developed with the cooperation of the Navy at Rheem Field near San Diego, and the black light landing method became standard practice on carriers.

Present day problems in black light control of aircraft are, strangely enough, brought to a focus both by the high speeds of jet aircraft, and by the slow helicopter which must be maneuvered in close quarters or in close proximity to other whirly-birds. One problem is that, because of wind and spray, landing signal officers find it impractical to use ultra-violet

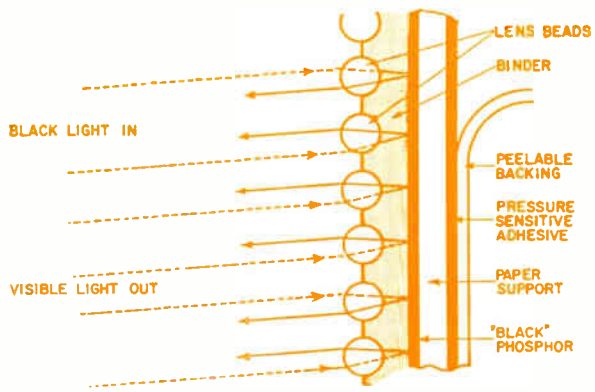


Fig. 3: A "black" phosphor, invisible in ordinary light, can be applied to the outside of packages or materials. It responds to a beam of ultra-violet light of a particular wavelength to emit visible light.

absorbing goggles, with the result that the fluid in their eyeballs fluoresces, making vision less than perfect for the critical problem of control in high speed landings. On the other hand we find problems in connection with pin-point landings of helicopters under blackout, particularly where the landings are concentrated as close as 75 feet apart. Some new techniques are needed so that close-in operations can be handled with a minimum of casualties.

We have been working, at Shannon, on methods of helicopter control and instrumentation as well as control of fixed wing air traffic, and we feel that sensing devices employing black light may well be feasible. For example, in our proposed PIRAD system (Proximity Information, Range and Disposition) we are exploring the possibilities of using invisible radiations such as black light for sensing and control functions in close proximity where conventional Radar

(*Continued on page* 134)

Fig. 1 left: Technician in foreground is making a "float" assembly while the other one inspects a completed assembly. Gyro is "floated" in a viscous fluid to absorb friction and shock.

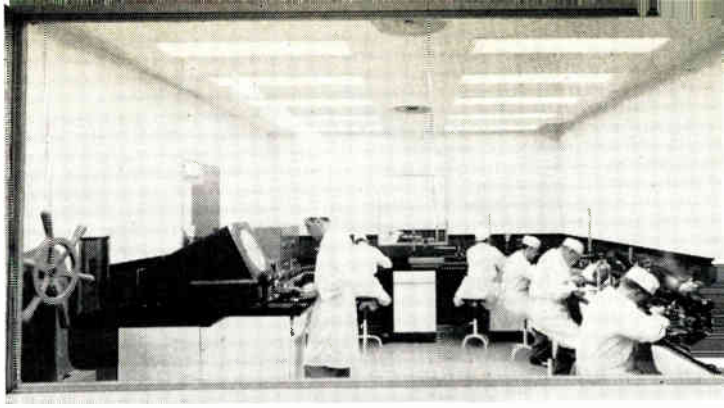


Fig. 2 right: Overall view of supercontrolled work area gives the impression of a hospital.

GYROS for Jets & Missiles

To meet the Air Force standards of accuracy, gyros must be assembled under conditions of super cleanliness in which even a dust particle .3 microns in size can not be tolerated.

GYROS are constantly growing in importance today due to their extensive use in jets and guided missiles. As with all components in the electronic field, they must be small, light weight, rugged, reliable and accurate. To fill all of these requirements special facilities and manufacturing techniques must be employed.

The major consideration in establishing the gyro facility in Reeves Instrument Corporation's new plant at Roosevelt Field, L. I., N. Y., was rigid controlling of air purity. The "supercontrolled" laboratory for prototype research and assembly has an air filtration system that "catches" particles of dust invisible to the eye which are as small as 3/10 micron.

After washing, changing clothes and shoes, technicians enter through tightly-sealed airlocks, don dust shedding orlon gowns and "dust-off" any particles picked up with gelatin pads. All waste inside the laboratory is removed through vacuum hoses built into the walls. Material entering the laboratory is electronically cleaned and passed through a revolving door type opening which turns so that its opening is in only one room at a time. Humidity and temperature are constantly monitored and recorded. Personnel work at microscopes and other

(*Continued on page* 141)

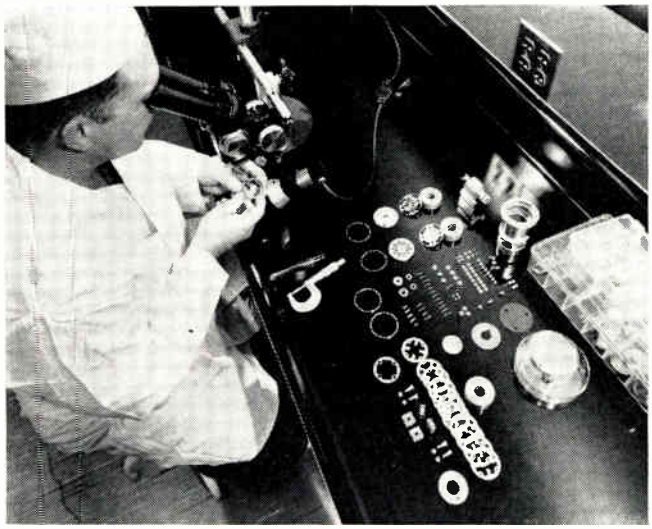


Fig. 3 right: Gyro parts undergo a microscopic examination for burrs just prior to complete assembly. Most of the gyro's mechanical parts are laid out on the counter for assembly.

Fig. 4: Operator is determining the gyro-wheel unbalance under dynamic conditions

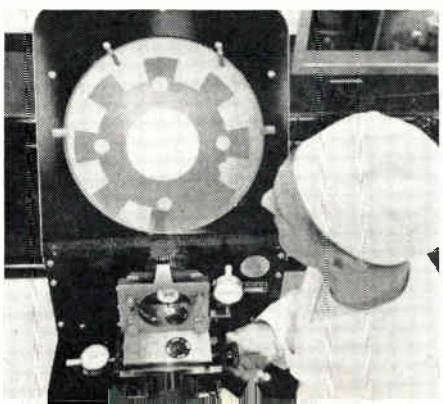


Fig. 5: Comparator is used to minutely examine the parts to insure precise accuracy

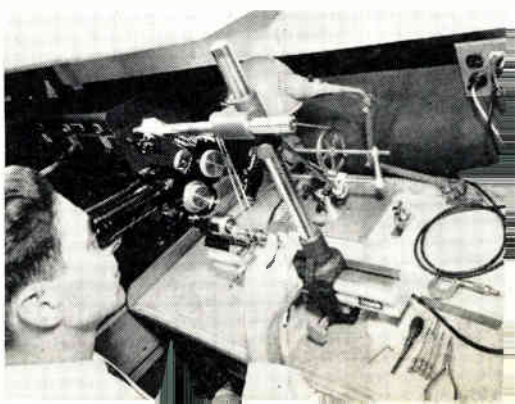


Fig. 6: Jeweler's lathe and microscope are used to grind pivots for gimbal mounting

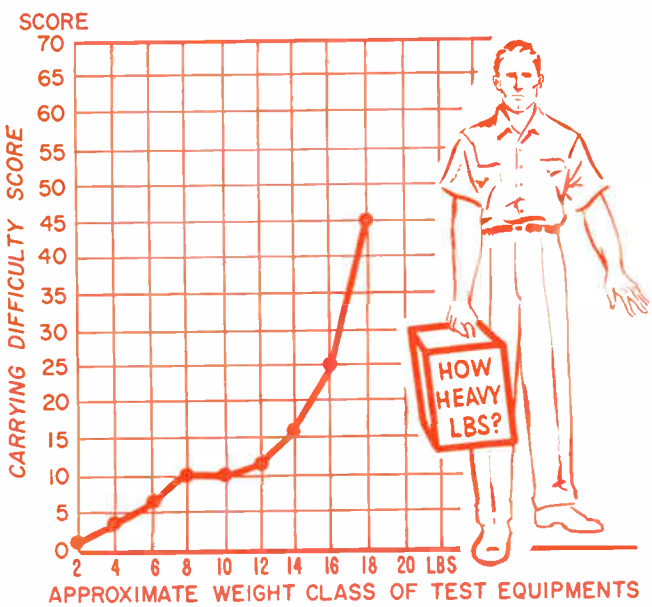
Is Portable Test Equipment Portable?

Often technicians will not carry the proper test equipment to the job simply because it is either too clumsy, or too heavy. The maximum size and weight have a very obvious relationship to the average technician's physical dimensions.

By DR. ROBERT BILINSKI,
Human Factors Div.,
U. S. Navy Electronics Laboratory,
San Diego 52, Calif.

HOW portable should test equipments be? In the past, it was usually an easy task to carry the test equipments then in use to wherever they were needed in the repair of prime electronic equipments. However, with the advent of electronic equipments of greater complexity and more exacting tolerances, test equipments have increased in size as well as number, and the ease with which they can be carried from place to place has become a problem to technicians. The military services have discovered that technicians frequently will not use certain items of test equipment simply because they are too large and bulky to carry easily.

Fig. 1: Average carrying difficulty scores for 10 weight classes.



One part of a current Navy test-equipment study being conducted by the author at the U. S. Navy Electronics Laboratory, San Diego, has to do with determining the maximum acceptable size and weight characteristics of portable test equipments. An observation of shipboard technicians hand-carrying test equipments under field conditions revealed the following indications of difficulty:

1. Test equipment bumping other objects.
2. Shifting of test equipment from one hand to the other.
3. Rest periods being taken.
4. Carrier momentarily losing his balance.
5. Test equipment rubbing or bumping against the carrier's thigh.
6. Extending the arm sideways in order to hold the equipment away from the thigh.

A record was kept of the frequency with which each of the listed difficulties occurred while carrying the test equipments over typical and randomly selected routes. In order to determine a carrying difficulty

score for each equipment, a score of *one* was recorded each time one of these difficulties occurred. The sum total of individual scores was considered the difficulty score.

Influence of Weight

An examination of Fig. 1 reveals that test equipments up to about 12 pounds in weight presented no serious carrying difficulties. Carrying difficulties increased sharply at the 14-pound level.

The question was then asked: "Is the carrying difficulty of test equipment solely a result of weight or is it influenced by *how* the weight is packaged?" For example, could such difficulty be the result of test equipment which is too long, too wide, or too high?

Influence of Width

Fig. 2 shows that test equipments with a width of 8 inches or less, presented little carrying difficulty. Difficulties increased significantly when the width was greater than 8 inches.

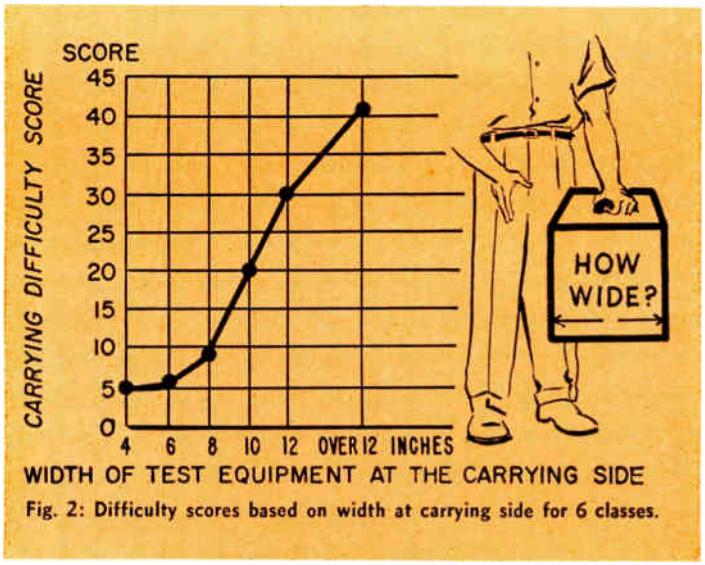


Fig. 2: Difficulty scores based on width at carrying side for 6 classes.

Influence of Height

Difficulties related to the height of test equipments are due essentially to the presence of floor obstacles over which test equipments must be carried. If test equipments are to be straight-arm carried, the bottoms of the equipments must clear floor obstacles which aboard ship are generally not over 14 inches above the floor. Proceeding as previously, a carrying difficulty score for height was determined for each test equipment. The results are presented in Fig. 3.

It is shown in Fig. 3 that test equipment under 18 inches in height presented the least amount of carrying difficulty. Carrying difficulty increased abruptly when equipment was taller than 18 inches.*

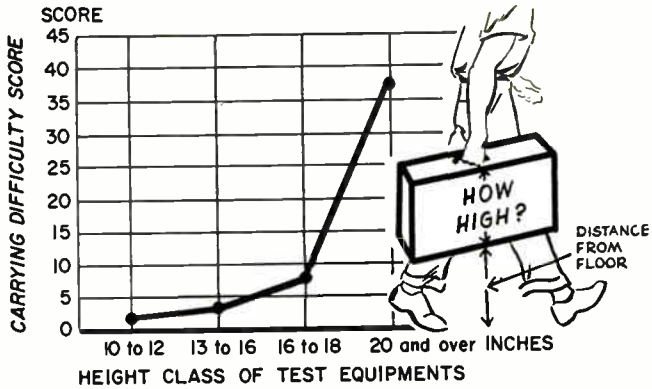


Fig. 3: Based on height of test equipment for 4 height classes.

Influence of Length

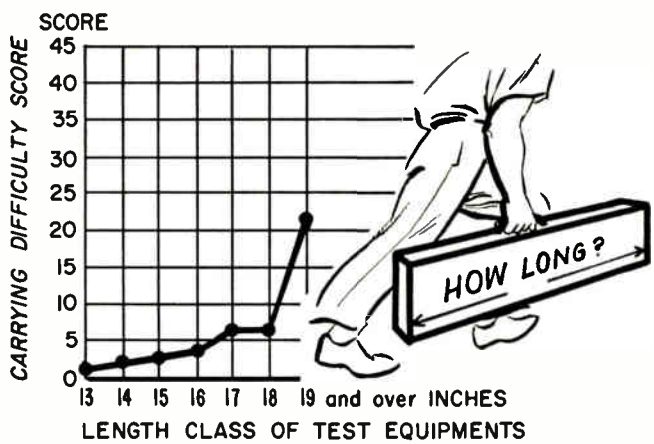
A carrying difficulty score based on the length of test equipments was determined in the same manner as for the previously mentioned factors. Results are presented in Fig. 4.

Fig. 4 indicates that test equipment with a length of 18 inches or less, presented fewer carrying difficulties than equipment of greater length. Most difficulties associated with length occurred when carriers were not able to maneuver successfully around an obstacle without striking one end of the equipment against it.

Maximum Acceptable Weight and Size Characteristics

On the basis of the data derived from the observational studies, it is believed that maximum acceptable weight should be 14 pounds, maximum acceptable size should be 8 inches wide, by 18 inches high by 18 inches long. Weight or size beyond these limits sharply increase the carrying difficulty, thus decreasing the portability of test equipments.

Fig. 4: Average carrying difficulty score based on length of the test equipment for seven classes of shipboard test equipment.



* The average man's knuckle-to-floor measurement is 28 inches, from which one inch should be subtracted for the distance from the top of the equipment to the carrying handle. Therefore, in order to clear 14-inch obstacles, it would appear that test equipment should not exceed 13 inches in height. On the other hand, the limit indicated by observations as shown in Fig. 3 was 18 inches. It is believed that of these two dimensions 13 inches should be considered the ideal limit for test equipment height. However, because of certain packaging considerations, 18 inches may be judged the practical limit.

Electronic Engineering Positions With The U. S. Government

A nation-wide round-up of the jobs available for electronic engineers, electronic technicians and physicists with the U. S. government. Locations, starting pay and potential earnings are included.

For further information contact the Regional Office of the U. S. Civil Service Comm. indicated on the map.

FIRST REGION

Agency & Location	Electronics Engineers	Electronics Technicians	Physicists
MASSACHUSETTS:			
AF Cambridge Research Center, Bedford	GS-5/14	GS-5/11	GS-5/15
U.S. Naval Shpyd, Boston	GS-5/14	GS-7/9	GS-9
Smithsonian Astrophysical Observatory, Cambridge	...	...	GS-11/15
GM Research & Dev. Command, Natick	...	GS-7	GS-7/14
Supervisor of Shipbuilding, Quincy	GS-9/11	...	...
Springfield Armory, Springfield	GS-5/12	...	GS-5/9
Watertown Arsenal, Watertown	...	...	GS-5/15
MAINE:			
Supervisor of Shipbuilding, Bath	GS-9/12	...	...
NEW HAMPSHIRE:			
U.S. Naval Shpyd, Portsmouth	GS-5/14	GS-7/9	GS-5/12
CONNECTICUT:			
Supervisor of Shipbuilding, Groton.	GS-9/12	...	...
U.S. Naval Underwater Sound Lab., New London	GS-5/14	GS-7/9	GS-5/15
RHODE ISLAND:			
U.S. Naval Underwater Ord. Sta., Newport	GS-5/14	GS-7/9	GS-5/14
U.S. Naval Air Sta., Quonset Point	GS-9/12	...	GS-9

SECOND REGION

Agency & Location	Electronics Engineers	Electronics Technicians	Physicists
NEW JERSEY:			
Naval Air Sta., Lakehurst	GS-7/15	GS-5/9	GS-9/11
Picatinny Arsenal, Dover	GS-7/15	GS-5/9	GS-5/15
Raritan Arsenal, Metuchen	GS-7/15	...	...
Ft. Monmouth	GS-7/15	GS-5/11	GS-5/15
Naval Air Turbine Test Sta., Trenton	...	GS-7/9	GS-5/7
Naval Air Rocket Test Sta., Dover.	...	GS-7/9	...
NEW YORK:			
Naval Shipyard, Bklyn.	GS-7/15	GS-5/9	GS-5/15
Naval Trg. Center, Pt. Washington	GS-7/15	GS-5/9	GS-9/13
Ft. Jay, Governors Island	GS-9/15	GS-7/11	...
Griffis AFB, Rome	GS-7/15	GS-5/11	GS-5/15
CAA, Jamaica	GS-7/15	GS-5/12	...
Watervliet Arsenal, Watervliet	...	...	GS-5/15

THIRD REGION

Agency & Location	Electronics Engineers	Electronics Technicians	Physicists
DELAWARE:			
Dover AFB, Dover	GS-5/12	...	...
New Castle Co., AFB, Wilmington.	GS-5/12	...	...
MARYLAND:			
Aberdeen Prvg. Ground	GS-5/15	GS-5/11	GS-5/15
Army Chemical Center, Edgewood	GS-5/15	...	GS-5/12
Ft. Detrick, Frederick	GS-5/15	...	GS-5/15
Naval Eng. Experiment Sta., Annapolis	GS-5/13	...	GS-7/12
Ft. George Meade	GS-5/12	GS-5/11	...
Naval Air Sta., Patuxent River	GS-5/11	...	...
Naval Powder Factory, Indian Head	GS-5/15	...	GS-5/14
Air Research & Dev. Command, Baltimore	GS-5/15	...	GS-5/15
PENNSYLVANIA:			
Naval Air Development Center, Johnsville	GS-5/15	GS-5/9	GS-5/15
Frankford Arsenal, Phila.	GS-5/15	...	GS-5/15
U. S. Naval Shpyd., Phila.	GS-5/15	GS-7/11	GS-5/15
Army Signal Supply Agency, Phila.	GS-9/11	...	...
Air Materiel Area, Middletown	GS-5/13	...	...
Bureau of Mines, Pittsburgh	...	...	GS-5/15
Supervisory Insp. of Naval Materiel, Upper Darby	GS-5/12	...	...
Signal Depot, Tobyhanna	GS-5/12	GS-5/11	...

Agency & Location	Electronics Engineers	Electronics Technicians	Physicists
VIRGINIA:			
NACA, Hampton	GS-5/14	GS-7/11	GS-11/15
Langley AFB, Hampton	GS-9/11	...	...
Naval Air Sta., Chincoteague	GS-7/11	GS-7/9	GS-11/12
Fifth Naval Dist., Norfolk	GS-7/11	GS-5/11	...
Naval Air Sta., Norfolk	GS-7/13	GS-9/11	...
U. S. Naval Shpyd., Portsmouth	GS-9/15	GS-7/11	GS-5
Supervisor of Shipbuilding, Newport News	GS-9/12	...	...

FIFTH REGION

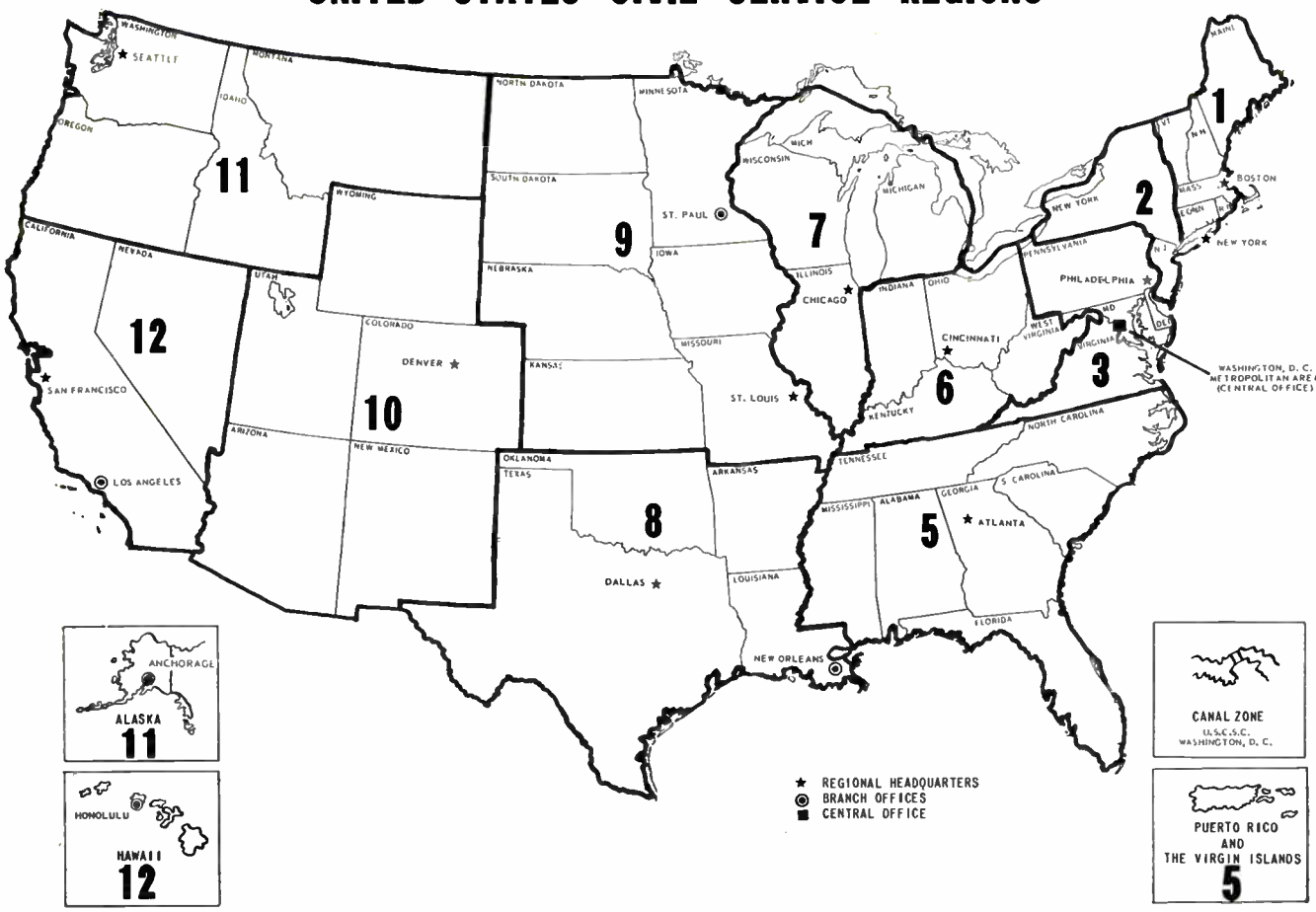
Agency & Location	Electronics Engineers	Electronics Technicians	Physicists
ALABAMA:			
Redstone Arsenal, Huntsville	GS-5/15	...	GS-5/14
Brookley AFB, Mobile	GS-5/14	...	...
FLORIDA:			
Eglin, AFB	GS-5/15	...	GS-5/14
Patrick, AFB	GS-5/15	...	GS- 14
U. S. Naval Air Sta., Jacksonville	GS-5/13	...	...
U. S. Naval Sta., Key West	GS-5/13	...	...
U. S. Underwater Sound Ref. Lab., Orlando	...	...	GS-5/12
U. S. Mine Defense Lab., Panama City	...	...	GS-5/17
U. S. Naval Air Sta., Pensacola	GS-5/13	...	GS-5/12
International Airport, West Palm Beach	GS-5/12	...	...
GEORGIA:			
U. S. Naval Ordnance Plant, Macon	GS-5/13	...	...
Robins, AFB	GS-5/14	...	GS-5/12
MISSISSIPPI:			
U. S. Engineers, Vicksburg	...	...	GS-5/11
NORTH CAROLINA:			
Marine Corps Air Sta., Cherry Pt.	GS-5/12	...	...
Fort Bragg	GS-5/12	...	...
SOUTH CAROLINA:			
U. S. Naval Shpyd., Charleston	GS-5/14	GS-7/9	GS-5/11
Donaldson AFB, Greenville	...	...	GS-5/9
TENNESSEE:			
U. S. Engineers Dist., Nashville	GS-5/13	...	...

SIXTH REGION

Agency & Location	Electronics Engineers	Electronics Technicians	Physicists
OHIO:			
NACA, Cleveland	GS-5/18	...	GS-5/18
Air Development Center, Wright-Patterson AFB	GS-5/15	GS-5/11	GS-5/15
Gentile AFB, Dayton	GS-14	GS-5/10	GS-9/13
Air Materiel Command, Wright-Patterson AFB	GS-5/13	GS-5/12	GS-14
U. S. Engineers, Cinn.	GS-5/11	...	...
Robt. A. Taft Sanitary Eng. Center, Cinn.	...	...	GS-9/12
Air Technical Intelligence Center, Wright-Patterson AFB	GS-9/13	...	GS-14/15
INDIANA:			
U. S. Naval Avionics Facility, Indianapolis	GS-5/12	GS-5/9	GS-5/12
CAA, Indianapolis	GS-5/15	...	...
Jefferson Proving Ground, Madison	GS-11	...	...
Naval Ammunition Depot, Crane	GS-9/11	...	...
KENTUCKY:			
Signal Depot, Lexington	GS-5/11	GS-5/11	GS-5/11
U. S. Engineers, Louisville	GS-12	...	...
Fort Knox	...	...	GS-5/15
U. S. Public Health Service, Lexington	...	...	GS-11
Naval Ordnance Plant, Louisville	...	...	GS-9

(*Continued on page* 68)

UNITED STATES CIVIL SERVICE REGIONS



SEVENTH REGION

Agency & Location	Electronics Engineers	Electronics Technicians	Physicists
ILLINOIS:			
Hdqtrs., 5th Army, Chgo.	GS-5/13	GS-5/11	GS-5/14
Naval Ord., Plant, Forest Park	GS-5/13	...	...
9th Naval Dist., Great Lakes	GS-5/13	GS-5/11	...
Electronics Supply Off., Great Lakes	GS-5/13	GS-5/11	...
U. S. Engineers, Wilmette	...	...	GS-5/14
Ft. Sheridan, Chgo.	GS-5/13	...	...
Signal Corps Supply Agency, Chgo.	GS-5/13	...	...
QM, Dept. Army, Chgo.	...	...	GS-5/14
Rock Island Arsenal, Rock Island	...	...	GS-5/14
Signal Depot, Decatur	GS-5/13	GS-5/11	...
Bureau of Standards, Havana	GS-5/13	GS-5/11	...
WISCONSIN:			
Forest Products Lab. Madison	GS-5/13	...	GS-5/14
MICHIGAN:			
Army Ballistics Missile Agency, Detroit	GS-5/13	...	GS-5/14
Detroit Arsenal, Centerline	GS-5/13	GS-5/11	GS-5/14
U. S. Engineers, Detroit	...	GS-5/11	...
Ft. Wayne, Detroit	...	GS-5/11	...
Fed. Civil Defense Adm., Battle Creek	GS-5/13	GS-5/11	GS-5/14

EIGHTH REGION

TEXAS:			
U. S. Naval Air Station, Corpus Christi	GS-5/9	...	...
Ft. Bliss, El Paso	GS-11	...	...
CAA, Region 2, Ft. Worth	GS-5/11	GS-5/11	
Weather Bureau, Ft. Worth	...	GS-5/9	...
Kelly AFB, San Antonio	GS-5/13	GS-7/11	GS-5/7
AF Security Service, San Antonio	GS-5/12	GS-7/9	...
School of Aviation Medicine	...	...	GS-11/12
Hqs., 4th Army, San Antonio	...	GS-11	...
OKLAHOMA:			
Tinker AFB, Okla. City	GS-5/13	GS-7/11	GS-9
CAA Aero Center, Okla. City	GS-5/12	GS-7/11	...
Bureau of Mines, Bartlesville	...	...	GS-7/11
Ft. Sill	GS-11	...	...
ARKANSAS:			
Pine Bluff Arsenal	...	...	GS-5/9
LOUISIANA:			
Southern Regional Research Lab., USDA, New Orleans	...	...	GS-5/12
U. S. Naval Station, News Orleans	GS-9	...	...

NINTH REGION

MISSOURI:			
CAA, Kansas City	GS-5/15	GS-5/12	...
2nd Coast Guard Dist., St. Louis	GS-9	...	...
U. S. Engineers, St. Louis	...	GS-9	...
Bureau of Mines, Rolla	...	...	GS-5/12
NEBRASKA:			
Offutt AFB, Omaha	GS-13	...	...
MINNESOTA:			
Bureau of Mines, Minneapolis	...	...	GS-5/12

TENTH REGION

NEW MEXICO:			
White Sands Prvg. Ground, Las Cruces	GS-5/15	GS-5/12	GS-5/15
Holloman Air Dev. Center, Alamogordo	GS-5/15	GS-5/12	GS-5/15
Kirtland AFB, Albuquerque	GS-5/15	GS-5/12	GS-5/15
COLORADO:			
Bureau of Standards, Boulder	GS-5/15	...	GS-5/15
UTAH:			
Proving Ground, Dugway	GS-5/13	...	GS-9
Hill AFB, Ogden	GS-7/9	...	...
ARIZONA:			
Army Electronic Prvg. Ground, Ft. Huachuca	GS-5/15	GS-5/12	GS-5/11

ELEVENTH REGION

WASHINGTON:			
Puget Sound Naval Shipyard, Bremerton	GS-5/14	...	GS-5/14
Alaska Comm. System, Seattle	GS-5/14	GS-7/12	...
Asst. Industrial Mgr., Navy, Seattle	GS-9/12	GS-9	...
Naval Torpedo Sta., Keyport	GS-5/12	...	...
Naval Ordnance Depot, Bangor	GS-5/11	...	...
13th Naval Dist., Seattle	GS-11/12	...	...

Agency & Location	Electronics Engineers	Electronics Technicians	Physicists
U. S. Coast Guard, Seattle	GS-9/11	...	...
CAA, Seattle	GS-7/14	GS-7/12	...
Fish & Wildlife Service, Seattle	...	...	GS-7/11
Atomic Energy Commission, Richland	?	...	?
OREGON:			
Bureau of Mines, Albany	...	...	GS-5/12
Bonneville Power Admin., Portland	GS-5/13	...	GS-9/12
Fish & Wildlife Service, Portland	...	...	GS-7/11
Asst. Industrial Mgr., Navy, Astoria	GS-9/12	GS-9	...
ALASKA:			
Alaska Comm. System, Anchorage	GS-5/14	GS-7/12	...
CAA, Anchorage	GS-7/14	GS-7/12	...
17th Naval Dist., Kodiak	GS-9/12	...	...

TWELFTH REGION

CALIFORNIA:			
Army Terminal Center, S. F.	GS-11	...	...
Presidio of San Fran.	GS-9/13	...	...
Reg. Research Lab., Agric., Albany	GS-9	...	GS-5/12
McClellan AFB	GS-5/13	GS-7/9	...
U. S. Naval Shpyd., S. F.	GS-5/13	GS-7/11	...
U. S. Naval Shpyd., Mare Island	GS-5/14	GS-9/11	GS-7/12
Navy Radiation Def. Lab., San Fran.	GS-7/12	GS-7/9	GS-5/14
Navy Ammunition Depot, Port Chicago	GS-11/12	GS-9	...
Naval Air Sta., Alameda	GS-9/13	GS-7/9	...

TWELFTH REGION

Asst. Industrial Mgr., Navy, San Fran.	GS-9/12	GS-7/9	...
Coast Guard, San Fran.	GS-11	...	...
NACA, Moffett Field	GS-5/15	GS-5/11	GS-5/15
Bureau of Reclamation, Sacramento	GS-12	...	...
CAA, San Fran.	GS-11/12	GS-5/9	...
FCC, San Fran.	GS-5/13	GS-5/7	...
Signal Depot, Sacramento	GS-5/11	GS-7/11	...
Fort Ord	...	GS-7	...
Forest Service: **See Page 3			
San Francisco	...	GS-7/12	...
Bishop	...	GS-5	...
Placerville	...	GS-6	...
Nevada City	...	GS-7	...
Quincy	...	GS-7	...
Alturas	...	GS-6	...
Porterville	...	GS-6	...
Yreka	...	GS-5/7	...
Fresno	...	GS-6	...
Eureka	...	GS-6	...
Sonora	...	GS-6	...
Forest & Range Exp. Sta., Berkeley	...	...	GS-7/13
Navy Deg. Sta., S. F.	...	...	GS-9
Bureau of Standards, Arcata	...	...	GS-5/12
Edwards AFB	GS-5/13	GS-9/12	GS-5/14
Western Div., ARDC, Inglewood	GS-12	...	...
Lookout Mountain Lab., L. A.	GS-13	GS-7/10	...
March AFB, Riverside	GS-11	...	...
Norton AFB, San Bernardino	GS-5/13	GS-5/11	...
Ballistic Missile Ofc., Inglewood	GS-12	...	...
Parachute Test Dev., El Centro	GS-11	GS-9	GS-13
U. S. Engineers, L. A.	GS-12	...	...
L. A. Ordnance Dist., Pasadena	...	...	GS-14
Naval Insp. of Ordnance, Pomona	GS-12	GS-8/10	...
U. S. Naval Shpyd., Long Beach	GS-9/13	GS-9/11	...
Naval Amm. Depot, Seal Beach	GS-11/12	GS-7/12	...
CAA, Los Angeles	GS-5/13	GS-6/12	...
Marine Corps Supply Center, Barstow	GS-12	...	...
Naval Air Sta., North Island, San Diego	GS-7/13	GS-9	...
Naval Repair Facility, San Diego	GS-9/13	GS-7/9	...
Naval Ord. Test Sta., China Lake	GS-5/15	GS-7/12	GS-5/15
Naval Ordnance, Pasadena	GS-5/15	GS-7/12	GS-5/15
Naval Air Missile Test Center, Point Mugu	GS-5/15	GS-7/12	GS-5/15
Navy Electronics Lab., San Diego	GS-5/15	GS-7/12	GS-5/15
Naval Ordnance Lab., Corona	GS-5/15	GS-7/12	GS-5/15
Naval Civ. Eng. Research Lab., Port Hueneme	GS-5/15	...	...
Dist. Public Works Ofc., San Diego	GS-9/10	...	...
NACA, Edwards	GS-5/12	...	...
NEVADA:			
Naval Ammunition Depot, Hawthorne	GS-11	...	...
Bureau of Mines, Boulder City	...	...	GS-5/12
Bureau of Mines, Reno	...	...	GS-7
HONOLULU, HAWAII:			
Naval Ammunition Depot	GS-9/12	...	...
Pearl Harbor Naval Shpyd.	GS-5/14	...	...
Dist. Public Works	GS-9/12	...	...
U. S. Information Agency	...	GS-10/11	...
Federal Communications Comm.	GS-9/13	...	...
Coast & Geodetic Survey	GS-9/11	...	...
U. S. Army Pacific	GS-9/12	GS-6/8	...
Weather Bureau	...	GS-7/11	...
Hickam AFB	GS-11	...	...
CAA	GS-7/13	GS-6/11	...
Coast Guard	GS-9/12	...	...

Explanation of Pay Grades

Because Federal white-collar salaries have been increased since the accompanying material was prepared, the following salary scale should be used to convert salaries mentioned. The entrance salaries given apply to most positions. However, the Civil Service Commission has authorized higher starting salaries for certain kinds of jobs because of the shortage of personnel in some fields. Examples are engineers, physicists, chemists, electronic scientists, metallurgists, astronomers, mathematicians, architects, and certain technologists, who are hired at $4,480 in grade GS-5, $5,335 in GS-7, $6,115 in GS-9, and $7,035 in GS-11. Also, starting pay in various aeronautical engineering specialties is at the maximum salary of the grade. Current entrance salaries are shown on job announcements, which can be obtained from Civil Service Commission offices and many post offices.

GENERAL SCHEDULE (GS)

Grade	Entrance Salary	Periodic Increase	Maximum Salary
1	$2,690	$85	$3,200
2	2,960	85	3,470
3	3,175	85	3,685
4	3,415	85	3,925
5	3,670	135	4,480
6	4,080	135	4,890
7	4,525	135	5,335
8	4,970	135	5,780
9	5,440	135	6,250
10	5,915	135	6,725
11	6,390	215	7,465
12	7,570	215	8,645
13	8,990	215	10,065
14	10,320	215	11,395
15	11,610	270	12,690
16	12,900	215	13,760
17	13,975	215	14,835
18	16,000	...	16,000

New Lightning Laboratory

A COMPLETELY equipped laboratory with facilities for producing, measuring and recording simulated lightning strikes has been opened by Dale Products of Columbus, Nebraska. One of the few commercially available lightning and transient voltage research facilities in existence, the unit was originated to test lightning arrestors for aircraft. The equipment now assembled can simulate lightning strikes on many types of electrical and electronic apparatus such as electrical transmission units, aircraft antenna arrestors, etc. The facilities allow conducting stroke current and capacitor explosion tests in accordance with MIL-A-9094B (ASG) and MIL-M-25160 (USAF).

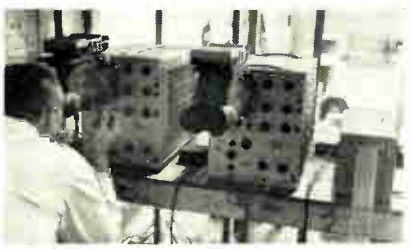
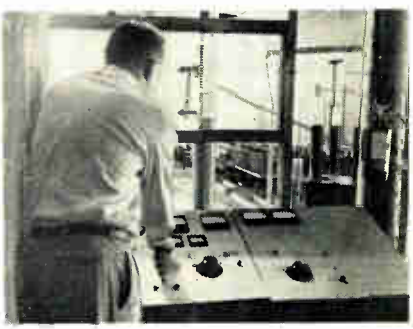


Fig. 1: Instrumentation includes Tektronix oscilloscopes and Dumont recording cameras.

Lightning Lab circuits include:

(*Continued on page* 142)

Fig. 2: Surge currents to 200 coulombs are obtained from a bank of storage cells.



New Tech Data for Engineers

Dynamotor

Induction Motors Corp., 570 Main St., Westbury, L. I., N. Y., has just issued data sheets on a dynamotor for use in guided missiles. Sheets present engineering drawing of typical unit in the series and includes a performance curve on efficiency vs. output.

Circle 161 on Inquiry Card, page 101

Digital Voltmeter

Non-Linear Systems, Inc., Del Mar, Calif., announces the availability of a new 28-page booklet which describes the company's full line of digital voltmeters, digital ohmmeters, AC-DC converters, and complete data logging systems. The book is complete with illustrated charts, diagrams, and photographs.

Circle 162 on Inquiry Card, page 101

Stepdown Transformers

A new stepdown transformer catalog listing stock sizes with specifications and dimensions has been issued by Acme Electric Corp., Cuba, N. Y. This 2-color full-page booklet contains photographs and suggested uses.

Circle 163 on Inquiry Card, page 101

Ballast Tubes

A 2-color brochure gives complete information on ballast-regulating tubes. Brochure is complete with photographs, tables, graphs, charts and some circuitry. Amperite Co., Inc., 561 Broadway, New York 12, N. Y.

Circle 164 on Inquiry Card, page 101

Electronics Components

The Radio Corporation of America, Components Div., Camden, N. J., has just issued a new 22-page brochure, titled "RCA Electronics Components," covering their complete line of electronic components and test equipment sold through distributors. Volume includes more than 115 photographs and illustrations.

Circle 165 on Inquiry Card, page 101

Electronic Equipment

The Industrial Test Equipment Co., 55 E. 11th St., New York 3, N. Y., has recently made available a short form catalog of their precision electronic equipment. This brochure includes, in a concise form, descriptions, specifications and photographs of various instruments.

Circle 166 on Inquiry Card, page 101

Ceramic Magnets

The Indiana Steel Products Co., Valparaiso, Ind., has issued a 12-page booklet which describes the application of permanent magnets to motor design and is complete with photographs, tables, charts and graphs.

Circle 167 on Inquiry Card, page 101

All-Purpose Computer

A 16-page, 2-color booklet has been issued by the Bendix Computer, Div. of Bendix Aviation Corp., 5630 Arbor Vitae St., Los Angeles 45, Calif., describing in great detail their G-15 all-purpose computer system.

Circle 168 on Inquiry Card, page 101

Tube Test

"A Positive Grid Voltage-Space Current Division Test for Power Vacuum Tubes" is the name of a 16-page 2-color booklet issued by Eitel-McCullough, Inc., San Bruno, Calif. Complete with photographs, tables, graphs and other data, booklet describes the existing test techniques for power vacuum tubes and the limitations of the positive grid voltage-space current region. Related mechanical tube variations and dynamic circuit effects for one tube type are illustrated.

Circle 169 on Inquiry Card, page 101

Miniature Meters

International Instruments Inc., New Haven, Conn. have issued a 44-page booklet describing their line of miniature side indicators, panel meters, rotary switches, lever switches, and ruggedized meters. Booklet contains complete photographs, line drawings, specifications and tables.

Circle 170 on Inquiry Card, page 101

Audio Consoles

A 14-page booklet has been issued by the Collins Radio Co., 315 2nd Ave., S. E., Cedar Rapids, Iowa, which describes their complete line of audio consoles and accessories. Booklet is complete with photographs, specifications and block diagrams.

Circle 171 on Inquiry Card, page 101

Pulse Generators

Rutherford Electronics Co., 8944 Lindblade St., Culver City, Calif., has just issued a 2-color brochure describing their complete line of pulse generators and time delay generators. Photographs and complete specifications are included.

Circle 172 on Inquiry Card, page 101

Semiconductor Products

A 22-page booklet titled "RCA Transistors and Semiconductor Diodes" contains transistor theory, technical data on their line of transistors and semiconductor diodes, the circuit section illustrating some of the more important applications of these devices, and an interchangeability directory which list more than 500 types produced by 27 manufacturers. RCA, Semiconductor Div., Somerville, N. J.

Circle 173 on Inquiry Card, page 101

Thyratrons-Rectifiers

A fully illustrated 12-page catalog on thyratrons and rectifiers tubes has just been published by Continental Electric Co.-Taylor Tubes, Inc., 6 N. Michigan Ave., Chicago 2, Ill. Included are charts, schematics, cross-reference replacement data and descriptive matter on the Cetron-Taylor product line.

Circle 174 on Inquiry Card, page 101

Transistor Applications

A 2-color brochure has been issued by Texas Instruments, Incorporated, P. O. Box 312, Dallas, Tex., describing in tabular form the various transistors manufactured by them. Contain photographs, tables and complete electrical and physical specifications.

Circle 175 on Inquiry Card, page 101

Choppers

A 2-color bulletin describes the effect of drive and temperature on performance of choppers. The technical discussion on choppers is complete with multicolored charts. Airpax Products Co., Middle River, Baltimore 20, Md.

Circle 176 on Inquiry Card, page 101

Electronic Instruments

A new bulletin describing and illustrating their new line of small size self-balancing electronic potentiometers and bridges has just been released by The Bristol Co., Waterbury, Conn. The 2-color bulletin, P1271, is complete with photographs and specifications.

Circle 177 on Inquiry Card, page 101

Measuring Instruments

Brush Electronics Co., 3405 Perkins Ave., Cleveland 14, Ohio, has issued a 24-page booklet that describes, with pictures, their line of measuring instruments for sound, strain, vibration and acoustics. Accessory equipment is also described.

Circle 178 on Inquiry Card page 101

New Tech Data for Engineers

Ceramic Magnets

A new 12-page bulletin is available from the Stackpole Carbon Co., St. Marys, Pa., describing the advantages of various mechanical, electrical and electronic applications of ceramic magnets. Also included are 10 graphs plotting every magnetic characteristic of importance to design engineers.

Circle 179 on Inquiry Card, page 101

Polymers

More than a dozen tables of properties are among the features of a 10-page, 2-color technical booklet on "Kel-F" brand halofluorocarbon polymers now available from the Minnesota Mining & Mfg. Co., St. Paul, Minn. Booklet also contains graphs, complete specifications and suggested usages.

Circle 180 on Inquiry Card, page 101

Temperature Instruments

Small-case temperature instruments are described in a 16-page booklet, issued by Fisher & Porter Co., Hatboro, Pa. Two-color booklet contains complete information on how the equipment works, photographs, drawings and complete specifications.

Circle 181 on Inquiry Card, page 101

DC Voltage Regulators

C. J. Applegate & Co., 1816 Grove St., Boulder, Colo., has issued a series of bulletins describing their DC voltage regulators with zero load regulation. Bulletin describes these plug-in units along with photographs, complete electrical and mechanical specifications and price list.

Circle 182 on Inquiry Card, page 101

High Frequency Scope

A bulletin has just been issued describing a new Model 150 A high frequency oscilloscope. It contains complete electrical and mechanical specifications and photographs of the equipment. Hewlett-Packard Co., 275 Page Mill Rd., Palo Alto, Calif.

Circle 183 on Inquiry Card, page 101

Printed Circuitry

A 12-page booklet describes printed circuitry at high production rates through the use of a dry screen process. Booklet gives step-by-step information on the manufacture of printed circuitry. Dry Screen Process, Inc., 1016 Madison Ave., Pittsburgh, Pa.

Circle 184 on Inquiry Card, page 101

Subminiature Resistors

New molded composition resistors only .056 in. in diameter and .140 in. long are the subject of a new 2-color booklet. Construction, dimensions, stock resistance values and prices are covered in Bulletin 150 which is available from the Ohmite Mfg. Co., 3650 Howard St., Skokie, Ill.

Circle 185 on Inquiry Card, page 101

Computer Applications

A new brochure is available describing the function and application of the Univac Scientific Computer Model 1103A. Written specifically for the busy executive, this brochure describes the computer in nontechnical terms and cites examples of uses to which this large-scale equipment is being applied. Remington Rand Div. of Sperry Rand Corp., 315 4th Ave., New York 10, N. Y.

Circle 186 on Inquiry Card, page 101

Batteries

A series of bulletins incorporated in one folder describe automatically-activated silver-zinc batteries and silver-zinc secondary (storage) batteries. Bulletins contain graphs, photographs, electrical specifications, and other information concerning these batteries. Frank R. Cook Co., 36 S. Santa Fe Drive, Denver 23, Colo.

Circle 187 on Inquiry Card, page 101

Flexible Laminates

Oliver Tire & Rubber Co., 1256 65th St., Oakland 8, Calif., has just issued 2-color brochure describing their own flexible copper-clad silicone rubber laminate for printed circuits. A complete description of this material was given along with photographs. Also included is complete information on a new electrostatic shielding medium made of neoprene rubber and silver-plated wire.

Circle 188 on Inquiry Card, page 101

Transistorized Amplifier

United Control Corp., 4540 Union Bay Place, Seattle 5, Wash., has issued a bulletin describing their transistorized amplifier module which is designed to withstand temperatures up to 212°F without damage. Amplifiers can be used in any system requiring an on-off control function. Two amplifier modules may be contained in a single package to form a modulating controller which can be used in any servo system where two-direction control is required. Photographs and specifications are included.

Circle 189 on Inquiry Card, page 101

Frequency Measurements

Data File 111 describes frequency measurements and how to make them. This 16-page booklet covers such things as measurement of low to UHF frequencies, rotational velocity, flow, pressure, temperature and strain. It also covers telemetry and setting up a secondary standard of frequency. Complete with graphs and charts, this is a definitive discussion of the topic. Dept. 7220, Beckman/Berkeley, 2200 Wright Ave., Richmond 3, Calif.

Circle 190 on Inquiry Card, page 101

Tape Recording

"How To Be A Magnetic Tape Recording Expert" is a new brochure from the Ampex Corp., 934 Charter St., Redwood City, Calif., describing the proper ways to handle all types of tape recording jobs. It is written for the beginner as well as the engineer.

Circle 191 on Inquiry Card, page 101

Transmitter-Receiver

Transval Engineering Corp., 10401 W. Jefferson Blvd., Culver City, Calif., has just issued a 2-color brochure describing their 6 channel, MHF aircraft transmitter-receiver with transistorized power supply and modulator that reults in 35 w. output in a 14 lb. package. Also included are bulletins on the various other pieces of equipment manufactured by this company.

Circle 192 on Inquiry Card, page 101

Recording Terms

An up-to-the-minute glossary of 99 high fidelity and tape recording terms has been prepared by Minnesota Mining and Manufacturing Co., Dept. M7-177, 900 Bush St., St. Paul, Minn., The 12-page glossary gives concise, easy to understand definitions of terms applying to magnetic recording tape as well as to tape recorders and hi-fi generally.

Circle 193 on Inquiry Card, page 101

Germanium Rectifiers

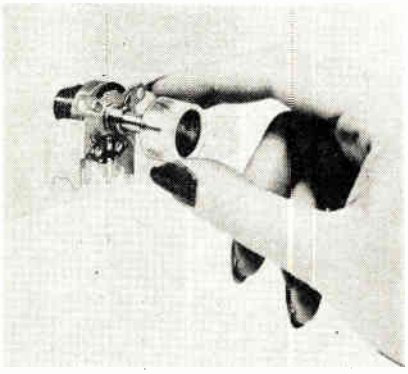
A revised replacement guide for using germanium rectifiers to replace selenium rectifiers is now available from the General Electric Semiconductor Products Dept., Syracuse, N. Y. The revised replacement guide lists all American-made TV sets since 1953 in which selenium rectifiers may be conveniently replaced. Booklet is in handy pocket size.

Circle 194 on Inquiry Card, page 101

New Products . . . for the Electronic Industries

PULL-PUSH SWITCH

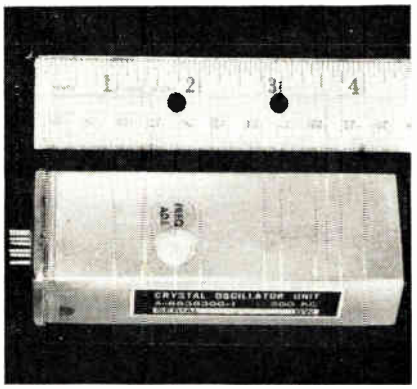
A new pull-push switch which switches radio, TV and other electronics equipment on with a gentle pull and off with a gentle push without altering volume setting is now offered. Regardless of number of on-off operations, volume remains indefinitely at any selected setting or it may be changed instantly by rotating the volume control. Type K spst switch has a 3 a. 12 v. Underwriters' approved rating and is available with either printed circuit or standard solder lug type terminals. The switch can be used with any CTS 15/16 in. diameter bushing. Chicago Telephone Supply Corp., Elkhart, Ind.



PACKAGED OSCILLATORS

A complete line of sub-miniature packaged crystal oscillators are available. Ruggedized for missile and other airborne applications, the following specifications are designed to provide optimum frequency control: dimensions, 1 x 1½ x 4 in.; frequency stability, up to ± 1 part in 10^6; frequency range, 180 KC to 50 MC; harmonic content, less than 5%. Available output voltage up to 50 volts peak to peak; input voltages, 75, 150, 250, volts for tube circuits 6 to 24 volts for transistorized circuits. Bulova Watch Co., Electronics Div. P-815, Woodside 77, N. Y.

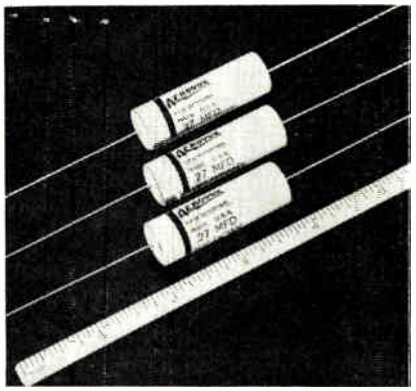
Circle 196 on Inquiry Card, page 101



WAX FREE CAPACITOR

Wax-free paper tubular capacitor is known as Type V84 "WHITECAP." The absence of any wax coating will eliminate gummed-up machines and equipment. Light in weight, all units are clearly marked and coded and will enhance the appearance of electronic assemblies. They offer good humidity resistance. Operating temperatures up to 85° C without derating and to 100° C with voltage derating to insure long-life. Insulation resistance is many times higher than conventional paper tubulars. They are available in quantity. Aerovox Corp., New Bedford, Mass.

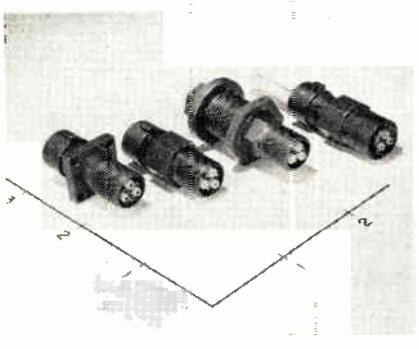
Circle 198 on Inquiry Card, page 101



CONNECTORS

Miniature, high-temperature electrical connectors are designed for high-altitude flight operation. Their major design feature is a staggered construction which gives long creepage path between pins despite small connector size. Three different types of receptacles and matching plugs are available. They have an insulation resistance of 10^6 megohms. Available with 1, 3, 7, or 19 pins, they are rated 1,800 vac at sea level and 800 vac at 70,000 ft. Consolidated Electrodynamics Corp., 300 N. Sierra Madre Villa, Pasadena, Calif.

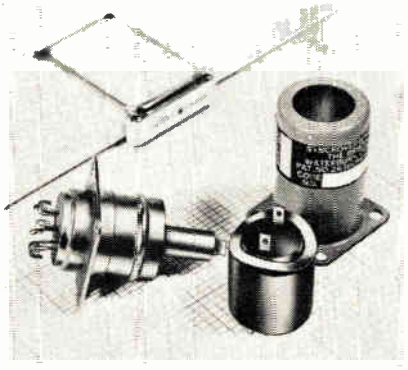
Circle 195 on Inquiry Card, page 101



LOW NOISE CHOPPER

The Syncroverter Switch, miniature, precision, non-resonant inverter, is now available in a low-noise, external coil model for dry circuit applications. Chopper has been designed to eliminate the problem of capacitive coupling between contact and coil leads which exists in the operation of miniature choppers in high impedance circuits. It is offered with single pole-double throw switch action, with nominal contact ratings up to 10v, 1 ma. and is approximately 1¾ in. high and ⅞ in. in diameter. The Bristol Company, Waterbury 20, Conn.

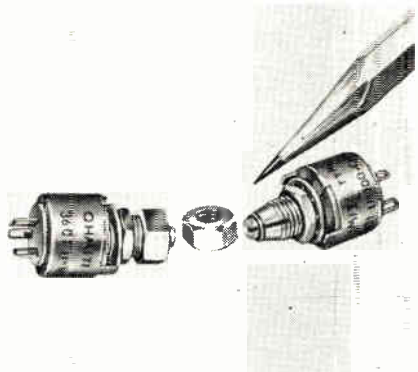
Circle 197 on Inquiry Card, page 101



MOLDED POTENTIOMETER

Type AS miniature potentiometers are ½ in. in diameter and rated at 0.5 w. continuous duty. The relatively thick, solid, molded resistance elements offer a large factor of safety. Even the brush is molded for long wear and lower noise level. Units are furnished in linear taper with locking type, screw-driver-slotted shafts. They are dust tight, splashproof and fungus-resistant. Terminals are gold plated. Available in 15 values from 100 ohms to 5.0 megohm, these units meet military specifications. Ohmite Mfg Co., 3630 Howard St., Skokie, Ill.

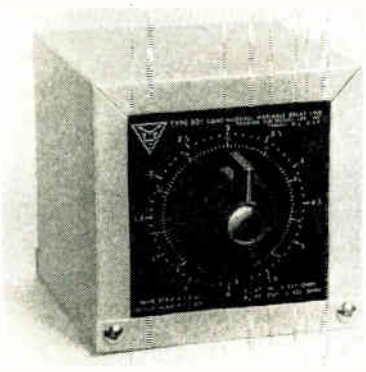
Circle 199 on Inquiry Card, page 101



New Products . . . for the Electronic Industries

VARIABLE DELAY LINES

Type 521 series was developed to meet an increasing need of continuously variable time delay with maximum delay time over 15 microseconds. Size is 4 x 4 x 4 in., and weight of

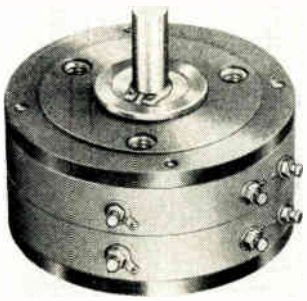


unit is approximately 2½ lbs. Features for this device are good stability, fast rise time, repeatability better than ½ millimicrosecond, and freedom of time jitter. Rise time is less than 8% of the time delay at any point. Three models are available with different maximum time delays. Advance Electronics Lab., Inc., 249 Terhune Ave., Passaic, N. J.

Circle 200 on Inquiry Card, page 101

SMALL POTENTIOMETER

A small enclosed, high resolution 2 in. diameter potentiometer, series HP-200, can be supplied singly or as multiple ganged units. Mountings include piloted servo or 3 tapped holes.

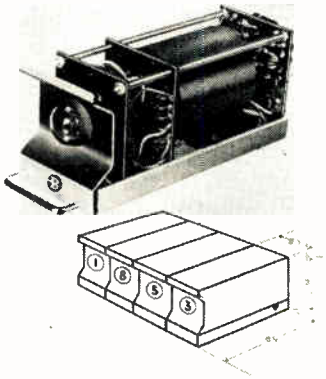


Power dissipation is 3 watts. Mechanical rotation is 360°. Up to 16 taps can be provided, depending on spacing. Precious metal brush, collector and tap contacts, together with hard gold plated terminals and slip rings, are standard design features. Uses Kohlrausch resistance element. DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.

Circle 202 on Inquiry Card, page 101

DECADE COUNTER

A new decade counter with an all-electronic numerical readout is now available. Made with beam switching tube type 6700 and Nixie indicator tube type 6844, the unit displays

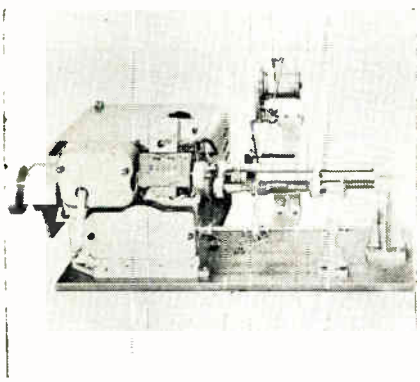


numerical information that is directly controlled by a single counter tube. Precise "in-line" figures are visible 30 to 40 ft. Plug-in units have been designed for a minimum panel height and may be cascaded to provide any desired count capacity with provisions for manual and electronic zero setting. Electronic Tube Div., Burroughs Corp., Plainfield, N. J.

Circle 204 on Inquiry Card, page 101

COIL WINDER

A newly designed versatile coil winding machine for laboratory and production runs winds variable pitch progressive universal coils, variable pitch solenoids, progressive universal coils, automatic pi-wound coils, close and space wound single layer solenoids and random wound bobbin coils is now available. Outstanding fea-

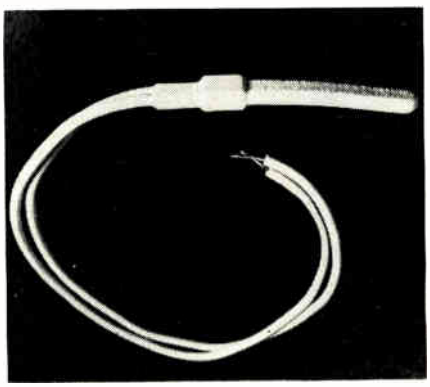


ture is that cam and gears are instantly available for fast, simple changing. Model 600-AM also has continuous automatic lubrication of cam, yoke and all high speed gears. Geo. Stevens Mfg. Co., Inc., Pulaski Rd. at Peterson, Chicago 30.

Circle 201 on Inquiry Card, page 101

WIRE INSULATION

A new silicone rubber compound specifically designed and manufactured for wire insulation is available for use on aircraft wire, motor and apparatus lead wire, defroster and hook-up wire, atomic Navy cable and other wire applications. Offers combination of electrical and physical properties plus low water absorption,



SE-975 wire insulation may be used in long service at 150°C and for many applications at 200°C. Furnished as a white compound, it may be tinted to obtain a side range of colors. Especially suited for thin wall extrusions. General Electric Co., Waterford, N.Y.

Circle 203 on Inquiry Card, page 101

COLOR CRT

A new round, all-glass shadow-mask-type CRT for color TV receivers, is now available to equipment manufacturers. The tube, RCA-21CYP22 is capable of generating full-color and black-and-white pictures measuring 19¼ x 15½ in. and having a projected area of 261 square in. It has a spherical filterglass face-

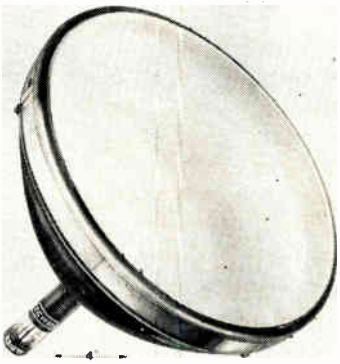


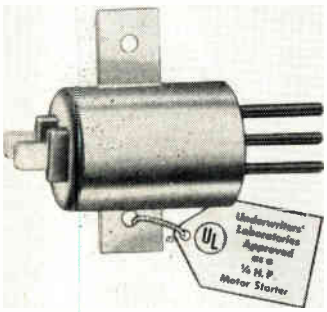
plate and an aluminized, tricolor, phosphor-dot screen. It has an overall length of 25 1/32 in. The all-glass envelope reduces the high-voltage insulation requirements of the color receiver. Radio Corporation of America, Harrison, N. J.

Circle 205 on Inquiry Card, page 101

New Products ... for the Design Engineer

MOTOR CONTROL SWITCH

Reloid, an electromagnetic switch actuated by a plunger, is now available in a special version carrying approval marking as a ¼ H.P. industrial motor starter. Switch is totally

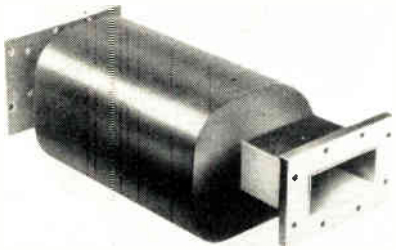


enclosed in a metal case to resist impacts, dust and moisture. Three contact leads, plugged with molded bakelite, are equipped with AMP or Douglas type terminals; coil has 2 AMP terminals. Available for any voltage from 6 to 230 v., 60 cycles ac, or from 6 to 110 v. dc. Contacts are rated up to 8 a. at 115 v., non-inductive. Guardian Electric Mfg. Co., 1621 W. Walnut St., Chicago 12, Ill.

Circle 206 on Inquiry Card, page 101

FERRITE ISOLATOR

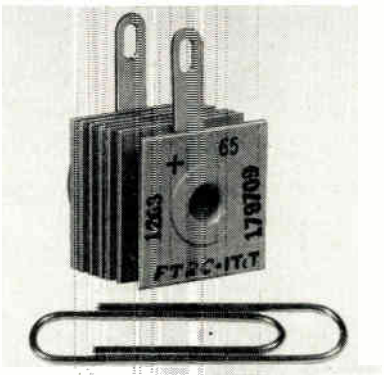
Operating over the band of 2350 to 3600 MC. without loss of magnetron to load isolation characteristics, the unit finds many applications in systems that continually sweep the entire frequency range. Constant magnetron to load isolation is provided. VSWR and attenuation have been held to a minimum. Electrical characteristics include a minimum isolation of 10 db, input VSWR of 1.20, maximum power handling capacity averaging 400 w. CW and a maximum insertion loss of 1.0 db in coaxial systems. Airtron, Inc., 1101 Elizabeth Ave., Linden, N. J.



Circle 208 on Inquiry Card, page 101

SELENIUM RECTIFIER

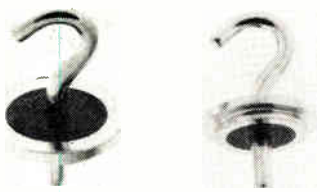
A new 65 mil selenium rectifier is ideal for use in phonographs, small radios, TV boosters and other small electronic chassis. Designated as type 1263-A for standard mounting, bracket-mounting type, 1262-B, is also available. It has the following characteristics for single phase capacitive load: Max. RMS input 130 v.; Max. peak inverse is 380 v.; Max. peak current 650 ma.; Max. RMS current 175 ma.; Max. dc current 65 ma.; Min. series resistance 22 mu.; Max. plate operating temp. 85°C. International Telephone & Telegraph Corp., 100 Kingsland Rd., Clifton, N. J.



Circle 210 on Inquiry Card, page 101

HERMETIC TERMINALS

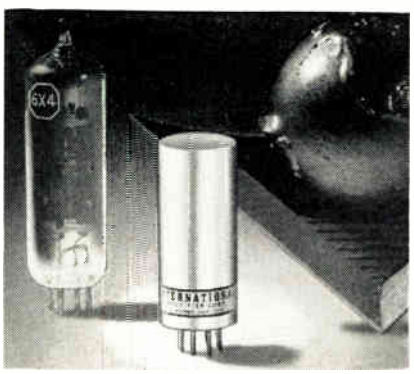
Two new high voltage fused glass-to-metal hermetic terminals for transformer applications have been developed. With a resistance of 100,000 ohms at 150° C., the new terminals are rated at 3500 v. RMS and 5000 v. RMS. Both terminals, made with single pin electrodes, can be soldered on high speed production lines. They meet all MIL-T 27 specs for humidity cycling, torque, and bend testing. As many as 4 No. 12 wires may be joined to the outside hook. The pin is made of stainless steel wire with a copper core. Fusite Corp., 6000 Fernview Ave., Cincinnati 13, O.



Circle 207 on Inquiry Card, page 101

SILICON RECTIFIERS

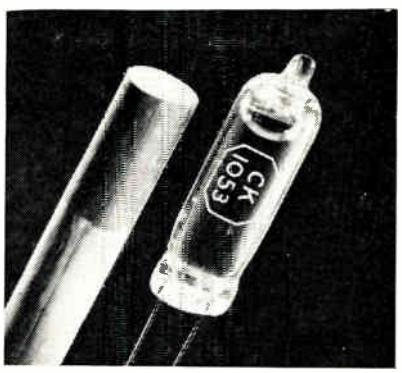
Tube base mounted silicon replacements for vacuum tube rectifiers which provide savings on filament power supply, cooler operation, long life and resistance to vibration and shock, are now in production. The S6X4, a direct replacement for the 6X4 full-wave high vacuum rectifier tube, features an output of 85ma. dc maximum, an input of 400 v. RMS., and a max. peak current of 225 ma. Maximum PIV is 1250 v.; the voltage drop 6 v. at 70 ma. Will plug directly into the same tube sockets. International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif.



Circle 209 on Inquiry Card, page 101

TIME INDICATOR

Subminiature tube type CK1053 is for use in measuring operating time to a total of between 500 and 5000 hours with an accuracy of 5% or better and at power consumptions of only a few microwatts. It is a two-element tube. The operating current is passed through the tube whenever the equipment is in use. Inexpensive colorimeters are used to indicate elapsed time. Within certain limits, the full scale life of the tube may be varied by means of the anode current used. Shelf life is 2 years or more. Raytheon Manufacturing Co., 55 Chapel St., Newton 58, Mass.

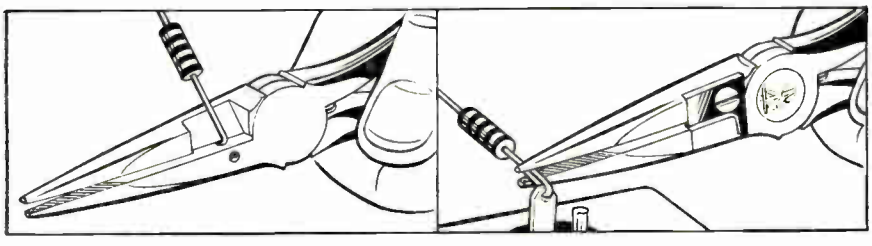


Circle 211 on Inquiry Card, page 101

Faster Wiring with NEW Klein Shear Cutting Plier

PATENT PENDING

Two-step wiring of resistors:



1. Cut wire and bend in hook.

2. Close for soldering.

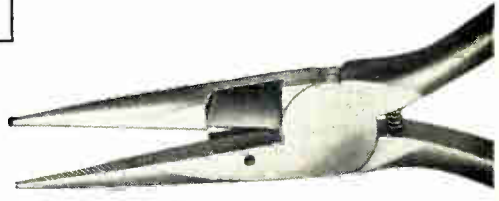
Here is a new Klein Plier based on an original principle which assures cleaner, faster cutting. The shear action makes it possible to cut hard wire or dead soft wire easily, quickly.

The reverse side of the plier has a milled section behind the knife so designed that when the wire is cut, it is held in position and a turn of the hand forms a 3/16-inch hook at the proper angle. Without changing pliers this hook may then be closed on the terminal for soldering.

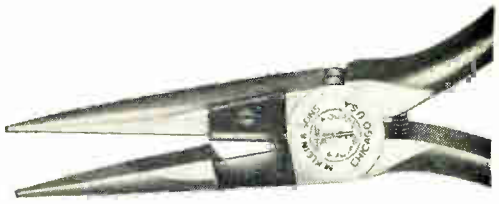
Shear blade is held in place with a countersunk setscrew and may be quickly replaced when knife becomes dull.

Also available as a straight side cutting plier with shear.

Furnished standard with self-opening coil spring and 1/16-inch point.



208-6NC. Similar in design to 208-6C but reverse side designed to put a positive 3/16-inch hook on the end of a resistor wire. Smooth one-motion operation saves production time on every television or radio set.



208-6C long nose shear cutting plier. A 6½-inch long nose plier with shear blades. Will cut dead soft or extremely hard wire. Blade replaceable. Plier never needs sharpening. Paint of nose 1/16-inch diameter. Coil spring keeps jaws open ready for use.

ASK YOUR SUPPLIER

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International Standard Electric Corp.
New York

Mathias KLEIN & Sons
Established 1857
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DESIGNED TO MEET MIL-E-1

MILITARY TYPE

Automatic silicon rectifiers

JAN TYPES

1N253

1N254

1N255

1N256

WRITE TODAY FOR ENGINEERING "SPEC" SHEETS FOR ANY TYPE.

The reliability demanded by the rigid electrical, mechanical and environmental specifications of MIL-E-1 is now assured with **Automatic's** JAN TYPE silicon rectifiers . . . offered in production quantities at prices reflecting volume output.

Automatic offers, in addition to these JAN types, a complete line of Silicon Rectifiers for industry . . . including magnetic amplifiers, power supply, high voltage, germanium replacement and general purpose types.

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Type No.	Peak Reverse Voltage	DC Output Current AV*	Maximum Reverse Current* **	Mounting	MIL-E-1 Technical Spec. Sheet No.
	(VDC)	(MA)	(MA)		
1N253	100	1000	0.1	Stud-Mount	1024
1N254	200	400	0.1	Stud-Mount	989A
1N255	400	400	0.15	Stud-Mount	990A
1N256	600	200	0.25	Stud-Mount	991A

*CASE TEMPERATURE 135°C.
**AVERAGED OVER 1 CYCLE FOR INDUCTIVE OR RESISTIVE LOAD WITH RECTIFIER OPERATING AT FULL RATED CURRENT.

Available JAN TYPES: 1N253, 1N254, 1N255, 1N256

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MASS PRODUCERS OF ELECTRONIC COMPONENTS

AUTOMATIC MANUFACTURING
DIVISION OF GENERAL INSTRUMENT CORPORATION
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1957

1957 MILITARY ELECTRONIC PROCUREMENT DIRECTORY

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VICE COMM
Maj Gen J W Sessums 7

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Brig Gen Dan R Ostrander 57

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DEPUTY R E Miedel 638

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DEPUTY C H Meyer 645

Management & Resources Div.
DIR Maj D H Hilker 569
DEPUTY D J Bertsch 569

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Col B G Halzman 36

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Col C H Lewis 66

DIRECTOR OF AERONAUTICS
Col D D McKee 75

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Col L B Williams 18

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TECH DIR A G Wimer Jr 59

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ASST FOR GUIDED MISSILE SYSTEMS
Col E A Kiessling 58

ASST FOR ELECTRONIC SUPPORTING SYSTEMS
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G G Bruder 984

EXECUTIVE FOR SMALL BUSINESS
J C Eiden 641

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Lt Col A L Thayer 61513

San Antonio Procurement Office
Lackland AF Base, Texas
phone WALNUT 3-3411
CHIEF Howard Huber

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phone KENMORE 7111
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VICE COMM
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Brig Gen V R Haugen 39257

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WEAPONS GUIDANCE LAB.
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ELECTRONIC COMPONENT LAB.
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DEPUTY Col D B White

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DEPUTY
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PROCUREMENT
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ELECTRONIC RESEARCH
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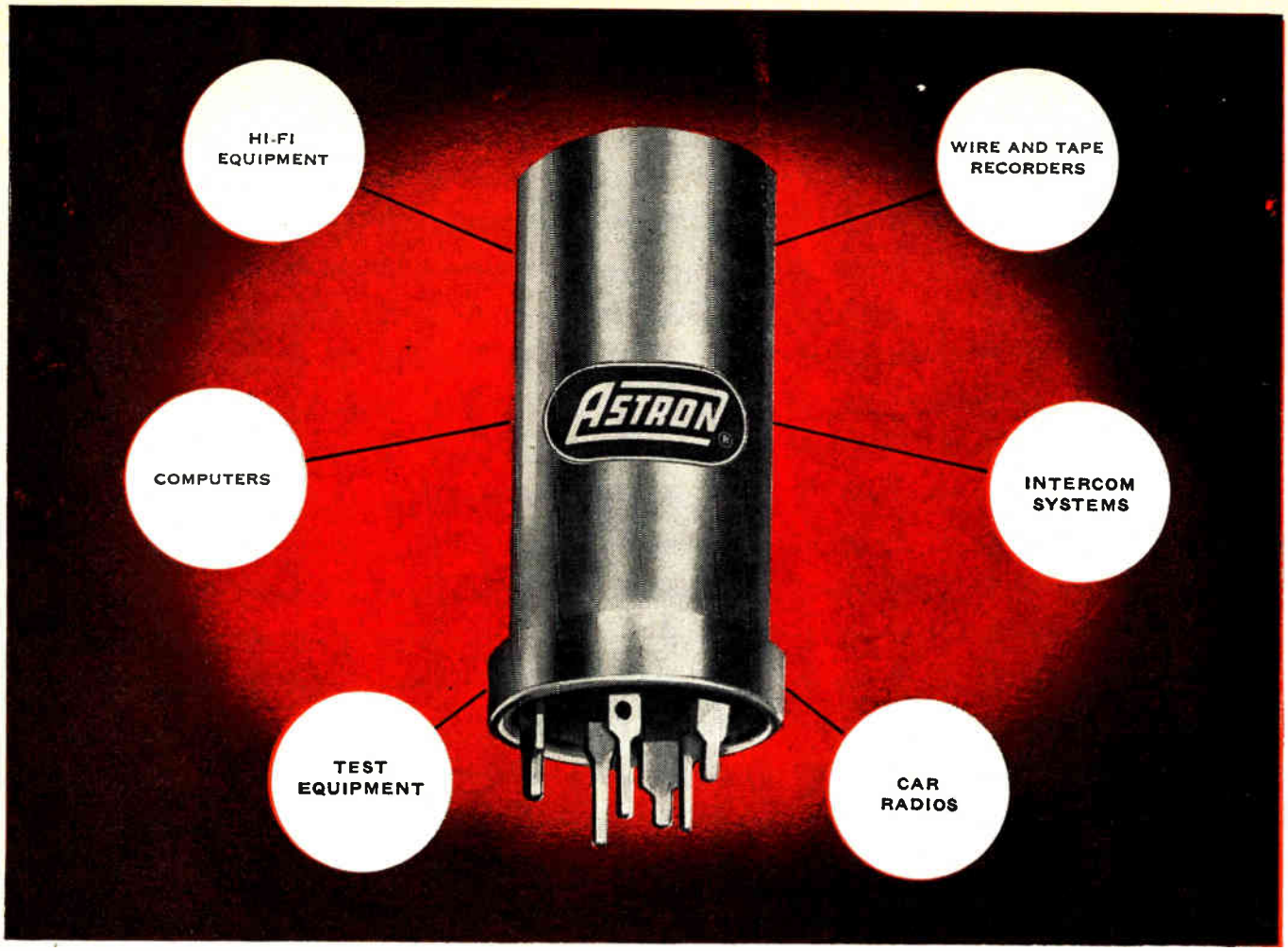
VICE COM Col W E Eider

PROCUREMENT DIV
CHIEF Lt Col M B Hall



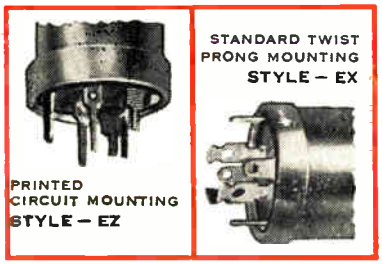
ASTRON ''SAFETY MARGIN''*

ELECTROLYTIC CAPACITORS

for transistorized and printed circuits

IMPORTANT DESIGN ADVANTAGES OF ASTRON EZ AND EX ELECTROLYTICS

- MINIATURIZED SIZE—LIGHT IN WEIGHT
- DESIGNED FOR MINIMUM LOSSES—LOW DRAIN
- LONG "SHELF" AND OPERATING LIFE
- HERMETICALLY SEALED
- RUGGEDLY CONSTRUCTED



Today's low-voltage transistorized and printed circuits demand capacitors with absolute minimum leakage and impedance. To meet these exacting needs, Astron Engineers developed new miniaturized EZ and EX Electrolytics for ambient operation up to 85° C.

99.99% pure aluminum foil is specially anodized by an exclusive process . . . power drain is cut to a minimum. They are constructed to withstand extreme temperature changes and give reliable operation after periods of "long idleness."

Each electrolyte formula is scientifically compounded of special chemicals, selected for their high purity. Assembly steps are kept meticulously clean . . . the result: Safety Margin Construction, famous for its ability to withstand ripple currents, vibration, shock and wide temperature fluctuations. These hermetically sealed units are available in a broad selection of capacitance and voltage ratings.

Send today for further technical information . . . **please describe your application; it helps us offer proper assistance to you . . . when special conditions require, we will design a prototype to meet your specifications.**

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Phone Eglin AF Base 3101
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Wilmington Pike Dayton Ohio
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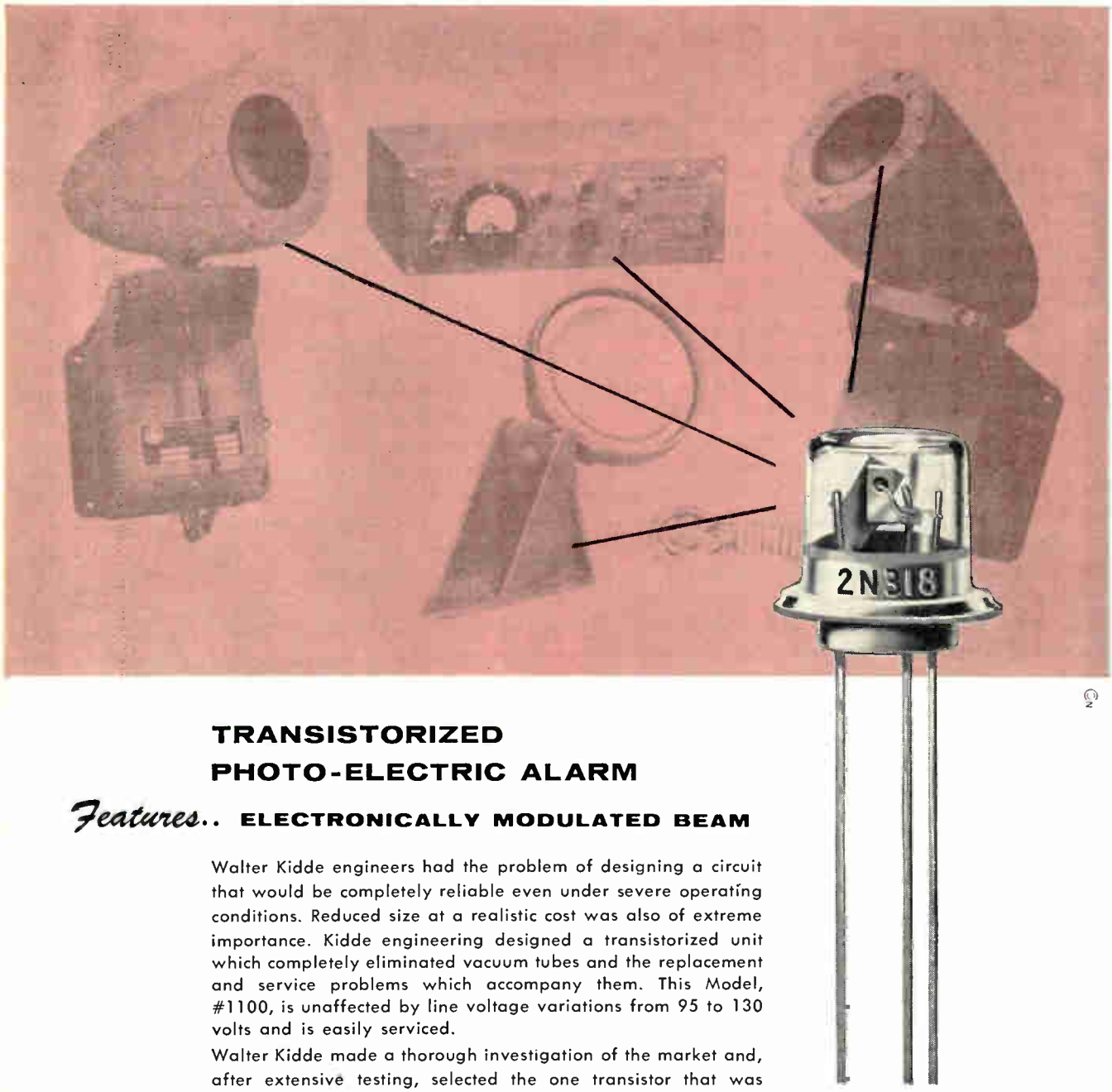

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Walter Kidde made a thorough investigation of the market and, after extensive testing, selected the one transistor that was able to meet all physical, electrical and reliability specifications . . . General Transistor's Photo-Transistor 2N318/GT-66.

This is just one more example why **General Transistor** is the **fastest growing name in transistors.**

Write today for complete technical information — Specification Sheet 2N318.

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91-27 138TH PLACE JAMAICA 35, NEW YORK

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Mrs I H [illegible]th 64976

A[illegible]F OF BUREAU FOR
[illegible]ICS
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ASS[illegible]ECTOR Capt G L Countryman 62463

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DIRECT[illegible] Capt W F Cassidy 64586

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RAD[illegible]NCH
Cdr E[illegible]nderburg 61796
R Jon[illegible] 61796
A L A[illegible] 61796

COMMU[illegible]ICATIONS BRANCH
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W Muench 64056

SUPPORT BRANCH
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L B W[illegible] 61217

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Capt R C Sergeant 66752
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Washington D C phone LIberty 5-6700
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phone JOhnson 3-6600

DIRECTOR Capt P H Horn 403

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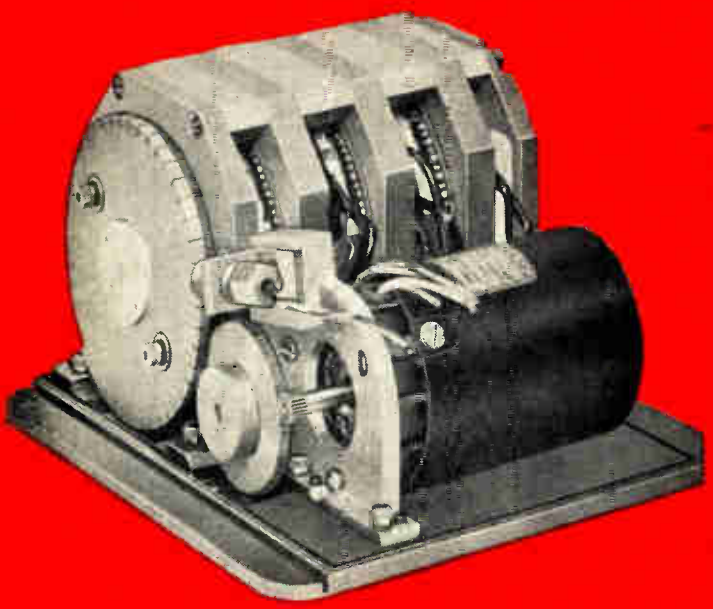
DESIGN ACHIEVEMENTS WITH **SUPRAMICA*** ceramoplastic



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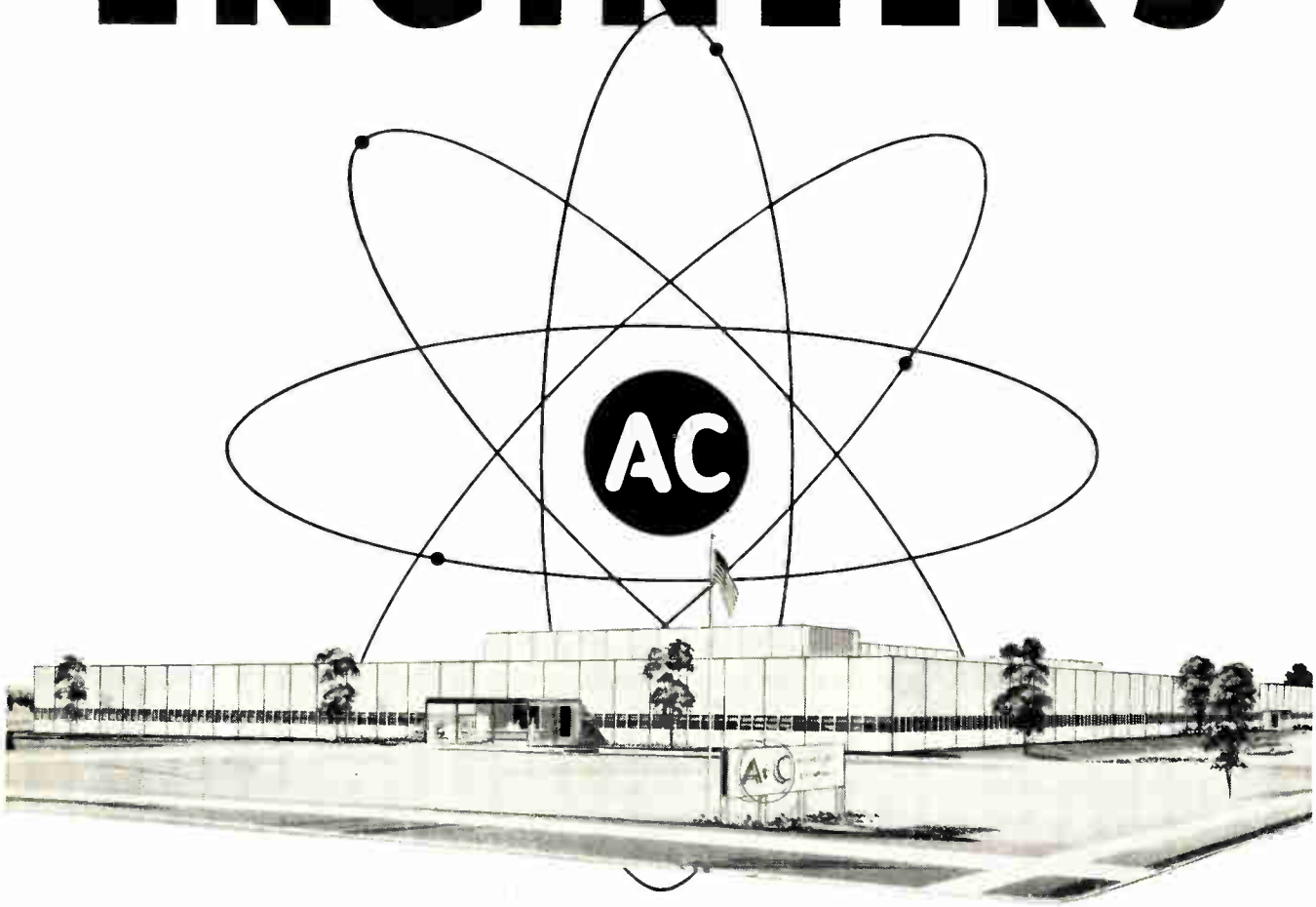
ENGINEERS



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ELECTRONIC INDUSTRIES'

1957 Guided Missile Directory

Listing the major operational and developmental guided missiles and the electronic firms and military agencies directly responsible for their design, development, testing and production. Includes personnel managers, chief engineers and military personnel in missile procurement.

For convenient reference the following information has been divided into sections: First, a listing of the major operational and developmental missiles. Second, a summary of the prime electronic contractors, with the names of the chief engineering executive and personnel manager. Third, the military agencies responsible for missile procurement, design and testing with the officers having prime responsibility.

U. S. ARMY

NIKE-AJAX guided missile units are deployed around vital industrial, highly populated and strategic areas of the U. S. NIKE-AJAX is about 20 ft. long and about 1 ft. in diameter, with two sets of fins for guidance and steering. It is boosted to supersonic velocity by a solid-propellant booster and maintained by a liquid sustainer motor. The missile and booster weigh more than one ton.

NIKE-HERCULES is an integral part of a weapon system which electronically acquires the target and causes the missile to intercept the target. The missile can engage and destroy at much longer ranges and higher altitudes than NIKE-AJAX either single, or formations of, aircraft of the present or foreseeable future. The dart-shaped missile alone is 27 feet long; the booster is 14.5 feet long. The missile is launched by remote control and is given its inital impetus by a solid propellant booster rocket and then accelerated by a solid sustainer motor.

REDSTONE. Activation of the first U. S. Army unit to fire the Army's supersonic REDSTONE missile was announced on March 14, 1956. It is capable of delivering both atomic and non-atomic projectiles. It is the largest surface-to-surface ballistic guided missile successfully fired in this country. Named for the place of its development, the Army's Redstone Arsenal at Huntsville, Alabama, it is a future operational field missile and at the same time a basic "step" toward the new JUPITER.

CORPORAL Guided Missile is capable of engaging tactical targets at ranges over 75 miles away. The weapon gives the field commander great firepower on the battlefield. The propulsion system uses a liquid propellant rocket motor. The missile travels through space at several times the speed of sound. CORPORAL battalions have been deployed to Europe.

LACROSSE, a highly accurate general support field artillery guided missile for use in close tactical support of ground troops. An all-weather guided missile capable of carrying highly effective area type warheads and sufficiently accurate for destroying hardpoint targets. Its propulsion system uses a solid propellant rocket motor.

DART, a guided anti-tank missile, solid-propellant rocket propelled. It was designed for an increased effective range, for higher accuracy at this larger range, for greater probability of a first round hit, and for a larger warhead. The Dart missile is designed for use by front-line troops. The Dart can be launched by a light-weight launcher from a variety of vehicles.

JUPITER. The Army's intermediate-range ballistic missile, capable of being launched from land, which the Army Ballistic Missile Agency was set up to develop under high priority early in 1956.

U. S. NAVY

SIDEWINDER, operational air-to-air guided missile, can destroy enemy fighters or bombers from sea level to altitudes of over 50,000 ft. Basically a defensive weapon, will be employed in air defense of the continental United States. Very few moving parts and no more electronic components than an ordinary radio.

REGULUS, a surface-to-surface missile resembling a conventional swept-wing jet fighter about 30 feet long, designed for launching from submarines, surface ships, and shore bases. The launching equipment can be installed in a short period of time on several types of vessels at relatively low cost, with only slight modification.

TARTAR, a surface-to-air guided missile, with a solid propellant rocket. Eight guided missile destroyers will be equipped to launch TARTAR.

PETREL, air-to-surface weapon primarily for use against enemy ships at sea. Launched by patrol aircraft well outside the range of the target's air defense. Engineering production phase was coordinated by the Naval Ordnance Experimental Unit, a field activity of the Bureau of Ordnance located at the Bureau of Standards, with the production contractor, Fairchild Engine and Airplane Corporation. PETREL is operational, assigned to a number of patrol-type aircraft and fleet squadrons.

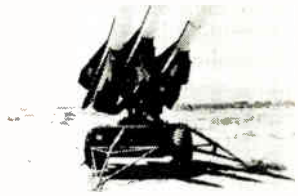
TALOS, a supersonic surface-to-air guided missile for use in air defense of the United States Navy. Will be used aboard USS Little Rock, USS Galveston, and USS Oklahoma City guided missile cruisers early in 1958.

TERRIER, a supersonic surface-to-air guided missile is designed to intercept aircraft at longer range and higher altitudes than conventional antiaircraft guns, and under all weather conditions. TERRIER is the main antiaircraft battery of guided missile cruisers USS Boston, USS Canberra and the guided missile destroyer USS Gyatt.

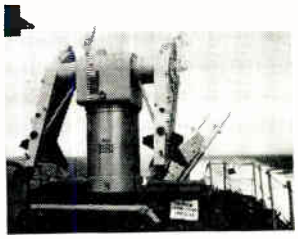
SPARROW I, a supersonic air-to-air missile operational in the fleet, is about 12 feet long, weighs about 300 pounds, and is powered by a solid propellant rocket motor. Guidance signals deflect the missile's wings and direct it to intercept the target, even under evasive action.

SPARROW III, an improvement of the original missile, will augment SPARROW I in fleet air defense.

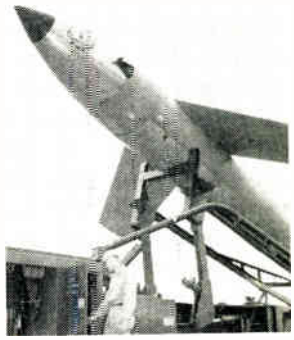
Army's NIKE-HERCULES



Army's HAWK

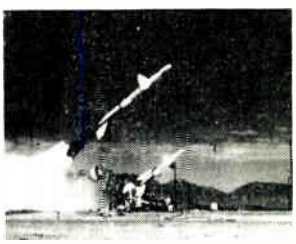


Navy's TERRIER



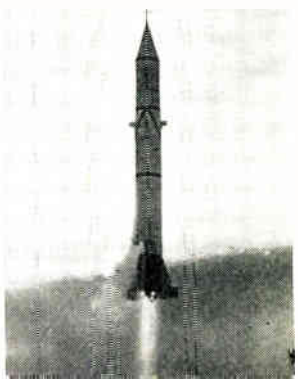
Air Force MATADOR

Navy's REGULUS II

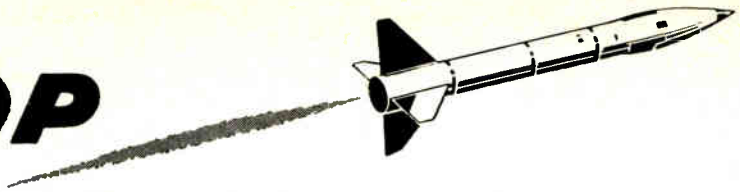


Navy's TALOS

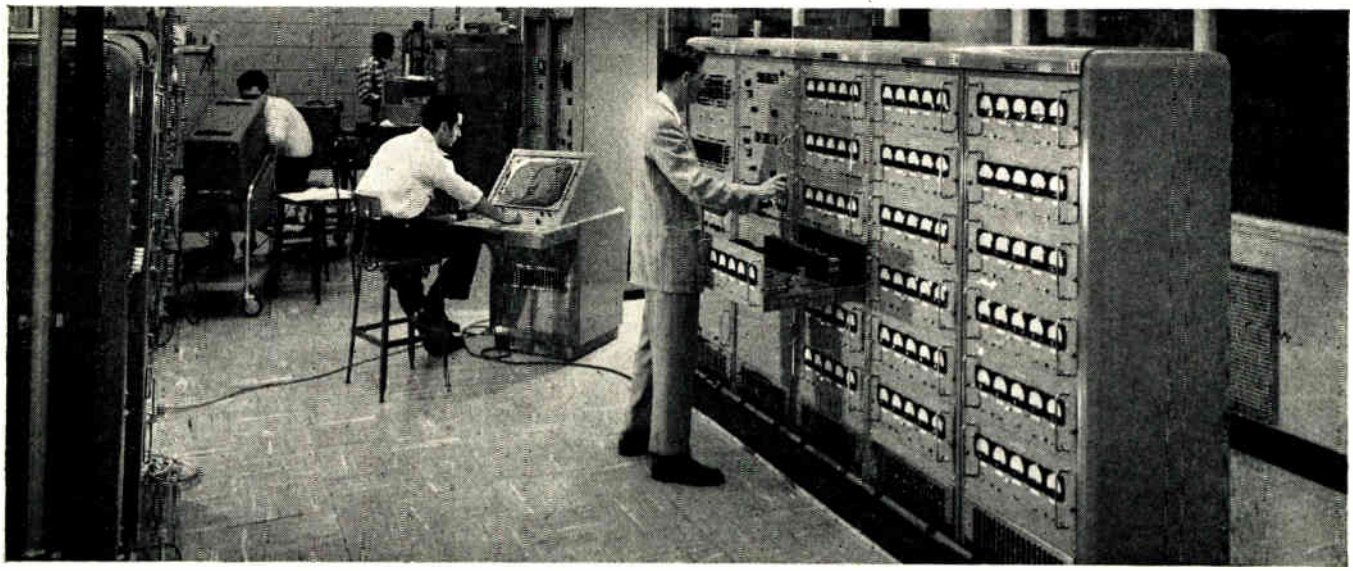
Army's REDSTONE



ASCOP



records missile "history" at giant new DATA CENTER



ASCOP M Series Ground Station at General Electric's Data Reduction Center

GENERAL ELECTRIC's new multi-million dollar Missile Data Processing Center — one of the nation's largest — is now engaged in advanced scientific computation and evaluation of missile flight tests.

This giant Philadelphia center contains the most advanced automatic data processing and handling equipment in use today. A completely integrated operation, it greatly facilitates the speed with which vital data can be made available for analysis.

Playing an important role in this strategic operation is the ASCOP PW Data Reduction System which includes monitoring facilities. An ASCOP Ground Station handles many channels of low frequency data . . . simultaneously reduces eighty-six data channels, held to a system accuracy well within 1%. This data is originally gathered in the missile by ASCOP airborne telemetering units.

The linearity and reliability of this ASCOP system is a major factor in the advanced performance of the entire installation. And, significantly, the modular-unit flexibility of ASCOP equipment made possible delivery of the system **months in advance** of the opening of the GE Data Center . . . one more reason why it will pay you to investigate ASCOP for your present and projected programs.

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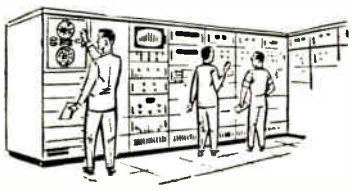

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U. S. AIR FORCE

BOMARC (IM-99), long-range interceptor guided missile of supersonic speed, designed to operate at long range and high altitude. It is launched vertically and cruises on twin ramjet engines supersonically toward the target, guided by electronic systems.

FALCON (GAR-1) guided aircraft rocket of supersonic speed, weighs slightly over 100 pounds and is approximately six feet long, is powered by solid rocket propellant, and electronically fired and guided. Designed for underwing or pod installation, it can be carried in quantity by interceptor aircraft, launched miles from target, and automatically "homes" on target.

MATADOR (TM-61) tactical missile of subsonic speed, has a wingspan of 28.7 feet, length of 39.6 feet. Ground-launched by a rocket booster from a roadable launcher, it is powered by an Allison jet engine (J-33-A-37), controlled electronically in flight by ground personnel, and is capable of delivering conventional or nuclear weapons several hundred miles. The MATADOR, presently in operational use in U. S. Air Force units, is being replaced by an improved version, designated as the MATADOR TM-61C.

RASCAL (TAM-63), long-range guided missile is rocket-powered pilotless bomber designed to be carried by strategic bombers and released miles from objective to proceed at high speed to target.

SNARK (SM-62), long-range strategic missile, is a winged pilotless bomber powered by an Allison turbo-jet engine, and is the first U. S. long-range missile to be test flown. It is considered to have range, accuracy and load-carrying capabilities as good as ballistic missile types.

INTERMEDIATE RANGE BALLISTIC MISSILE THOR IRBM. Douglas Aircraft Company was awarded a development contract for the THOR IRBM in December 1955. Separate contracts were awarded to prime contractors for sub-components such as guidance system, propulsion and other subsystems.

INTERCONTINENTAL BALLISTIC MISSILES include the ATLAS and TITAN ICBM. Convair Division of General Dynamics Corporation received a development contract for airframe and airframe components for the ATLAS ICBM. A second development contract for airframe and airframe components for the TITAN ICBM was awarded to Glenn L. Martin Company. Separate contracts were awarded to prime contractors for sub-components such as guidance system, propulsion and other sub-systems.

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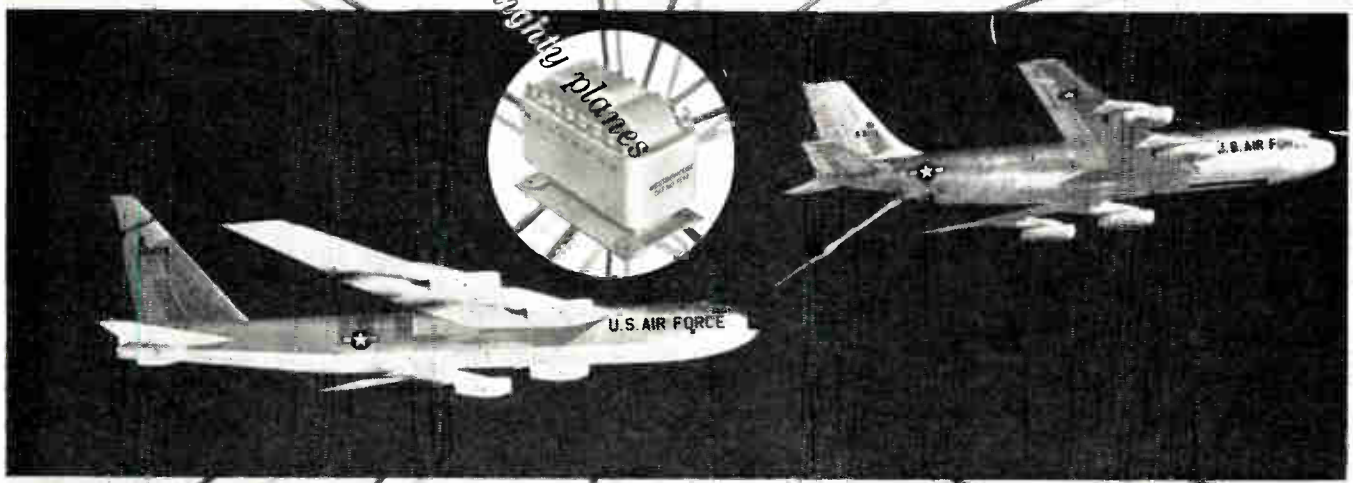
Western Elec. Co. 195 Broadway New York 7, N. Y.	F. R. Lack, V. P. Radio Div.	

reliability...for the nerve centers of these mighty planes



over 7000 westmold transformers helping the air force stay in the air

Operating through a wide range of temperatures and altitudes, electrical systems of the giant Boeing KC-135 tankers serving the Boeing B-47 and B-52 demand the utmost reliability from their components. Over 7000 Westinghouse Westmold transformers in MAGAMP* voltage regulators for electrical systems of these and other Air Force planes are proving that they have this dependability—under all operating conditions.

The low-voltage type Westmold transformers are molded of a flame-resistant plastic material which maintains its flexibility at extreme temperatures. Westmold transformers pass the type "C" thermal shock test of MIL-C-16923 — heating to 130°C, then plunging into a −55°C alcohol-dry-ice bath.

Exclusive dimensional fidelity is assured — the shape of the transformer is fixed by the mold into which it is poured. In addition, the thicker coating of resin afforded by molding, plus completely filled, void-free coils, increases the transformer's ability to withstand high humidity.

For further information, contact your Westinghouse representative, or write Westinghouse Electric Corporation, Specialty Transformer Department, P.O. Box 231, Greenville, Pennsylvania.

*Trade Mark.

J-70823

YOU CAN BE **SURE**...IF IT'S

Westinghouse

Guided Missile Directory

U. S. AIR FORCE

The Pentagon, Wash. 25 D C
Phone LIberty 5-6700

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Brig Gen C M McCorkle 78675

CHIEF FOR BALLISTIC DIV Col R E Soper 77095

AIR DEFENSE DIV Col B W Marshall 76455

STRATEGIC DIV Col G S Curtis 77562

TACTICAL DIV Col R H Mason 76630

DIRECTOR OF MAINTENANCE ENG
Maj Gen A G Hewitt 55356

ARMAMENT DIV, GUIDED MISSILES
Maj C G Palmer 78063

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Maj Gen C J Bondley 54900

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Lt Col P R De Longa 54300

DEPUTY CHIEF OF STAFF, DEVELOPMENT
Lt Gen D L Putt 77151

Air Research & Development Command

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Phone Lexington 9-2616

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DEPUTY R E Miedel 638

DEPUTY COMMANDER FOR WEAPONS SYSTEMS
Maj Gen A Boyd 17

ASST FOR GUIDED MISSILE SYSTEMS
Col E A Kiessling 58

AF Missile Test Center

Patrick AF Base Cocoa Fla
Phone Cocoa Beach 2231
Responsible for testing guided missiles

COMMANDER Maj Gen D N Yates

VICE COMM Col W E Elder

PROCUREMENT DIV Lt Col M B Hall

DCS FOR MATERIAL Col H C Rankin

DCS FOR OPERATIONS Col E R Manierre

AF Flight Test Center

Edwards AF Base Edwards Calif
Phone Edwards AF Base 1101
Responsible for flight testing research, parachute development, static rocket engine testing and experimental high-speed track testing.

COMMANDER Brig Gen M F Cooper

DIR OF FLIGHT TESTS & DEV Col H A Hanes

DCS FOR MATERIAL Col B E Conglenon

DCS FOR OPERATIONS Col J R Hoover

PROCUREMENT DIV Maj J R Pugh Jr

Holloman Air Development Center

Holloman AF Base Alamogordo New Mexico
Phone GRanite 3-6511
Responsible for tests, research and development related to tests of pilotless aircraft and guided missiles.

COMMANDER Maj Gen L I Davis

DEPUTY Col H S Judy Jr

DIRECTOR OF RES & DEV
Col J G Hemans

DIRECTOR OF AIRCRAFT MISSILE TEST
Col L Baker

DIRECTOR OF PROCUREMENT
Maj C Labarr

AF Ballistic Missile Division

Inglewood Calif
Phone ORchard 2-0171

COMMANDER Maj Gen B A Schriever

VICE COMM Brig Gen O J Ritland

DIRECTOR OF MATERIAL Lt Col R H Hebner

Arnold Engineering Dev. Center

Tullahoma Tenn
Phone GRanite 5-2611
Responsible for evaluation development of aircraft guided missile propulsian systems.

COMMANDER Maj Gen T Miller Jr

VICE COMM Col A Johnson

PROCUREMENT DIV J F Fuqua

U. S. ARMY ORDNANCE

Guided Missile Center

Redstone Arsenal Huntsville Ala
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COMMANDER Maj Gen H N Toftoy

CHIEF RES & DEV
Col M R Collins Jr

CHIEF OF INDUSTRIAL DIV
Col R O Lehtonen

Army Ballistic Missile Agency ("Jupiter", "Redstone")

Huntsville Ala
Phone JEfferson 6-4411

COMMANDER Maj Gen J B Medaris

DIRECTOR OF OPERATIONS DIV
Dr W Von Braun

DIRECTOR OF INDUSTRIAL OPERATIONS DIV
Col J M Stark

U. S. NAVY

18th St & Constitution Ave N W
Washington 25 D C
Phone LIberty 5-6700

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Control Section NA 65223
Surface-Launched Missiles
Cdr A G Hamilton Jr 65642
Surface-Launched Missile Cdr F L Yeo 62676
Air-Launched Missiles Lt Cdr R V Biordi 63067
Facilities Section Lt Cdr F N Quarles 66979

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Lt R W Shupp 67025

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Asst Chief of Bureau for Research
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Capt J L P McCallum 63363

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SECT M A Sheppa 66115

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GM Fire Control Section (Short Range) NA 64152
GM Fire Control Section (Long Range) Lt S P Gary 65877

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Short Range Missile Launcher Systems
L L Ludlow 66887
Medium Range Launcher Systems
R E Carlberg 63937
Long Range Missile Launched Systems
R K Bole 63043

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SEC Lt Cdr E J Sheehy 63165

UNDERWATER MISSILE BRANCH
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Fire Control Branch, Missile Guidance Sec (NA) 67117
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DIRECTOR OF SYSTEMS OFFICE
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Avionics Div., Asst. Dir. for Weapons Delivery System

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RADAR BRANCH K G Orman 64176

Guided Missiles Div.

DIRECTOR Capt H O Hauck 64446

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AIR-TO-SURFACE BRANCH
Cdr C W Griffing 65017

SHIP LAUNCHED BRANCH
Cdr R E Rader 63593

SPECIFICATION BRANCH P H Dougherty 64300

RESEARCH DIV, GM DESIGN RESEARCH BRANCH S R Alexander 62685

SHIP INSTALLATIONS DIV, MISSILE BRANCH
Cdr R H Lachman 62638

CONTRACTS DIV Capt J D Arnold 62905

PURCHASE BRANCH Cdr W S Tenhagen 66858

PRODUCTION DIV, AIRCRAFT PROD BR, GM PRODUCTION CONTROL
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Electronics Design & Dev. Div.

Capt W F Cassidy 64586

RADAR BR, GUIDANCE & CONTROL SYSTEMS S D Keim (acting) 64854

Contract Div.

Capt P F Wakeman 62112

PURCHASE BRANCH Cdr J C Snyder 63746

Electronic Companies And Their Subsidiaries Listed According To Net Value Of Military Prime Contract Awards

1 July 1950—30 June 1956

Companies	Millions of Dollars	Percent of U. S. Total
BOEING AIRPLANE CO.	6,175.7	4.4
UNITED AIRCRAFT CORP. United Aircraft Services Corp. Total	5,151.1	3.7
GENERAL ELECTRIC CO.	4,785.5	3.4
DOUGLAS AIRCRAFT CO.	4,293.2	3.1
NORTH AMERICAN AVIATION, INC.	4,180.8	3.0
GENERAL DYNAMICS CORP. Electronic Control Systems, Inc. Total	4,074.9	2.9
LOCKHEED AIRCRAFT CORP. Lockheed Aircraft Services, Inc. Lockheed Aircraft Service International, Inc. Lockheed Air Terminal, Inc. Total	3,552.7	2.5
AMERICAN TELEPHONE & TELEGRAPH CO. Bell Telephone Laboratories, Inc. Nassau Smelting & Refining Co., Inc. Teletype Corp. Weco Corp. Western Electric Co., Inc. Westrex Corp. Total	2,504.9	1.8
CURTISS-WRIGHT CORP. Marquette Metal Products Co., Inc. Propulsion Research Corp. Total	2,404.6	1.7
REPUBLIC AVIATION CORP.	2,332.1	1.7
CHRYSLER CORP. Chrysler Airtemp Sales Corp. Fargo Motor Corp. Total	2,131.2	1.5
SPERRY-RAND CORP. Engineering Research Associates Recording & Statistical Corp. Vickers, Inc. Wheeler Insulated Wire Co. Wright Machinery Co. Total	1,493.6	1.1
GRUMMAN AIRCRAFT ENGINEERING CORP.	1,446.0	1.0
BENDIX AVIATION CORP. Bendix-Westinghouse Automotive Air Brake Co. Total	1,443.2	1.0
MARTIN (GLENN L.) CO.	1,325.8	0.9
WESTINGHOUSE ELECTRIC CORP. Bryant Electric Co. Westinghouse Electric International Co. Westinghouse Electric Supply Co. Windsor Manufacturing & Repair Corp. Total	1,250.1	0.9
McDONNELL AIRCRAFT CORP.	1,215.0	0.9
NORTHROP AIRCRAFT, INC. Radioplane Co. Total	1,084.6	0.8
RADIO CORP. OF AMERICA RCA Communications, Inc. RCA Service Co., Inc. RCA Victor Distributing Corp. Radiomarine Corp. of America Total	973.6	0.7
STUDEBAKER-PACKARD CORP. Aerophysics Development Co. Total	957.5	0.7
HUGHES TOOL CO.	790.8	0.6
ALCO PRODUCTS, INC.	769.9	0.5
KAISER INDUSTRIES CORP. Kaiser Aircraft & Electronics Corp. Kaiser (Henry J.) Co. Kaiser Engineers International, Inc. Kaiser Metal Products, Inc. Kaiser Steel Corp. Willys Motors, Inc. Total	769.6	0.5
HUGHES AIRCRAFT CO.	715.9	0.5
INTERNATIONAL HARVESTER CO. Hough (Frank G.) Co. International Harvester Export Co. MacLeod & Co., Inc. Metropolitan Body Co. Total	685.4	0.5
FAIRCHILD ENGINE & AIRPLANE CO.	676.7	0.5
GOODYEAR TIRE & RUBBER CO. Goodyear Aircraft Corp. Goodyear Engineering Corp. Goodyear Synthetic Rubber Co. Goodyear Tire & Rubber Co. of Vermont Kelly-Springfield Tire Co. Total	673.9	0.5
INTERNATIONAL BUSINESS MACHINES CORP.	661.8	0.5
AVCO MANUFACTURING CORP.	641.8	0.5
INTERNATIONAL TELEPHONE & TELEGRAPH CO. Electrical Products Investors Corp. Federal Electric Corp. International Standard Electric Corp. International Standard Trading Corp. Kuthe Laboratories, Inc. Mackay Radio & Telegraph Co. Total	578.3	0.4
BELL AIRCRAFT CORP. Hydraulic Research & Manufacturing Co. Wheelabrator Corp. Total	559.8	0.4
RAYTHEON MANUFACTURING CO.	554.1	0.4
PHILCO CORP. Dexter Co. Lansdale Tube Co. Total	528.4	0.4
COLLINS RADIO CO.	430.2	0.3
GENERAL TIRE & RUBBER CO. Aerojet General Corp. Pennsylvania Rubber Co. RKO Teleradio Pictures, Inc. Total	406.9	0.3
VERTOL AIRCRAFT CORP.	379.0	0.3
ACF INDUSTRIES, INC. Carter Carburetor Corp. Total	360.0	0.3
GENERAL PRECISION EQUIPMENT CORP. Ampro Corp. Askania Regulator Co. General Precision Laboratory, Inc. Griscom-Russell Co. Hertner Electric Co. International Projector Corp. Kearfott Co., Inc. Librascope, Inc. Link Aviation, Inc. Minnesota Electronics Corp. National-Simplex-Bludworth, Inc. Precision Technology, Inc. Shand & Jurs Co. Society For Visual Education, Inc. Strong Electric Corp. Total	318.9	0.2
BEECH AIRCRAFT CO.	293.1	0.2
STEVENS (J. P.) & CO.	288.9	0.2
MINNEAPOLIS-HONEYWELL REGULATOR CO. Datamatic Corp. Total	258.6	0.2
AMERICAN BOSCH ARMA CORP.	245.6	0.2
UNITED STATES HOFFMAN MACHINERY CO. Aerolab Development Co. Anton Electronics Laboratories, Inc. Intercontinental Manufacturing Co. Radiant Manufacturing Co. Total	236.8	0.2
HAZELTINE CORP. Hazeltine Electronics Corp. Total	223.8	0.2
GILFILLAN BROTHERS, INC.	218.5	0.2
RHEEM MANUFACTURING CO.	215.3	0.2
SYLVANIA ELECTRIC PRODUCTS, INC.	214.3	0.2
AMERICAN MACHINE & FOUNDRY CO. Associated Missile Products Corp. Cleveland Welding Co. Dewalt, Inc. Junior Toy Corp. Potter & Brumfield Manufacturing Co., Inc. Thompson-Bremer & Co. Union Machinery Co. Total	195.9	0.1
MOTOROLA, INC. Motorola Communications & Electronics, Inc. Total	195.6	0.1
CHANCE VOUGHT AIRCRAFT, Inc.	191.4	0.1
MASSACHUSETTS INSTITUTE OF TECHNOLOGY	186.7	0.1
DYNAMICS CORP. OF AMERICA Anemostat Corp. of America Reeves-Ely Laboratories, Inc. Reeves Hoffman Corp. Reeves Instrument Co. Standard Electronics Corp. Winsted Hardware Manufacturing Co. Total	174.3	0.1
GARRETT CORP. Northill Co., Inc. Total	169.3	0.1
HAYES AIRCRAFT CORP.	164.7	0.1
BORG-WARNER CORP. Morse Chain Co. Weston Hydraulics, Ltd. York Corp. Total	159.0	0.1
ADMIRAL CORP. Midwest Manufacturing Corp. Total	154.9	0.1
STEWART-WARNER CORP. Alemite Corp. Bassick Co. Total	136.0	0.1

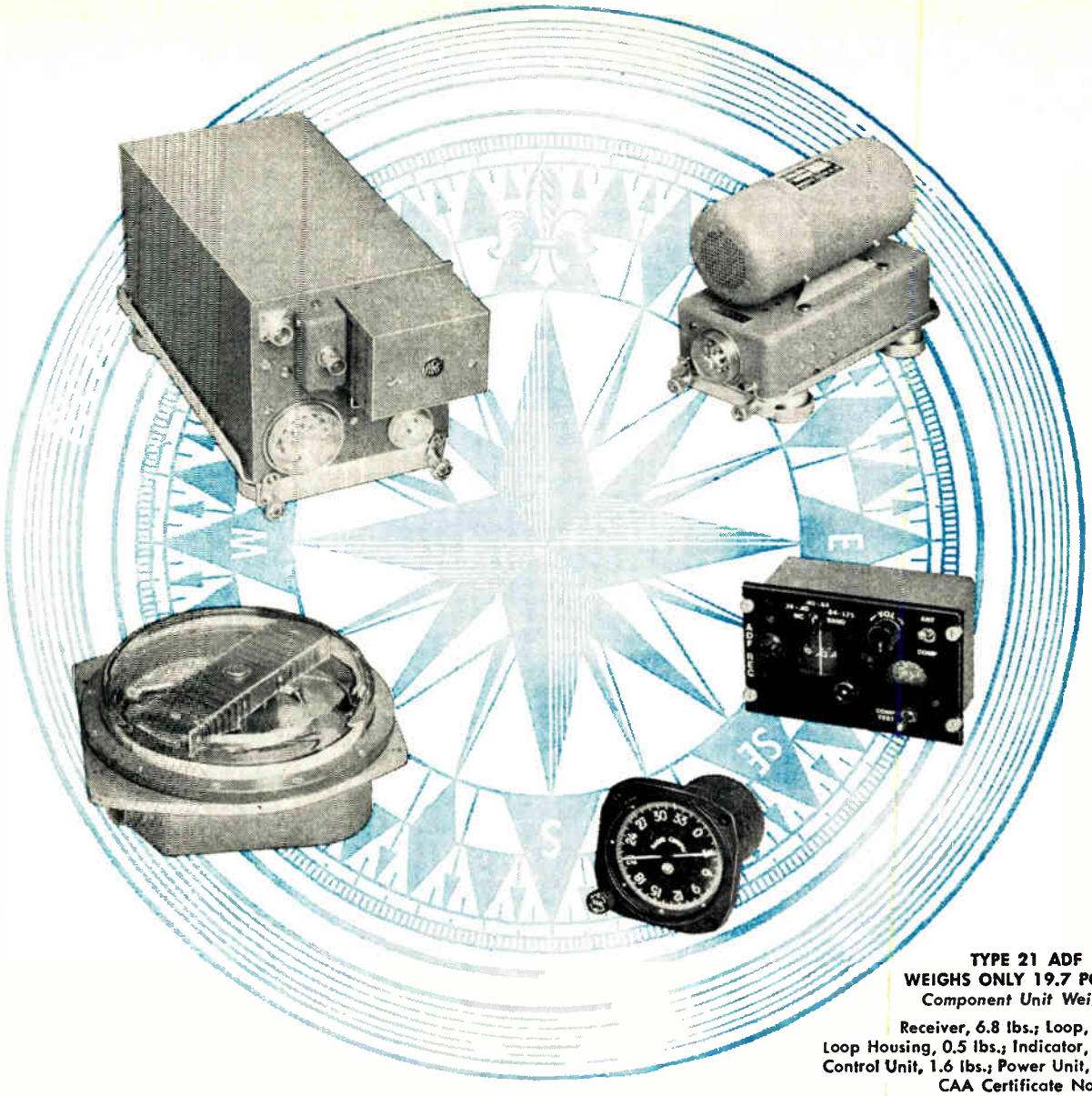
Nuclear Aircraft Study At Lockheed

Preliminary design studies on nuclear aircraft for the U. S. Air Force are being made by the Georgia Division of Lockheed Aircraft Corp. The toughest problem facing the designers is protecting the crew from radiation. In the typical profiles developed so far, the crew compartment is in the nose of the plane, far removed and shielded from the reactor, which is near the tail of the plane.

Designers favor placing the power plant inside the fuselage, instead of in the wings. This keeps the recator close to the engine, reducing the heat transfer problem. A further benefit of this configuration is that with engine, fuel, and landing gear placed in the fuselage, the wings of the atomic plane could be thin, clean, and efficient.

Semiconductor Leads By New Method

Bell Labs has achieved a significant break-through in semiconductor device fabrication. Leads can now be firmly bonded to semiconductor crystals by a combination of heat and pressure. The new Thermo-Compression Bonding technique produces a bond stronger than the lead itself.



TYPE 21 ADF
WEIGHS ONLY 19.7 POUNDS
Component Unit Weights:
Receiver, 6.8 lbs.; Loop, 4.3 lbs.,
Loop Housing, 0.5 lbs.; Indicator, 1.3 lbs.;
Control Unit, 1.6 lbs.; Power Unit, 5.2 lbs.;
CAA Certificate No. 1R 4-9

NEW LOOK in navigation aids

The Time Tested ADF Now In Less Weight, Less Space

The ADF is a basic air navigation instrument, used in all parts of the world, tunable to some 60,000 transmitters. But the important thing now about the ADF is that ARC has engineered an ADF system down to less than 20 pounds in weight, with a comparable saving in space.

Now pilots enjoy the advantages of dual installations of this compact miniaturized equipment in tolerable weight and space requirements.

The ARC Type 21 ADF is built to today's more critical speed and environmental demands. It has hermetic sealing of vital components, such as the entire loop assembly. It covers all frequencies from 190 kc to 1750 kc . . . operates on only 2.8 amps at 27.5 volts dc input. A significant feature is the extremely low loop drag – only two inches below the aircraft skin.

Ask your dealer for detailed literature.

Dependable Airborne Electronic Equipment Since 1928

Aircraft Radio Corporation BOONTON, NEW JERSEY

Miniaturized Automatic Direction Finders
Omni/Lac. Receivers • Course Directors • UHF and VHF Receivers and Transmitters • LF Receivers and Loop Direction Finders • 10-Channel Isolation Amplifiers • 8-Watt Audio Amplifiers • Interphone Amplifiers
Omnirange Signal Generators and Standard Course Checkers • 900-2100 Mc Signal Generators

ARC

PIONEER AWARD

Lawrence A. Hyland (lef), vice president and general manager of Hughes Aircraft Co., Culver City, California, receives IRE Pioneer Award for his demonstration in the early 1930's that radio waves will reflect from objects.

KK2XEI Transmits New NBS L-F Standard

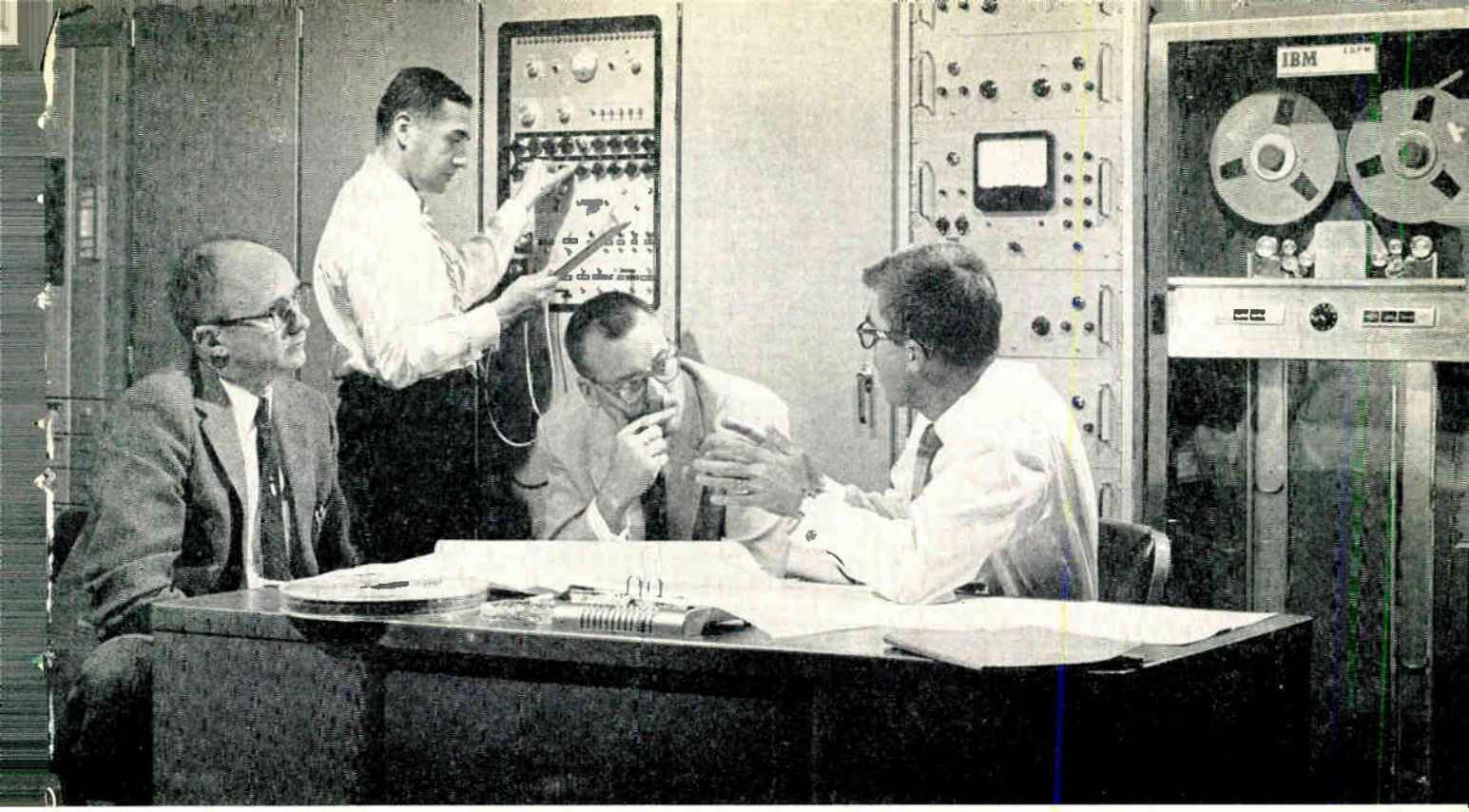
NSB has started experimental 60-KC standard frequency broadcasts from Boulder, Colorado, using the call KK2XEI. Greater accuracy will be obtained when receiving low frequency signals than when using the higher frequencies now regularly transmitted from WWV.

The experimental transmissions have already been used to compare NBS frequency standards with British standards to an accuracy of better than 2 parts in 1 billion. NBS hopes to use the 60 KC transmissions to compare Boulder Labs' highly precise atomic - frequency standard with those in England and elsewhere to an accuracy of comparison better than 1 part in 1 billion.

There is a strong possibility that one high powered VLF station could provide a world-wide frequency and phase standard. Although such a station would be expensive, it would probably represent a saving over the network of HF or VHF stations which would be needed to give a comparable world-wide coverage.

Reps' & Distribs Directory

A production error in the Aug. 1957 issue of EI resulted in the names of some electronic distributors appearing in the manufacturers' reps section and the converse, as well. Corrected reprints are being made available. They may be obtained by writing to The Editor, ELECTRONICS INDUSTRIES, Chestnut & 56th Sts., Phila. 39, Pa.



Here A. E. Sibley (right), Data Systems and Automation section head, discusses new methods of applying digital conversion equipment to a high speed plotting problem with C. M. Wimberley (center), Programming and Mathematical Analysis group leader, and E. K. Fisher, Manager of the Data Services and Mathematics Department. In rear: Electronics Specialist F. A. Alvina operates a recently developed high speed data conversion system producing 704 computer tape directly from originally recorded telemetering tape.

Lockheed Missile Systems announces new positions in

DATA PROCESSING AND ANALYSIS

■ Few areas of missile systems technology equal automatic data processing and analysis in the need for continuing advances.

At Lockheed Missile Systems, a major effort is underway in these fields. Emphasis is on new methods and approaches in all phases of automatic data conversion, processing and analysis.

This expanding program has created a number of new positions for engineers and scientists in areas of flight test analysis, flight test data processing, mathematical analysis and automatic data conversion.

Assignments are of a most advanced nature and include:

- **Flight Test Data Analysis**
  New methods of analyzing reduced data and technical reporting in fields of aerodynamics, propulsion, guidance, telemetry, dynamics, environmental testing and behavior of ballistic and non-ballistic missiles.
- **Flight Test Data Processing**
  Developing new methods of processing, making maximum use of automatic equipment.
- **Mathematical Analysis**
  Utilizing IBM 704 and 650 digital computers on advanced data processing, celestial mechanics, thermodynamics, flight controls and aerodynamics. New approaches to complex problems are stressed.
- **Automatic Data Conversion**
  Developing new procedures and systems of electronic and electromechanical equipment to reduce human operations and decisions to a minimum and to convert large amounts of data into optimum form for advanced analysis.

Positions are open through supervisory levels. Those possessing a high level of ability and interest in these growing fields are invited to address the Research and Development Staff at Palo Alto 5, or Van Nuys 33, California.

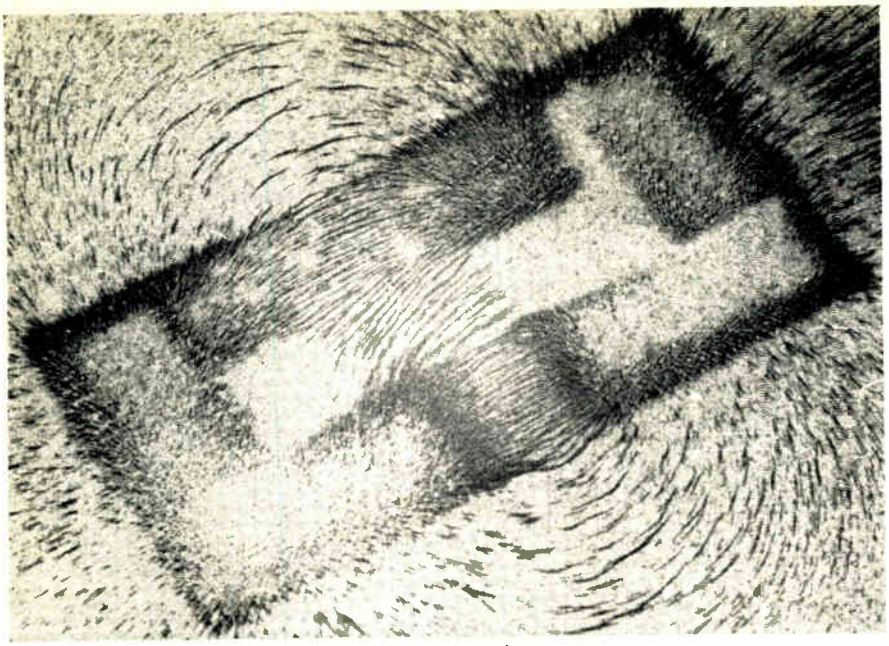
Lockheed MISSILE SYSTEMS

A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

VAN NUYS • PALO ALTO • SUNNYVALE

CALIFORNIA

Circle 52 on Inquiry Card, page 101



Flux pattern of experimental magnetic circuits

How location of magnets affects magnetic circuits

Adapted from an article by Charles A. Maynard, vice president, Research and Engineering, The Indiana Steel Products Company

The LOCATION of permanent magnets in a magnetic circuit is a definite factor in design. To determine the extent to which this is true, involved calculations are necessary.

A comparatively simple experiment, however, which shows the nature of the changes that take place when permanent magnets are placed in different positions in a magnetic circuit, was devised by Mr. Maynard. The material on which the following questions and answers are based was taken from a report, "An Experiment in Magnet Location," published in Vol. 3, No. 5, of Applied Magnetics. *A copy of this issue is available on request to The Indiana Steel Products Co., Dept. N-9. Valparaiso, Ind.*

Question: What effect does the location of permanent magnets have on a magnetic circuit?

Answer: It has a marked influence on the flux density in the various portions of the magnetic circuit.

Question: Is there a preferred location for magnets?

Answer: Yes, it is important to place the magnets as close to the air gap as possible.

Question: What is the benefit of their location?

Answer: The leakage flux is reduced, and the useful flux in the air gap is increased.

Question: How is this an important factor in design?

Answer: It minimizes the amount of magnet material required to produce a given flux in the air gap.

Question: Does this mean lower magnet costs?

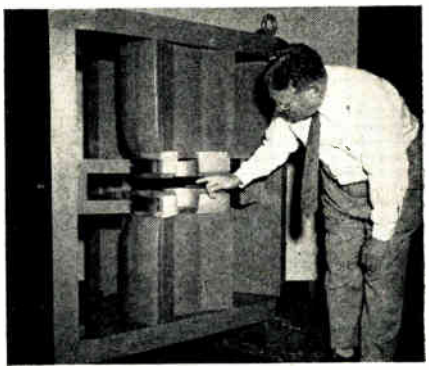
Answer: Generally, this is true. However, structural considerations may prevent the placement of permanent magnets at preferred positions.

Question: Are there available quantitative data which indicate the degree to which magnet position influences the efficiency of a circuit?

Answer: A brief experiment was conducted on the nature and magnitude of the changes that occur when magnets are placed in various positions in a simple magnetic circuit. The results are discussed in *Applied Magnetics*, Vol. 3, No. 5.

World's largest permanent magnet separates electron particles

The largest and most powerful permanent magnet ever designed is an important part of a new Mass Spectrometer to be used for high molecular weight hydrocarbon analysis at the Whiting, Indiana, research and development laboratories of a large Midwestern oil company. Function of the spectrometer is to establish a strong magnetic field that separates electron particles.



Indiana's C. A. Maynard inspects air gap of giant Alnico V magnet assembly

The Alnico V permanent magnet used in the assembly has a maximum field strength of 6,000 gauss . . . equal to 10 tons of magnetic holding force . . . and weighs 1,300 pounds. The complete assembly, which weighs approximately 4,700 pounds, was designed and fabricated by The Indiana Steel Products Company, Valparaiso, Indiana.

Whether it's Standard or Custom Designs...

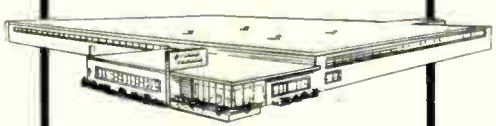
Custom Designs Manufactured by Electrical Industries

E-I has the solution!

Customer-made Components Sealed by Electrical Industries

GLASS-TO-METAL SEALS*

New E-I Plant Speeds Production!



The Murray Hill facility is newly equipped throughout. Tighter quality controls, testing and inspection plus vastly increased production mean better products, faster than ever before.

*Canadian Pat. 523,390; British Pat. 734,583; U. S. Patents Pending.

Here's 3-way service for designers

Electrical Industries offers complete facilities for the sealing of components in a wide range of sizes from large to sub-miniature. E-I will design and produce your complete sealed assembly, or seal components of your manufacture. The wide experience of E-I engineers is available to work out special seal requirements. For standard applications, E-I offers hundreds of economical stock terminals including single lead, multiple headers, end seals and transistor closures. Ask for a recommendation on your seal requirements or request catalog on standard E-I sealed components.

ELECTRICAL INDUSTRIES
MURRAY HILL, NEW JERSEY

A Division of Philips Electronics, Inc.

Circle 54 on Inquiry Card, page 101

Personals

Michael Z. Laslo and **George A. Phillips** have been appointed field engineers for Neely Enterprises.

Everett H. DeBruhl has been appointed eastern regional field engineering manager and **Willard M. Mecum** has been appointed field engineering supervisor in the Los Angeles District for the ElectroData Div. of the Burroughs Corp.

Charles B. Kish has been appointed chief engineer, Rectifier Div., Sel-Rex Corp. He will be responsible for much of the intricate circuitry design necessitated by the large power conversion units the company has contracted to build for several electrochemical manufacturers.

C. B. Kish

S. C. Spielman

Sterling C. Spielman was just appointed director of engineering for Philco's Government and Industrial Div. He will have full responsibility for all design and development engineering activities of the division. He holds several patents in the field of electronics.

Wilbur Erickson and **Manny Otis** have joined the Systems Div. of Daystrom, Inc., as systems engineers. Erickson was formerly with Ampex and Otis was formerly with the USAF Cambridge Research Center's Computer Laboratory.

L. D. Strom and **W. R. Hedeman, Jr.**, are now assistant chief engineers in the Apparatus Div. of Texas Instruments, Incorporated.

Archie F. Boscia has been appointed chief product engineer for KinTel Div. of Cohu Electronics, Inc. He was formerly with Stromberg-Carlson Div of General Dynamics.

Two brothers, **Boghos** and **Garbis Saatjian** have joined the Triad Transformer Corp. as engineers. They had owned and operated a transformer manufacturing company in Aleppo, Syria, prior to coming to the U. S.

L. E. (Whitey) Blank is now assistant chief engineer for the Webster Electric Co. He will be responsible for the firm's sound equipment line.

Richard A. Rall has been appointed Chief Engineer of the Heavy Duty Rectifier Div. of the Perkin Engineering Corp.

for low voltage power supply...

SANGAMO
Type DCM
Electrolytic Capacitors

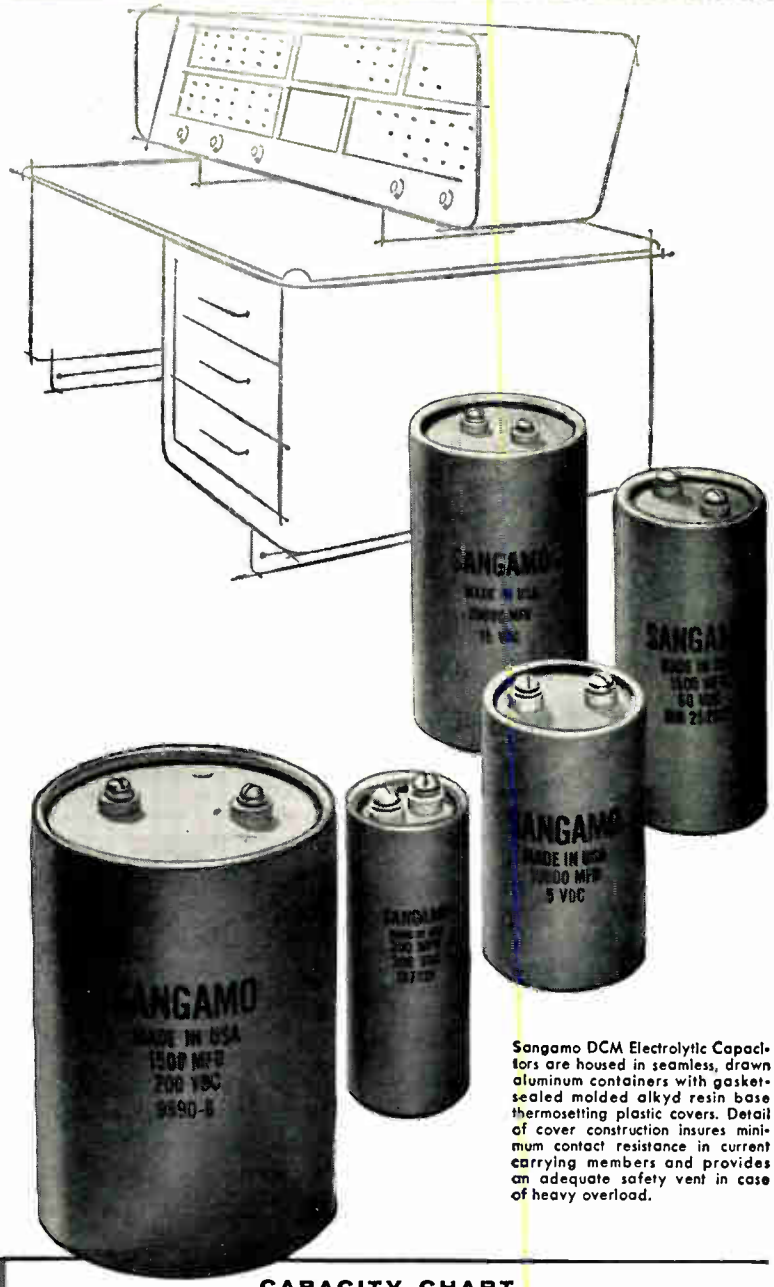
In computers, calculators, electronic controls, and related equipment—wherever *capacity stability with long life* is a must—count on Sangamo Type DCM Electrolytic Capacitors.

They minimize ripple voltage and insure steady, stable DC voltage. They save space by eliminating any need for heavy, bulky choke components with their substantial and often-varying load voltage drops.

Maximum Voltage Rating: 450 VDC

Sangamo DCM Electrolytic Capacitors provide exceptionally low equivalent series resistance . . . assure extremely high capacity for case size in low voltage ranges . . . and are specially designed to permit high ripple current without overheating. They can be supplied in maximum energy content rating of 80-watt seconds in voltage ratings from 15 to 450 VDC. Maximum capacity value of 33,000 mfds. can be supplied at 15 WVDC.

Write to-day for your file copy of Sangamo Engineering Bulletin TS-114.



Sangamo DCM Electrolytic Capacitors are housed in seamless, drawn aluminum containers with gasket-sealed molded alkyd resin base thermosetting plastic covers. Detail of cover construction insures minimum contact resistance in current carrying members and provides an adequate safety vent in case of heavy overload.

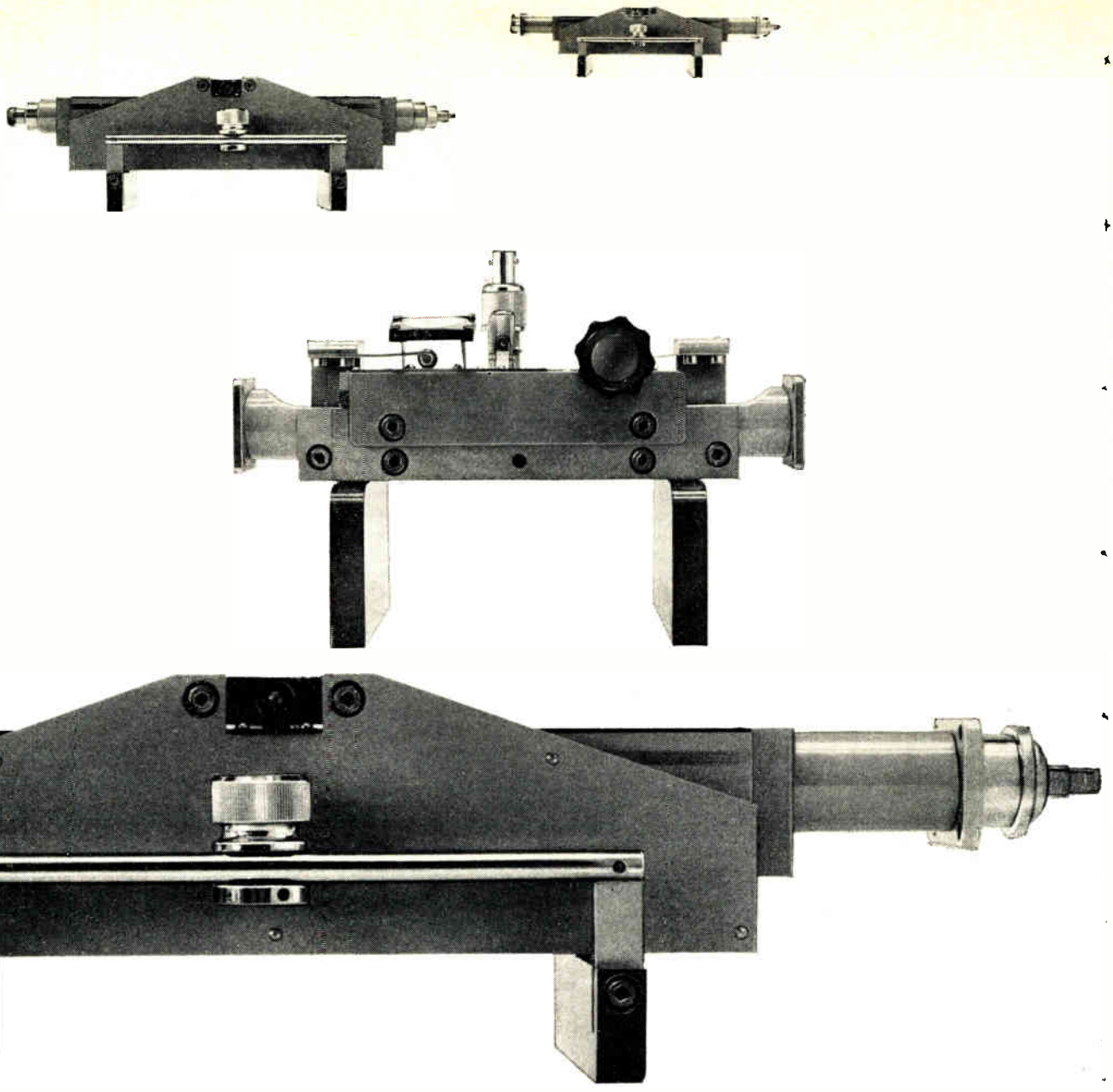
CAPACITY CHART

Rated Voltage DC	Surge Voltage	Max. Cap. in 2⅛ x 4⅝ Can	Max. Cap. in 2⅝ x 4½ Can	Max. Cap. in 3⅛ x 4½ Can
15	20	12,500	20,000	25,000
30	40	9,000	15,000	20,000
50	75	4,800	8,000	10,000
100	125	2,000	3,500	5,000
150	175	1,500	2,500	3,500
200	250	1,000	1,500	2,500
250	300	800	1,250	1,750
300	3[illegible]	700	1,000	1,500
350	400	600	1,000	1,250
400	475	400	500	1,000
450	525	350	400	800

For additional capacity and voltage combinations, write us.

SG67-1

SANGAMO
Electric Company
Electronic Components Division
SPRINGFIELD, ILLINOIS



FINEST, MOST COMPLETE LINE of Precision Slotted Sections

TYPICAL SPECIFICATIONS

Model	Line Size	Equivalent Wave Guide Type	Frequency Range kmc/sec	Insertion Length
200-C	7/8"		1.0 to 4.0	17"
215-A	3/8"		1.0 to 4.0	14 3/8"
203-E		RG-52 U	8.20 to 12.4	7 1/8"
210-A		RG-91/U	12.4 to 18.0	8 1/8"

For full technical details on the complete line of PRD Slotted Sections, or for consultation on the particular model best suited to your needs, call your local PRD Engineering Representative; or write to Applications Engineering Group E.

Be sure to take in the PRD Exhibit at the NEC Show, Booth 162-163.

Ready for IMMEDIATE Delivery!

Whether you are working up VSWR or impedance data in the design or testing of new transmission line components, or are designing an impedance matching device for monitoring antenna and transmission line VSWR in communications systems . . . PRD Slotted Sections provide the superlative answer for precise and accurate information with simplicity and dependability of use.

They have no equal in providing precise standing wave and impedance measurements. PRD Slotted Sections are built of precision-machined "micro-finished" transmission line.

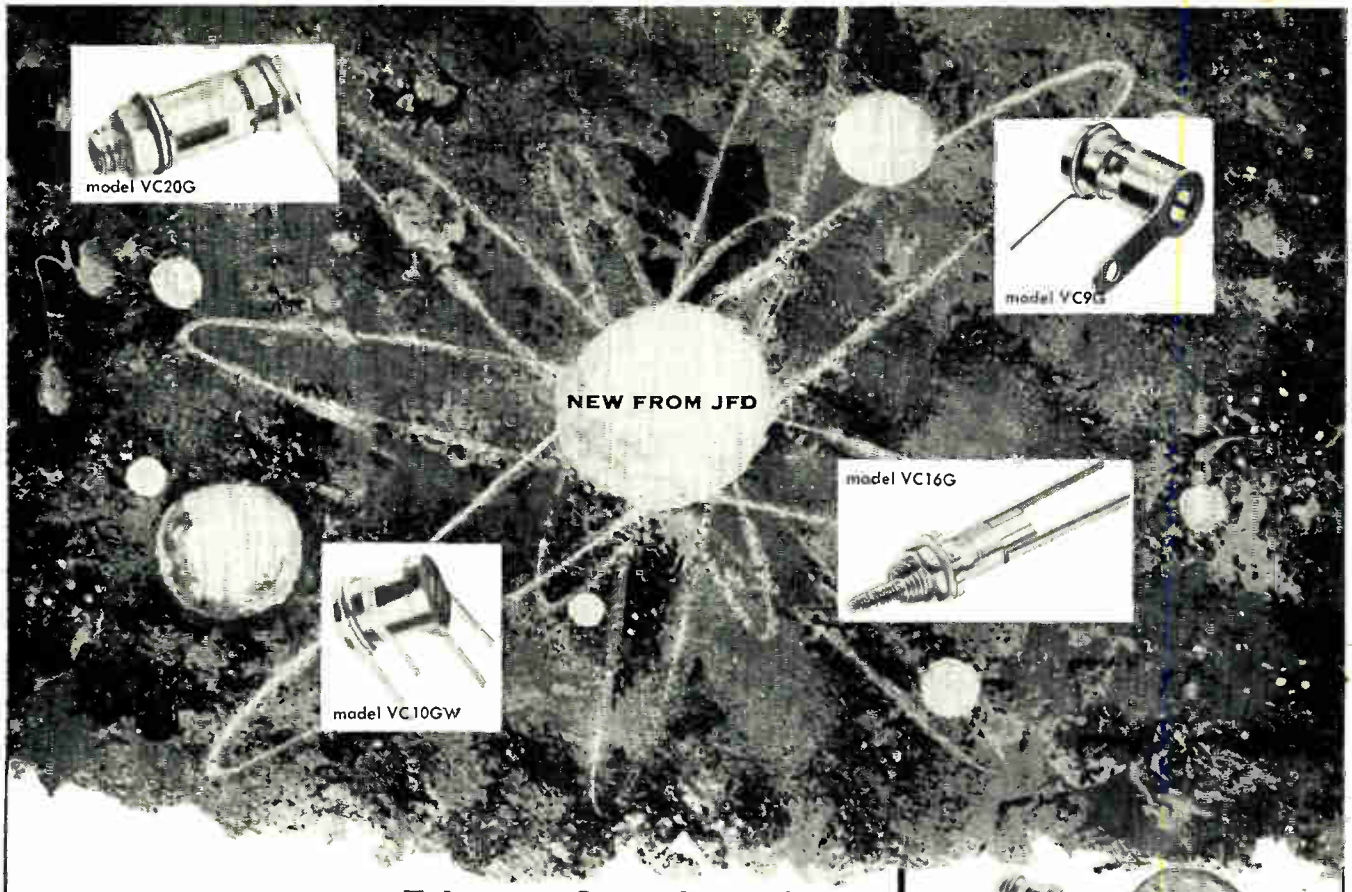
The probe is secured to a ball-bearing carriage that travels in precision-ground, hardened grooved runways. Thus the probe travels in a path exactly parallel to the axis of the transmission line. A marked advantage of PRD Slotted Sections is their permanent adjustment, at the factory, to zero slope—there is no need for adjustment to correct for changing slope characteristics. PRD Slotted Sections are designed to mate with standard MIL type connectors and flanges. Low reflection adaptors are available where additional types of connectors are used.

The ultimate in precision measurements is achieved when PRD accessory items such as Type 250-A Broadband Probe and Type 218-K Accessory Kit are used.

POLYTECHNIC RESEARCH & DEVELOPMENT CO., Inc.

202 Tillary Street, Brooklyn 1, N. Y.

Circle 57 on Inquiry Card, page 101



Trimmer Capacitors for Miniaturization and Subminiaturization


model VC10GW
actual size

WHERE DESIGNS CALL FOR MAXIMUM RANGE IN MINIMUM PHYSICAL SIZE

VC9G Trimmer series (lug & lead type for printed circuits)

Model	Capacitance Range (MMF) Min.	Max.
VC9G	0.8	8.5
VC10G	0.8	4.5
VC31G	0.8	12
VC32G	0.8	18
VC42G	1	21
VC43G	0.8	30

VC9GW Trimmer series (4 wire type for printed wiring boards)

Model	Capacitance Range (MMF) Min.	Max.
VC9GW	0.8	8.5
VC10GW	0.8	4.5
VC31GW	0.8	12
VC32GW	0.8	18
VC42GW	1	21
VC43GW	0.8	30

VC20G Trimmer series (panel type)

Model	Capacitance Range (MMF) Min.	Max.
VC20G	0.8	8.5
VC21G	0.8	4.5
VC22G	0.7	12
VC23G	0.8	18
VC24G	1	30

These new miniature types incorporate the exclusive new JFD telescoping tuning assembly. Both the telescoping piston and self-contained adjustment shaft function as a low inductance coaxial assembly within the dielectric cylinder. This innovation makes possible a highly compact variable trimmer piston capacitor of minimum size for the given capacitance range—up to 50% reduction in overall length compared to previous similar types.

VC16G Split stator series (panel type)

Model	Capacitance Range (MMF) Plate to Plate Min.	Max.
VC16G	0.8	2.5
VC17G	1.1	4.5
VC18G	1.8	7.5
VC80	0.4	1.0
VC81	0.6	1.6
VC82	0.85	2.8
VC83	3.0	6.0

The new JFD Split Stator trimmer series was expressly engineered for critical push pull radio frequency circuits and similar sensitive networks. The extreme stability and low temperature coefficient of the quartz dielectric types recommend these trimmers for applications requiring extreme low-loss operation with maximum tuning resolution. Where maximum range for physical size is needed, you have your choice of the JFD glass dielectric split stator type.

JFD keeps pace with new trimmer capacitors ready to meet new challenges. The result is today's JFD line of 42 Precision Trimmers (the industry's largest) to meet your most critical network design and production needs.

Write for Bulletins 201A, 202A, 203A and 204A, for comprehensive electrical data on above JFD trimmers.

PHONE: DEWEY 1-1000

JFD ELECTRONICS, INC.

PIONEERS IN ELECTRONICS SINCE 1929

1462 62nd Street, Brooklyn 19, New York

Temperature Near Zero

(*Continued from page* 59)

thermistors with decreasing temperature is expressed in first approximation by the formula:

$$\log \frac{\rho_1}{\rho_2} = \frac{B\,(T_2 - T_1)}{2.303 \cdot T_1 \cdot T_2} \qquad (2)$$

In which ρ_1 and ρ_2 represent resistivities at the respective absolute temperature T_1 and T_2. For a given temperature interval $T_2 - T_1$ the constant B is a linear function of Briggs logarithm of the resistivity ratio between T_1 and T_2. Between +20 and −183.3°C this ratio can be kept within a tolerance of ±10% for a series of ratio values ranging from 1000 to 20,000 corresponding to B-constant from 900 to 1300.

If these thermistors are cooled into the temperature range of liquid hydrogen which is necessary to produce superconductivity in vanadium silicide or similar compounds and to operate devices working with this effect, they again encounter a resistivity barrier and become obsolete because of their high resistance.

Further developments have now closed the gap between the boiling points of liquid hydrogen (20.4°K) and liquid nitrogen (77.6°K) with thermistors having a reasonable resistance value within this range (Type 3, Fig. 1). At this time, it may be mentioned that the negative temperature coefficient of thermistors offers certain basic advantages over metals. Because of the fact that the resistance value tends to increase with decreasing temperature, the lead resistance for very low temperatures can normally be neglected. In metallic resistance thermometers having decreasing resistivity, the residual resistance can be so small that the lead resistance becomes troublesome.

The application of heavier leads with lower resistance, on the other hand, would increase the heat exchange between the cooled device and the environment, resulting in uneconomical operation. The fact that thermistors, on account of the negative temperature coefficient of resistivity, are free of this trouble,

makes them attractive for certain low temperature applications.

If we go back to those thermistors which were developed for the temperature range between liquid oxygen and liquid nitrogen, we find that even those with the lowest B-constant of approximately 900 will have resistivities of more than 10^{14} ohm centimeter or 10^{8} megohm in the liquid hydrogen range. A decisive reduction of the resistivity to values which can be used in normal circuitry, for instance a few megohms, involves much smaller B-constants of the order of 300 or less, corresponding to activation energies <0.03 e.v.

The constant B or the activation energy can be influenced by the impurity concentration in the semiconducting thermistor material. If this concentration is extremely high, the semiconductor can degenerate. In this case, the number of current carriers becomes practically independent on temperature and the temperature coefficient metallic. There are two ways to

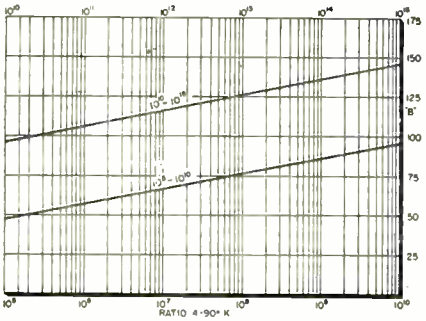


Fig. 2: This graph shows resistance ratio between 90° and 4°K vs. B.

accomplish high impurity concentrations:

a. Introduction of foreign impurities.
b. Creation of stoichiometric deviations.

By systematic combination of both methods, new thermistor types were created which can be used for temperature measurement and control in the entire range from 18 to 90°K. (See Table I.)

Resistance values of the order of 10^{7} ohm may still be tolerated for many measurements and circuits. This would make it possible to use the group with -60% per degree temperature coefficient down

(*Continued on page* 108)

(*Continued from page* 107)

to —260°C (13°K). The boiling point of liquid helium is 4.2°K.

Table 1

Practical range of Resistance, Temperature coefficient and B-value for disk thermistors in liquid oxygen and liquid hydrogen

a.) −183.3°C = 89.85°K			
Resistance value	90–450 ohm in tolerance groups of ±20%		
Temperature coefficient	−2.55	−3.10	−3.70% per degree
B-value	200	240	290
b.) −252.75°C = 20.4°K			
Resistance	300–3000 Kohm in tolerance groups of ±30%*		
Temperature coefficient	−58	−74	−95% per degree
B-value	200	240	290

* Corresponding to ≦ ±½° tolerance according to the specified temperature coefficient.

4°K and Below

How will these thermistors which are still useful for liquid hydrogen perform in liquid helium? This question is roughly answered by Fig. 2 in which the resistance ratio between 90° and 4°K is plotted

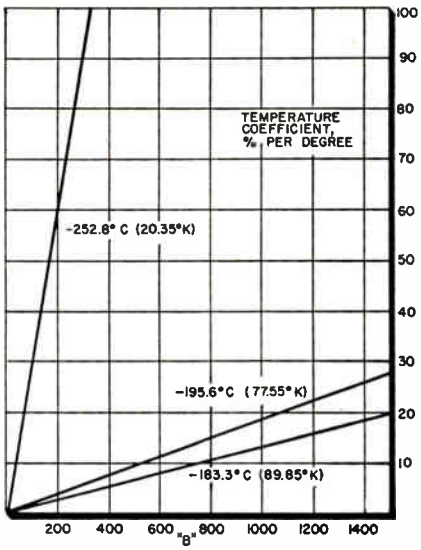


Fig. 3: Temperature coefficient in % per degree C in dependence on B for −183.3°, −195.6°, and −252.8°C.

against the corresponding B-values. It is evident that even the lowest B-values of the liquid hydrogen thermistors result in resistance ratios of 10^{18} and more, between these two temperatures, making them obsolete and useless for liquid helium. Further progress seems

(*Continued on page* 112)

Arnold Magnetic Materials

. . . the most complete line in the industry

PERMANENT MAGNET MATERIALS

Cast Alnico Magnets

Sintered Alnico Magnets

Vicalloy

Cunife

Arnox III

HIGH PERMEABILITY MATERIALS

Tape Wound Cores of Deltamax, Supermalloy, Permalloy

"C" and "E" Cores of Silectron

Bobbin Wound Cores

Molybdenum Permalloy Powder Cores

Iron Powder Cores

Sendust Powder Cores

Special Magnetic Materials

PRECISION-TESTED TO YOUR SPECS . . .

Arnold magnetic materials can answer all your requirements. It is the most complete line in the industry; and in addition, Arnold maintains complete control over every production step from raw materials to finished products.

Typical testing of Molybdenum Permalloy Powder Cores is illustrated above. Precision equipment and methods such as these accurately measure the properties of all magnetic materials before shipment, insuring ultimate performance in accordance with your specifications.

Such a source can bring you advantages in long experience and undivided responsibility, and in unequalled facilities for quality control and production.

• *Let us supply your needs!*

WSW 6781

THE ARNOLD ENGINEERING COMPANY

Main Office & Plant: Marengo, Illinois

Repath Pacific Division Plant: 641 East 61st Street, Los Angeles, Calif.

District Sales Offices:

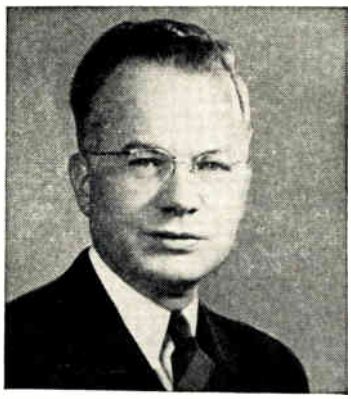
Boston: 200 Berkeley St. Los Angeles: 3450 Wilshire Blvd.

New York: 350 Fifth Ave. Washington, D.C.: 1001-15th St., N.W.

What good is specialized business

No one is in a better position to give a hard-boiled, practical answer to this question than the men who spend their working lives on the sales front... the men the ads are supposed to help... the men who sell.

Here are the statements of salesmen who know what advertising does for them when it appears in the industrial, trade or professional publications that serve the specialized markets to which they sell:



William F. Mattes, Jr.
Lamp Division,
General Electric

Sells retailers

Says Mr. Mattes: "My selling is mostly with the headquarters offices of chains—variety stores and food stores. Matter of fact, some of these chains, particularly in the variety store field, do not permit salesmen to call on store managers. They prefer to interview sales people at headquarters, and then send out mimeographed letters to their districts and store managers.

"This makes our trade ads doubly important—they have to take the place of salesmen with the individual store manager or department manager; and they add color and pictures and enthusiasm to the letters that are passed down from headquarters.

"In the old days, the idea of trade paper advertising would simply be to say: 'Stock General Electric lamps, they have the best customer preference.' Today the tendency is to be more specific, to show pictures of the product, illustrations of displays, and pertinent merchandising information. For instance, it is a good merchandising service to be able to tell chain retailers the proportionate popularity of different size bulbs, different colors and types, so that the best merchandising effort is made on the fast selling items. Any facts like these in our trade advertising help the chain store managers and so, of course, make our sales effort that much easier and more productive.

"Trade advertising very definitely helped us introduce and sell packaged light bulbs. Half our unit sales come in bulbs in the 25 to 100 watt range. Knowing this, we put these popular sizes in a handy 4-bulb package. Merchandising bulbs in packages was quite a revolutionary idea when we first introduced them ten years ago, and trade advertising was used to help sell the idea to store managers. Of course, some variety stores still sell loose bulbs, but more and more the trend is toward packaged sales."

Chester Burt
American Hard
Rubber Co.

Sells industry

Says Mr. Burt: "After some years as an inside man at American Hard Rubber, I'm taking on my first sales territory and believe me, I'd be worried if I didn't have good leads from our business paper advertising. They give me something to latch on to. With an advertising lead as a start I find there's a better possibility of something coming from a call than if I made a cold call.

"For one thing, even if the man who sent in the inquiry isn't in a very important position in the company, at least the inquiry gets me through the door and once I'm inside I can work it out.

"Another thing I've found is that I can do a better job of planning my trips if I have some advertising leads. More worthwhile calls can be scheduled and it's possible to accumulate leads

publication advertising?

to make a profitable trip to out-of-the-way areas. Of course, on top of all this, I think that in many cases where I've gotten business, trade advertising has reached some of the people inside that I can't see; like people who leave it to others to interview salesmen, but still have to give the final okay themselves."

Robert E. Furer
Mead Johnson & Company

Sells physicians

Says Mr. Furer: "I know that our journal advertising gets a message to the physicians I call on. Here's an example.

"Just the first of this year we adopted the Mead Johnson slogan, '*Symbol of Service in Medicine*'. Last week when working in New Haven, I had three physicians say to me, 'How is the Symbol of Service in Medicine today?'. They did not get the slogan from me. They must have had their thoughts jell from our advertisements in the ethical specialty journals.

"One very important thing is I know our advertising is selling items for me when that item is not on our list of products to push for the current period. For instance, Sustagen is a hot product we have in our line and it's not on our list this quarter. I love the product. It helps people be well fed and stay on the job. But this quarter my instructions are to put major effort on other items. Every time I'm tempted to deviate from the program and go after the big dollar-volume potential of Sustagen sales, I'm reassured that because of our advertising in the journals it is not being forgotten by my doctor friends. Man, this kind of help keeps you on the ball and helps me utilize the three to five minutes of face-to-face selling I have available to me with my doctor friends."

Frank Kistenberger
Metallizing Engineering Co., Inc.

Sells industry

Says Mr. Kistenberger: "I happen to know that better than 50% of my sales to new companies can be traced to leads from our business paper advertising. Another 25% of my sales to new owners I close after following up leads that can't be traced directly to our advertising, but I know darn well that that's where they come from because that's about the only place they could learn about our metallizing systems.

"It's been my experience that our trade advertising is getting to the right people. In many cases this man is an executive who is hard to see on a cold call. But he's a guy that will take the time and trouble to read and he's just the one to drum up interest in metallizing down the line in his company. In other words, you get more action if the suggestion comes down to the production department or the plant engineer from this executive."

Why not ask your own salesmen what your company's business publication advertising does for them. If their answers are generally favorable you can be sure that your business publication advertising is really helping them sell. If too many answers are negative it could well pay you to review your advertising objectives—and to make sure the publications that carry your advertising are read by the men who must be sold.

National Business Publications, Inc.

NBP

...each of which serves a specialized market in a specific industry, trade or profession.

1413 K Street, N.W., Washington 5, D. C. • STerling 3-7535

(*Continued from page* 108)

possible and a few hopeful starts have been made to expand the thermistor scale to B-values of 50-70 corresponding to ratios of 10^5 to 10^7 between 4° and 90°K. However, it is still doubtful whether these specimens will grow to reliable units of moderate price.

At temperatures below 4°K the situation looks somewhat brighter again. In the past few years, carbon resistors have been recommended for this range (Type 4, Fig. 1). A critical study of carbon resistance thermometry below 1°K (2) has shown that commercial carbon resistors are very different in their behavior at these low temperatures. Types with B-values as low as 1 to 3 were found among these groups. One of them with the resistance ratio of 7.2 between 0.3° and 4.2°K has been suggested as a useful resistance thermometer below 1°K.

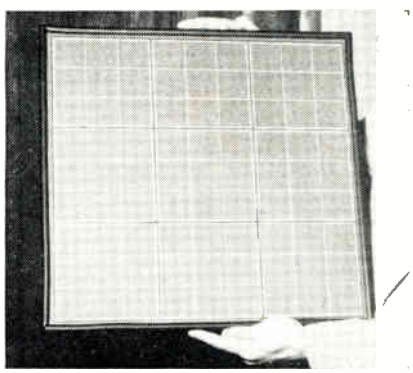
Acknowledgments

The author wishes to thank Mr. G. W. Vollmer for his assistance and Keystone Carbon Company for granting permission to publish this information. Mr. R. D. Goodwin of the National Bureau of Standards, Cryogenic Engineering Laboratory, has supported this project by measurements in liquid hydrogen. I am greatly indebted for this important contribution.

References

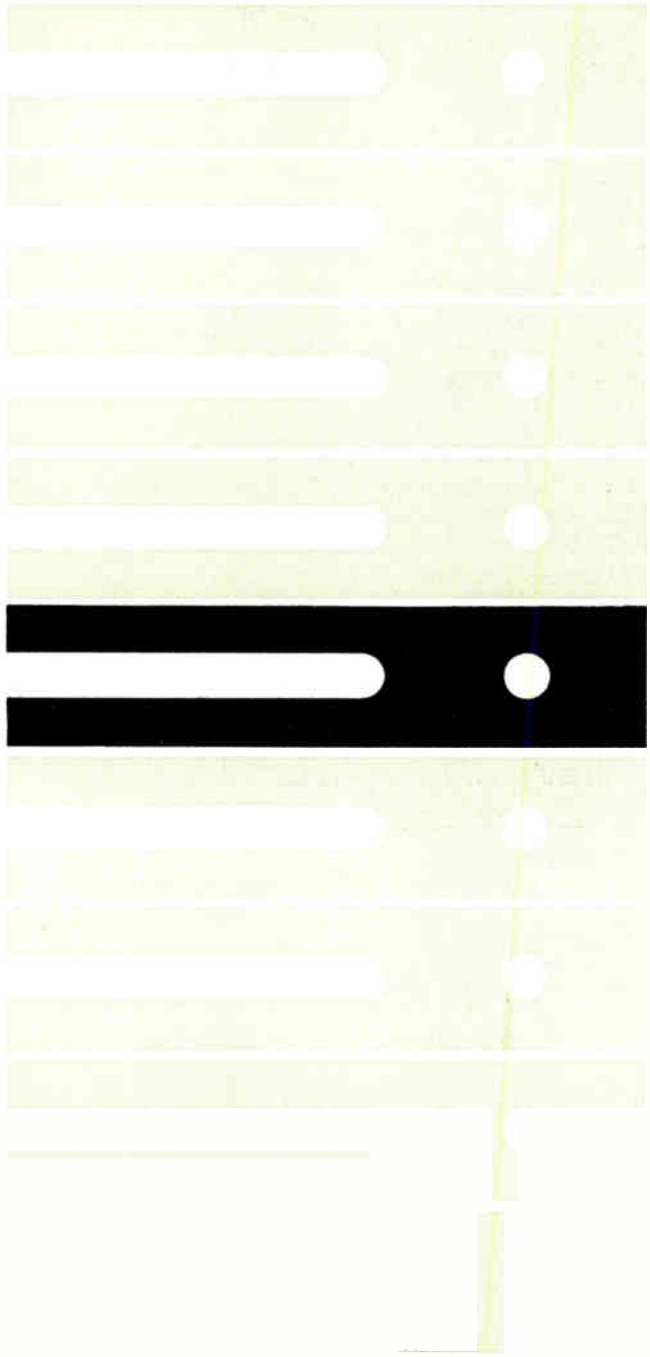
1. G. B. Yutema, Bulletin of the American Physical Society. Volume 30, Page 58 (1955).
2. T. Nicol and T. Soller, Bulletin of the American Physical Society. Series II, Volume 2, No. 1, Page 63 (1957).
3. T. Babiskin, Bulletin of the American Physical Society. Volume 30, Page 68 (1955).
4. Low Resistance Thermistors As Ultra-Cold Thermometers, H. B. Sachse, Electronic Industries, January 1957.

SUN BATTERY



This 18" by 18" selenium sun battery, developed to convert solar energy to electrical current for a wide variety of applications was displayed at WESCON by International Rectifier Corporation of El Segundo, California.

Tuning Fork Controlled



Tuning Fork Resonators, the ultimate in precision audio frequency control.

PHONE OR WRITE

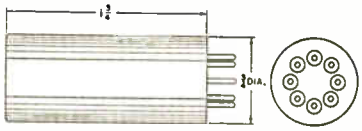
for complete information regarding component type Tuning Fork Resonators, and variously packaged Frequency Standards, Oscillators, Drivers, and Frequency Dividers.

PHILAMON LABORATORIES INC.

90 Hopper Street, Westbury, Long Island, N. Y. EDgewood 3-1700

New 3/4" Sensitive Relay

APPLICABLE TO PRINTED CIRCUITS



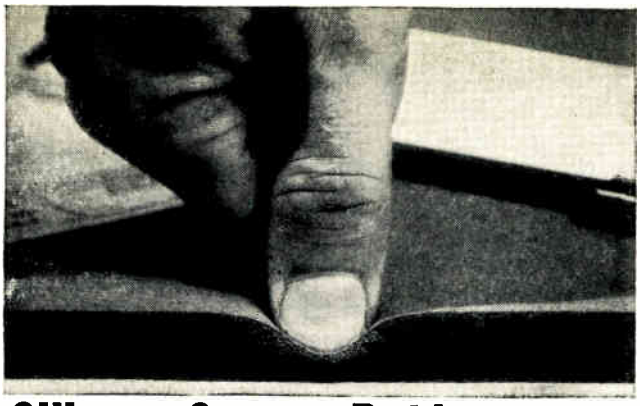
Allied Type RSH

ELECTRICAL SPECIFICATIONS

Contacts: Up to D.P.D.T. rated at 2 amperes at 26.5 volts DC or 115 volts AC resistive load
Coil: Sensitivity—40 milliwatts D.P.D.T., 22 milliwatts S.P.D.T.
Resistance—up to 14,000 ohms
Temperature: Minus 60° C to plus 125° C
Vibration: 10G up to 500 cycles
Shock: 50G plus (operating)
Altitude: 70,000 feet or 1.3 inches of mercury
Terminal Type: Solder, plug-in, and printed circuit
Weight: 2 ounces

Write for catalog sheet giving complete information

ALLIED CONTROL
ALLIED CONTROL COMPANY, INC.
AL-161 **2 East End Avenue, New York 21, N. Y.**
Circle 65 on Inquiry Card, page 101



Silicone Sponge Rubber

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.

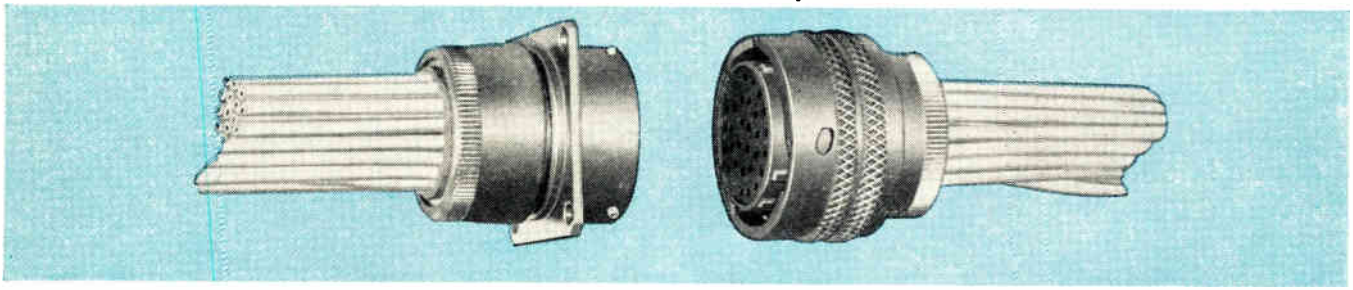
FREE SAMPLES and folder—write, phone or use inquiry service.

CONNECTICUT HARD RUBBER
NEW HAVEN 9 **CHR** CONNECTICUT

AIRFRAME SEALS | SILICONE RUBBER COATED FABRICS | SILICONE RUBBER SHEET & SPONGE | MOLDINGS & EXTRUSIONS

Circle 66 on Inquiry Card, page 101

Bendix "PT" PYGMY ELECTRICAL CONNECTOR WITH 5-KEY POLARIZATION, 3-POINT LOCK



Positive locking feature eliminates safety wiring

The new Bendix* "PT" connector represents the greatest advance yet achieved in miniature connector design. It incorporates more exclusive features than any miniature connector on the market. Here are a few of the things that make the Bendix "PT" outstanding in the connector field today:

- Safety wiring completely eliminated
- Mechanically assisted coupling and uncoupling through cam action
- Visual and audible inspection of coupling—perfect for "blind" locations
- Three-point bayonet lock; perfect axial alignment of mating parts at all times
- Constant spring tension behind mated insert faces
- Five key polarization—positive protection against mismating or cross-plugging
- Resilient inserts, performance-proved in millions of Bendix connectors over the past ten years
- Heavy gold plating over silver on all contacts
- Closed entry, probe-proof socket contacts
- Both pin and socket contacts machined from high-grade copper alloy
- Machined bar stock or impact-extruded shell components cadmium-plated to QQP-416; olive drab iridite after treatment

"PT" connectors accommodate about three times as many circuits, size for size, as comparable "AN" connectors. Like so many Bendix products, they are a result of the traditional Bendix policy of anticipating the needs of the aviation industry, in this case the trend to higher voltages and smaller conductors. *TRADEMARK

SCINTILLA DIVISION of SIDNEY, NEW YORK
Bendix AVIATION CORPORATION

Export Sales and Service: Bendix International Division, 205 East 42nd St., New York 17, N. Y.
FACTORY BRANCH OFFICES:
117 E. Providencia Ave., Burbank, Calif. • Paterson Building, 18038 Mack Ave., Detroit 24, Mich. • 545 Cedar Lane, Teaneck, N. J. • 5906 North Port Washington Rd., Milwaukee 17, Wisc. Hulman Building, 120 W. Second St., Dayton 2, Ohio • 2608 Inwood Road, Dallas 19, Texas • 8425 First Ave., South, Seattle 8, Washington • 1701 "K" Street, N.W., Washington 6, D. C.

Flat Tape Cable

(*Continued from page* 60)

tors per cross-section square inch as compared with only 225 for ordinary cable having No. 22 wire insulated with .010 inch wall. Since the weight of Tape Cable is only a fraction of standard insulated cable, a 100-foot roll of 50-conductor Tape Cable weighs only 2½ pounds, a saving of 85% in copper over conventional cable.

A striking electrical characterteristic of Tape Cable is its low interconductor capacitance, less than 5 μμf/ft. between conductors. Grounding alternate conductors reduces interconductor capacitance to under 1 μμf/ft. in free air. Because of the large heat dissipating characteristics of flat conductors, each conductor in Tape Cable has a conservative rating in free air of one ampere, or more if adjacent conductors are derated.

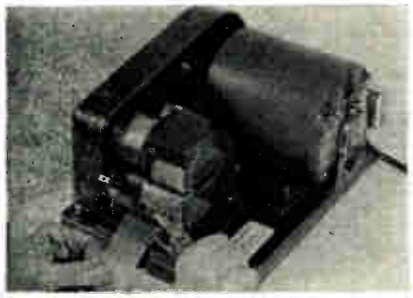


Fig. 3: Opposed glass fiber wheels quickly strip Tape Cable for soldering.

Tape Cable is thin and has a very high flex life. It has been successfully used in applications requiring continuous flexing on a radius of ¼ inch.

Since the insulation is of uniform thickness and the conductors are accurately positioned, the insulation may be removed from all of the conductors in one operation. Then all conductors as a unit may be aligned with a mating conductor and dip-soldered simultaneously to complete the connection.

1957 Directory

The following additions or changes should be made in the June Directory:

Riverbank Laboratories, Geneva, Ill., should be listed under "Measurement and Test Equipment — Special Purpose," section 44-49, Tuning Forks and not #48.

United States Dynamics Corp., Boston 20, Mass., should be added to "Rectifiers," section #77-12.

News of Reps

Kierulff Electronics, Inc., 820 W. Olympic Blvd., Los Angeles, has been appointed to distribute Hetherington and Daven electronic components in the Southern California area.

George Weinreich and Associates of 1210 Old Gate Rd., Dallas 18, Tex., are reps for the American Electronic Laboratories, Inc., in the states of Texas, Oklahoma, New Mexico, Louisiana and Arkansas.

The Kittleson Co., West Coast reps for 12 electronics manufacturers throughout the U. S. A., has expanded its Los Angeles operations by renting another building on Beverly Blvd.

Barker Sales Co., 996-8 Edgewater Ave., Ridgefield, N. J., has been appointed exclusive U. S. reps for Connollys (Blackley) Ltd. of Great Britain.

M. W. Reidel Co., 1633 Cabrillo, Alhambra, Calif.; **Jerry Deere Co.**, 1809 Virginia Ave., Redwood City, Calif., and **Southwest Electronic Industries**, 4515 Prentice St., Dallas, Tex., have been named reps in the West Coast area for Kelvin Electric Co.

Ben Kanowsky, Inc., 5513 Maple Ave., P. O. Box 7313, Dallas, Tex., is now rep in the Oklahoma-Texas area for Diamonite Products.

Wild Associates, Inc., have been appointed reps for Epsco, Inc., in the New York-Philadelphia area.

Edward D. F. Whitehead is now sales rep in Washington, D. C., for the Cal-Tronics Corp. of Los Angeles.

Hal F. Cory Co. of Dallas, Tex., will represent both the relay and microphone lines of the Electronics Div. of the Elgin National Watch Co. in Texas.

Cappels & Associates, a new rep organization, has been established in Chicago by J. L. Cappels. The firm covers Illinois, Indiana, Wisconsin, Iowa and Minnesota industrial instrument markets. They have been appointed as reps for Millivac Instrument Corp., Barnes Development Co., and Laboratory for Electronics.

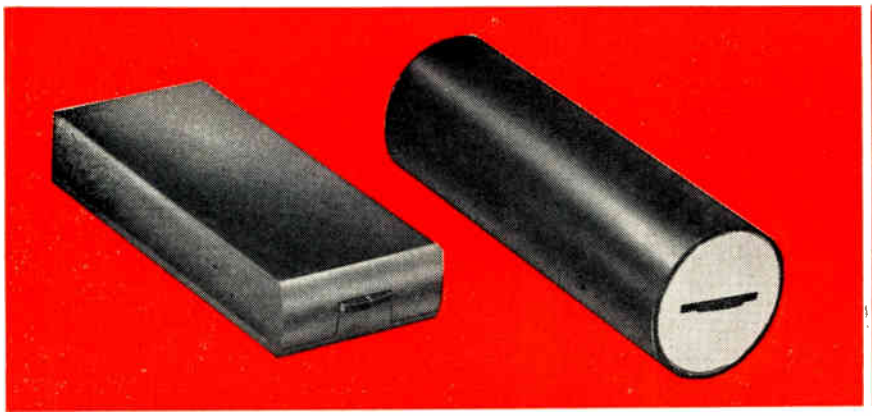
Frank C. Abbot has been appointed Texas-Oklahoma Sales rep for the Synthane Corp. of Oaks, Pa.

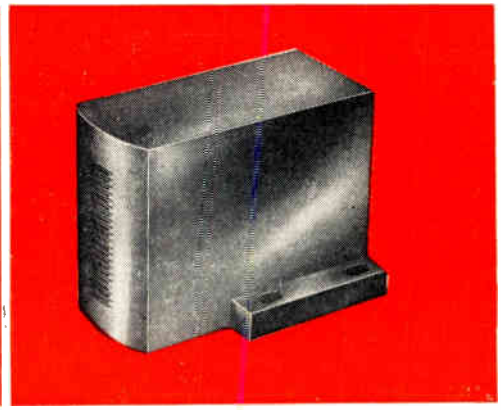
Eugene L. Park of 651 Paddock Rd., Southampton, Pa., will cover Virginia and **William F. Hemminger**, 619 N. E. 78th St., Miami, will handle the Florida area with the exception of Panama City and Pensacola for the Blonder-Tongue Laboratories, Inc. They will handle the line of master TV and closed-circuit TV products.

(Continued on page 118)

now GENERAL TRANSISTOR WESTERN gives you magnetic recording heads for computers

PRECISION-MADE TO YOUR SPECIFICATIONS IN PRODUCTION QUANTITIES AT LOWEST PRICES





Micro-second recording without distortion . . . and with complete reliability. This is the only kind of recording accuracy tolerated in today's complex computers.

The magnetic recording heads used in these systems must, of necessity, give such optimum recording features. Their mechanical and electrical characteristics are calculated to exclude such recording problems as cross-talk and imperfect recording gap to achieve excellent high frequency response.

General Transistor Western Corporation will build magnetic recording heads to your own specifications . . . to adhere rigidly to these standards of perfect recording. New construction methods, devised by their staff of design and production engineers, enable GT Western to produce highest quality heads at lowest prices for you. All metal construction, laminated shielding between each channel, precision machined gaps and mounting surfaces account for their excellent reputation in the computer field.

Write now for full details.

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6110 VENICE BLVD. • LOS ANGELES, CALIFORNIA

SUBSIDIARY OF GENERAL TRANSISTOR CORP.

News of Reps

(*Continued from page* 116)

Goode Associates, 65 Eliot St., Ashland, Mass., have been appointed reps for Corson Electric Mfg. Corp. in the New England area and **George H. Weiland,** 76-49 168th St., Flushing N. Y., will represent them in the New York territory.

Charles S. Polachek Associates, of 1500 E. Fairy Chasm Rd., Milwaukee, Wis., and **Jess Haskell Associates,** of 202 N. Marion Ave., Oak Park, Ill., have been appointed distributor sales reps for the Radio Receptor Co. They have the Eastern Wisconsin and Northern Illinois territories respectively.

Yarbrough Sales Co. of San Marino, Calif., reps specializing in electronic materials, has opened a branch office at 275 Brannon St., San Francisco.

T. Louis Snitzer Co. are now sales and engineering reps in the states of Arizona, California and Nevada for the Polarad Electronics Corp.

George E. Johnson has been appointed special rep for International Business Machines Corporation's midwestern sales region. He will coordinate sales activities and planning of applications of IBM equipment.

The Ambos-Jones Co., 3951 Lee Rd., Cleveland, Ohio, will represent "Control," a division of Magnetics, Inc., in the northern Ohio area.

R. L. Pflieger Co. are now reps in the northern California and Nevada territory for The Victoreen Instrument Co.

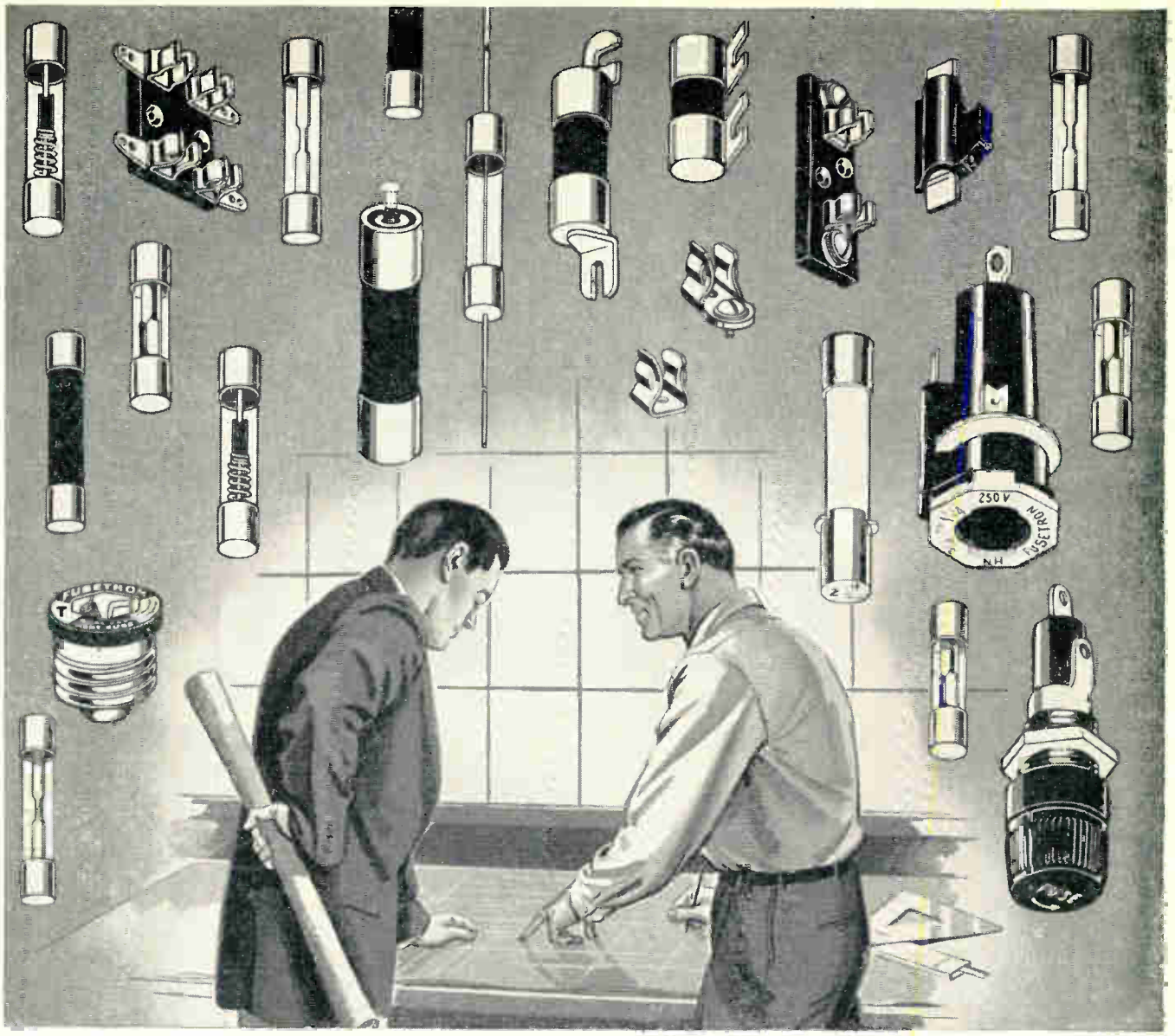
E. V. Roberts and Associates have opened a San Diego office at 4379 30th St. Their headquarters is still in Los Angeles.

Howard J. Benner, 800 Washington Lane, Jenkintown, Pa., and **Philip Lepofsky,** 1345 Kimberly Drive, Philadelphia, Pa., have been named special reps of the Radio Receptor Co. Mr. Benner will handle the Philco account and Mr. Lepofsky is assigned to the Martin, Bendix and Westinghouse plants in Baltimore.

Ward Humphrey, New England rep for Geo. Stevens Mfg. Co., Inc., is operating a new showroom for them at 253 Worcester Turnpike, Natick, Mass.

Allied Components, Inc., 2517 Converse St., Dallas, Tex., has been appointed reps for Tel-Instrument Electronics Corp. Their territory covers Oklahoma and Texas with the exception of El Paso.

Rod Butchart Co., 11327 Stockwell Ave., Detroit 24, Mich., are reps in the state of Michigan for the Fairchild Recording Equipment Co.



Whenever You Want Dependable Electrical Protection

. . . BUSS FUSES ARE YOUR ANSWER!

Here's why . . With BUSS fuses, dependable electrical protection isn't left to chance. Every BUSS fuse is tested in a sensitive electronic device that automatically rejects any fuse not correctly calibrated, properly constructed and right in all physical dimensions.

The result — when an electrical fault occurs, BUSS fuses quickly clear the circuit and the danger of damage to equipment is held to a minimum. Yet, BUSS fuses won't cause needless shutdowns by blowing when trouble does not exist.

By specifying BUSS fuses, you make sure your product received maximum electrical protection. And you are helping to safeguard the good name of your product for service and reliability.

If you have a troublesome fuseing problem . . . you can save engineering time by letting our research staff of fuse engineers work with you. If possible, a fuse will be selected that is available in local wholesalers' stocks, so that your device can easily be serviced.

For more information on BUSS and FUSETRON Small Dimension fuses and fuseholders . . . Write for bulletin TT. Bussman Mfg. Division (McGraw-Edison Co.) University at Jefferson, St. Louis 7 Mo.

BUSS fuses are made to protect—not to blow, needlessly

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

Makers of a complete line of fuses for home, farm, commercial, electronic, automotive and industrial use.

957

At the zero second everything must function without failure. ANDREW HELIAX cable is used in postassembly and preflight checkouts of missile radio frequency systems. The cable forms a closed circuit over which interrogation and response signals are transmitted between checkout equipment and airborne radio frequency packages. The HELIAX cable runs from a mobile trailer to connecting points on the missile.

The ruggedness of HELIAX makes it well suited to this challenging task, where its low VSWR, low RF leakage and low attenuation give accurate measurement of systems performance. Flexibility permits the cable to be taken down, recoiled and subsequently reused many times.

If you require similar characteristics in a cable, consider the special advantages of HELIAX.

HELIAX is normally supplied as an assembly, complete with end fittings factory attached, reducing installation labor and improving quality.

Complete uniformity throughout its entire length gives HELIAX *superior* electrical characteristics.

HELIAX is always less difficult, less costly to install, *easier to handle*.

HELIAX is available in 7/8" size (Type H0) and 1 5/8" size (Type H1).

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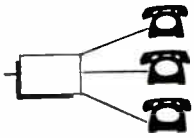
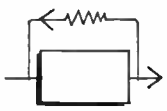
Pacemakers in the technology of our electronic age

Certain discoveries, inventions and developments of Bell Telephone Laboratories have been truly epochal in their effect upon the technology of our time. Each has come out of a single quest—a search for ways to make telephony ever better. But many have opened the way to exciting advances in TV, movies, radio, horology, astronomy. Here are ten of Bell Laboratories' contributions to the modern world.

Electronic amplifier. First high-vacuum electronic amplifier. Made possible long distance telephony and then opened the way to radio broadcasting.



Wave filter. Precisely separates bands of frequencies. Provided major key to economical sharing of the same wires by many voices or radio programs. Indispensable control tool in radio, television and radar.



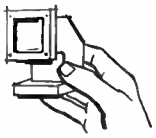
Negative feedback amplifier. Provides distortionless and stable amplification. Made possible the enormous, precisely controlled amplification needed in long distance telephone calls. The principle is now basic in high-quality amplifiers for radio, TV and high-fidelity reproduction.

Quartz crystal. Standard super-accurate quartz crystal oscillator developed for frequency controls in radio telephony. Has also become the standard control for clocks in world's astronomical laboratories.

Coaxial cable system. Hollow tube with a central conductor was developed to transmit hundreds of voices simultaneously. Now also provides long distance carrier for TV in partnership with microwave beams.

Transistor. Tiny solid-state device uses extremely small amounts of power to amplify signals. Makes possible electronic telephone switching and much smaller hearing aids, radios, TV sets and electronic computers.

Dial system "brain and memory." Takes over your call and sees that you are connected in the best and quickest way. Newest example: Direct Distance Dialing from home telephones to any part of the nation.



Waveguide. Hollow conductor transmits high-frequency waves. From this came the "pipe" circuits that are essential to radar and very short-wave radio communications.

Microwaves. Bell Laboratories developed long distance microwave transmission. It operates by focusing radio beams from station to station, carries cross-country telephony and TV.

Radio astronomy. This great new science began in the study of radio interference at Bell Laboratories . . . with the tremendous discovery that radio waves emanate from the stars.

BELL TELEPHONE LABORATORIES

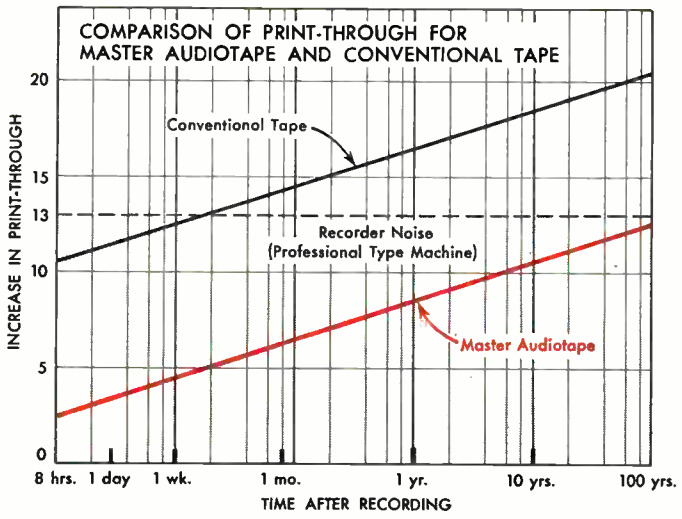
WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

Master Low Print-Through audiotape

The FIRST and FINEST low-print tape . . .
Cuts "magnetic echo" by 8 db

What Is Print-Through?

Print-Through is the magnetic "echo" effect induced in adjacent layers of tape by any recorded signal. It continually increases with time while the recorded tape is in storage. To keep print-through from being too objectionable, conscientious recordists have heretofore had to lower recording levels as much as 6 to 8 db, with reduced signal-to-noise ratio and sacrifice in tone quality.



0 = 63 db below 3% distortion at 1 kc, peak bias

How Is It Eliminated?

In Master Low Print-Through Audiotape, print-through has been reduced 8 db, by the use of specially developed magnetic oxides and special processing techniques — *without changing any other performance characteristics.* The curves at the left show the remarkable improvement obtained. Since print-through of Master Low Print-Through Audiotape remains well *below* the machine noise, it is "eliminated" for even the most critical ear.

Master Low Print-Through Audiotape on 1½-mil cellulose acetate

Master Low Print-Through Audiotape on 1½-mil "MYLAR" polyester film

Thoroughly PROVED in service, and now available in AMPLE QUANTITY!

Master Low Print-Through Audiotape has proved itself in over a year of actual service. Thousands of reels have been used by manufacturers of phonograph records and pre-recorded tapes and other top professional users. It has been in regular production since May, 1957, and is now available in ample quantity through dealers everywhere.

Laboratory studies indicate that stored Master Audiotape will take *more than 100 years* to reach the same print-through level that mars ordinary tape in one week! With an 8 db reduction in print-through, you can use higher recording levels, get better signal-to-noise ratio, and still have decades of freedom from harmful print-through effects. For a new high in hi-fi and new permanence for your priceless recordings, ask your dealer for Master Low Print-Through Audiotape. Available in 1200 and 2500 foot lengths in *two types* — on 1½-mil acetate and on 1½-mil Mylar*.

*DuPont Trade Mark

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International ELECTRONIC SOURCES

ELECTRONIC INDUSTRIES' exclusive monthly digest of the world's top electronic engineering articles

ANTENNAS, PROPAGATION

D. F. Aerial Systems for Decimetre Wavelengths, C. Clarke. "E. & R. Eng." July 1957. 8 pp. Development of two aerial systems, suitable for direction finding on vertically and horizontally polarized waves, respectively, is described. They are designed for a twin-channel CRT instrument in which azimuth coverage is limited to a selected 90° sector, thereby giving unambiguous bearings, improved sensitivity and reduction of site errors.

A Reactance Theorem for Antennas, C. A. Levis. "Proc. IRE." Aug. 1957. 7 pp. A rigorous expression for the frequency derivative of the input reactance or susceptance of an arbitrary antenna is derived by integration of Maxwell's equations. This expression is shown to depend on the polarization properties of the far field of the antenna and on a quantity which may be interpreted as the electromagnetic energy stored in its near field.

Insulated Loop Antenna Immersed in a Conducting Medium, J. R. Wait. "NBS J." August 1957. A solution is given for the fields of a circular loop in a conducting medium. The loop is assumed to have a uniform current, and it is enclosed by a spherical insulating cavity. The impedance of the loop is also considered. It is shown that the power radiated from the loop varies approximately as the reciprocal of the radius of the cavity for a specified loop current.

Special Features Of The Operation Of Coupled Long Lines When Using Distributed Inductive Coupling, V. S. Mel'nikov. "Radiotek," May, 1957. 5 pp. An analysis is made of the operation of two coupled infinitely long transmission lines when only inductive coupling is used. Terminating loads are determined which provide traveling-wave operation for lines of finite length.

Distortion of Polar Diagram Due to Interposition of Wooden Screen in the Vicinity of a VHF Radiator, H. R. Bapu Seetharam and M. N. Gadre. "J. ITE." March 1957. 17 pp. A teak wood structure in the proximity of a VHF radiator distorts the polar diagram. Experiments showed that the distortion in the polar diagram is due to the "reflection" and "transmission" properties of teak wood and "absorption" is only of a second order of magnitude. The relationship between the reflection coefficient, frequency, dielectric constant and thickness of wood is determined. The agreement between the theoretically calculated and experimentally observed values of distortion is close.

The Effect Of Refraction Upon The Diffuse Propagation Of UHF Waves In The Troposphere, D. M. Vysokovsky. "Radiotek," May, 1957. 7 pp. The paper derives approximate formulas for determining the factors affecting the diffuse propagation of radio waves. These factors include lowering the height of the scattering volume, varying the scattering angle, and varying the magnitude of the scattering volume. The variation in the power arriving at the reception point when refraction obtains is computed. The results are compared with data obtained on the basis of the theory governing the scattering of radio waves by turbulent inhomogeneities of the troposphere and with experimental results.

A Nonresonant Endfire Array for VHF and UHF, W. A. Cumming. "Proc. AIRE." March 1957. 8 pp. A new type of endfire array is described which has moderate bandwidth in the vhf and uhf ranges. Two types of arrays are dealt with; one, an unbalanced type fed with a coaxial line, which was studied primarily to test the theory of operation of the antenna; the other, a balanced type fed with unshielded twin-line, which was developed as a receiving antenna for vhf television.

The Geometrical Optics of VLF Sky Wave Propagation, by J. R. Wait and A. Murphy. "Proc. IRE." June 1957. 7 pp.

Antenna-Multiplex System Design, H. K. Schlegelmilch, O. K. Nilssen, and W. Y. Pan. "El." July 1, 1957. 4 pp. A distribution network giving an average of 25 db isolation between TV receivers connected to a single antenna is described.

AUDIO

Audio Amplifiers, F. L. Smith. "IRE Trans. PGA." March-April 1957. 6 pp. Attention is given to the question of comparing the performance of different amplifiers and to the lines along which future investigation should proceed.

A New Concept on the Physiological Aspect of Stereophonic Sound, H. F. Hume. "Int'l. Projectionist." July 1957. 3 pp. A series of experiments designed to establish the factors that provide the stereophonic effect and to analyze their results in practical terms are described.

Minimum Signal to Interference Ratio Required for Broadcasting, S. C. Mazimdar, G. V. Padhye and W. V. B. Ramalingham. "J. ITE." March 1957. In order to determine the level of maximum interference at which a satisfactory broadcasting service is possible, a large number of listening tests were conducted. The study has been confined to the determination of protection required for a speech modulated broadcast signal against interference from speech and music and also against CW Morse.

* Those articles marked with an asterisk are available as reprints to EI readers. Requests should be sent, on company letterhead, to Sources Editors, Electronic Industries, Chestnut & 56th Sts., Philadelphia 39, Pa.

REGULARLY REVIEWED

AEG Prog. AEG Progress
Aero. Eng. Rev. Aeronautical Engineering Review
Ann. de Radio. Annales de Radioelectricite
Arc. El. Uber. Archiv der elektrischen Uebertragung
ASTM Bul. ASTM Bulletin
Auto. Con. Automatic Control
Auto. El. The Automatic Electric Technical Journal
Avto. i Tel. Avtomatika i Telemekhanika
AWA Tech. Rev. AWA Technical Review
BBC Mono. BBC Engineering Monographs
Bell Rec. Bell Laboratories Record
Bell J. Bell System Technical Journal
Bul. Fr. El. Bulletin de la Societe Francaise des Electriciens
Cab. & Trans. Cables & Transmission
Comp. Rend. Comptes Rendus Hebdomadaires des Seances
Comp. Computers and Automation
Con. Eng. Control Engineering
E. & R. Eng. Electronic & Radio Engineer
Elek. Elektrichestvo
El. Electronics
El. & Comm. Electronics and Communications
El. Des. Electronic Design
El. Energy. Electrical Energy
El. Eng. Electronic Engineering
El. Eq. Electronic Equiment
El. Ind. ELECTRONIC INDUSTRIES & Tele-Tech
El. Mfg. Electrical Manufacturing
El. Rund. Electronische Rundschau
Eric. Rev. Eriesson Review
Freq. Frequenz
GE Rev. General Electric Review
Hochfreq. Hochfrequenz-technik und Elektroakustik
IBM J. IBM Journal
Insul. Insulation
IRE Trans. IRE Transactions of Prof. Groups
Iz. Akad. Izvestia Akademii Nauk SSSR
J. BIRE. Journal of the British Institution of Radio Engineers
J. ITE. Journal of The Institution of Telecommunication Engineers
J. IT&T. Electrical Communication
J. UIT. Journal of the International Telecommunication Union
Nach. Z. Nachrichtentechnische Zeitschrift
NBS Bull. NBS Technical News Bulletin
NBS J. Journal of Research of the NBS.
NRL. Report of NRL Progress
Onde. L'Onde Electrique
Phil. Tech. Philips Technical Review
Proc. AIRE. Proceedings of the Institution of Radio Engineers
Proc. BIEE. Proceedings of the Institution of Electrical Engineers
Proc. IRE. Proceedings of the Institute of Radio Engineers
Radiotek. Radiotekhnika
Radio Rev. La Radio Revue
RCA. RCA Review
Rev. Sci. Review of Scientific Instruments
Rev. Tech. Revue Technique
Syl. Tech. The Sylvania Technologist
Tech. Haus. Technische Hausmitteilungen
Tech. Rev. Western Union Technical Review
Telonde. Telonde
Toute R. Toute la Radio
Vak. Tech. Vakuum-Technik
Vide. Le Vide
Vestnik. Vestnik Svyazy
Wire. Wld. Wireless World

For more information, contact the respective publishers directly. Names and addresses of publishers may be obtained upon request by writing to "Electronic Sources" Editors, ELECTRONIC INDUSTRIES & Tele-Tech, Chestnut & 56th Sts., Philadelphia 39, Pa.

International **ELECTRONIC SOURCES**

CIRCUITS

Some New Circuits for High-Power Traveling-Wave Tubes, M. Chodorow and R. A. Craig. "Proc. IRE." Aug. 1957. 13 pp. A discussion of new types of slow-wave structures in which the coupling between sections is obtained largely by negative mutual inductance.

An Electronic Switching System for Ultra-Short Rapidly Repeated Exposure in Angiocardiography, T. H. Rogers. "Cathode Press." Vol. 14, No. 1, 1957. 4 pp.

Class A Transistor Power Amplifier Design, R. Minton. "El. Des." July 15, 1957. 3 pp. Design considerations are discussed for the use of recently available high power transistors. Power, distortion, and efficiency are discussed.

Automatic Bridge Balance for Nuclear Spin Resonance Spectrometer, R. L. Collins. "Rev. Sci." July 1957. 2 pp. Troublesome changes of the bridge balance in a twin-T nuclear resonance bridge have been eliminated by the application of a voltage-sensitive condenser. A small amplitude, high-frequency modulation voltage applied to the condenser senses any deviation from balance, and a servo loop provided a dc correction voltage which maintains the bridge balance.

Effects of Voltage-Divider Characteristics on Multiplier Phototube Response, R. W. Engstrom and E. Fischer. "Rev. Sci." July 1957. 3 pp. Data are presented on the effect of voltage-divider circuits on the operating characteristics of multiplier phototubes. Linear, superlinear, and saturated behavior of output current vs light flux are related to divider current. Characteristics are shown for varying sensitivity by controlling interdynode voltage.

An Improved Circuit for Reliable Operation of Nomotron Counter Tubes, T. M. Jakkson. "El. Eng." July 1957. 3 pp. The nature of changes in characteristics which have hitherto restricted the circuit application of cold-cathode multi-electrode counter tubes is described. Details of new operating conditions are given which extend the range of application and greatly enhance tube reliability and performance.

A Bridge Network for the Precise Measurement of Direct Capacitance, A. C. Lynch. "Proc. BIEE." July 1957. 5 pp. The network is particularly useful for measuring capacitances of less than 100 $\mu\mu$f in the presence of stray capacitances to earth.

Direct Indicating Bridge for the Measurement of Temperature Rises in Electrical Appliances, F. Kammer. "Proc. AIRE." March 1957. 6 pp. An instrument is described for use in the routine measurement of the temperature rise, under load, in the windings of electrical appliances. It consists of a direct reading Wheatstone bridge compensated for changes in ambient temperature. A special connector box is provided to facilitate rapid measurement.

A Method For Analyzing Amplifier Circuits In The Transient-Time Domain By Means Of Third-Degree Characteristic Equations, E. N. Mokhov. "Radiotek," May, 1957. 8 pp. A method is given which eliminates a number of the basic causes for the great difficulty and inefficiency which is involved in analyzing amplifier circuits in the transient-time domain by means of third-degree characteristic equations. As an example, the paper cites the results of an investigation of series—inductance compensating networks in the grid circuit.

Special Features Of Designing Radio Transmitters In Which The Plate Circuits Of The Tubes Are Supplied From Constant-Current Sources With A High Internal Impedance, N. I. Shtein. "Radiotek," May, 1957. 6 pp. The paper examines the possibilities for the optimum utilization of constant-current sources with a relatively high internal impedance (for example, dynamotors, kenotron rectifiers, etc.). An analysis is made of the conditions under which it is possible to guarantee the delivery of maximum power from the electronic tubes to the tank circuit, and appropriate recommendations are given with regard to oscillator design.

A Very Low Frequency Three-Phase Oscillator, M. D. Armitage. "El. Eng." July 1957. 6 pp. A cathode feedback circuit to increase the time-constant of the resistance-capacitance networks in a phase-shift oscillator is discussed. It is possible to increase the time-constant by a factor of 100; the preferred circuit gives a factor of about 18.

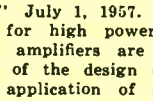
Transmission Properties and Design of Final Video Stages, G. Forster. "El. Rund." July 1957. 8 pp. The design of video amplifiers, especially for a standardized frequency response, is considered. For conventional compensating methods design data listed in a table and the rise times of an ideal voltage jump are specified.

Transistorized Photomultiplier Has 0.1-μsec Resolution, G. S. Brunson. "Nucleonics." July 1957. 2 pp. A transistorized photomultiplier circuit devised for a very small high-sensitivity fast-neutron counter capable of excellent time resolution.

Calculation Directions for Flip-Flop Circuits, G. Thiele. "El. Rund." July 1957. 4 pp. In the present 1st part of the article containing calculation directions for all parts of flip-flop circuits reference is made to two application examples; the operation of these circuits is briefly explained.

A.S.A.C.: Automatic Selection of any Channel, H. Dolan and F. C. S. Watson. "ATE J." April 1957. 12 pp. Recent papers have described the vhf single-channel radio equipment used with the RL range of line-integrated radio links. Switching circuits have been added to this range which permit up to six radio subscribers to share a common radio terminal at the nearest telephone exchange. This is achieved by the exchange switching equipment making a sequential search of the six channels.

Fluid-Cooling an Airborne Transmitter, J. B. Humfeld. "El." July 1, 1957. 3 pp. Design considerations for high power, low weight aircraft power amplifiers are discussed. A unique feature of the design described here is the direct application of 400-cycle, six-phase power to plate and screen of six paralleled output tubes in a self-rectifying output circuit.



COMMUNICATIONS

***Military Uses of Black Light,** J. R. Alburger. "El. Ind." Sept. 1957. 3 pp. Ultra-violet radiations offer advantages over infra-red for communications and control. Progress is reported in narrow beam transmissions as well as restricted area broadcasts of voice, code, and video.

Comparison of SSB and FM for VHF Mobile Service, H. Magnuski and W. Firestone. "IRE Trans PGVC." June 1957. 7 pp. Mobile SSB and FM systems are compared on the basis of the same equipment size. The influence of the speech processing on the comparative results is discussed.

Noise Stability Of Frequency-Modulation Systems, V. A. Kashirin. "Avtomatika i Telemekhanika," June, 1957. 7 pp. The ideal noise stability of multichannel frequency telemetering systems is examined for the case of weak fluctuating noise. A comparison is made between the noise stability of frequency-division and time-division channels.

The Statistical Properties Of Signals And Interference In Two-Channel Phase-Displacement Systems, V. V. Tsvetnov. "Radiotek," May, 1957. 18 pp. An analysis of the statistical properties of sinusoidal signals and Gaussian interference is made for two-channel phase-displacement systems. The paper derives the distribution law governing the amplitudes and phase differences, and examines the statistical phase characteristics for various cases.

Experimental Investigation Of A Method Of Optimum Amplitude-Phase Modulation, S. I. Tetel'baum and Iu. G. Grinevich. "Radiotek," May, 1957. 6 pp. The paper provides the results of an experimental verification of the basic postulates which constitute the mathematical theory of optimum amplitude-phase modulation. Circuit diagrams are provided and quantitative comparisons are made.

Concentric-Shear-Mode 455-Kilocycle Electromechanical Filter, R. W. George. "RCA." June 1957. 9 pp. The filter described here is an experimental filter consisting of four magnetostrictive ferrite disk resonators operating in the concentric shear mode.

A High-Speed Uniselector for Automatic Telephone Exchanges, J. M. Unk. "Phil. Tech." June 4, 1957. 9 pp. The importance of high speed in automatic telephone selectors is discussed with reference to several examples of such devices. It is demonstrated that, where one-motion selectors (uniselectors) are employed, it is advantageous to make them work at a speed such that at least 300 outlets can be swept per second.

Evolution of the Transatlantic Cable, O. B. Jacobs. "Bell Rec." June 1957. 6 pp. The continuing problem of developing ever better submarine cable systems has been studied since well before 1921, when three cables capable of transmitting telephone messages were put in service between Key West and Havana.

Four-Channel Military Carrier Terminal and Repeater, G. E. Harper. "Bell Rec." June 1957. 4 pp. Four-channel and twelve-channel telephone systems, along with coordinated radio service, have recently become available to the armed forces. Because of its integrated nature, and especially because of its high level of performance and portability, this equipment comprises a major contribution to military communication. The four-channel system for the shorter, light-traffic routes uses a terminal housed in only two transporting cases and a repeater which is housed in a single case.

An Electronically Controlled Crossbar Exchange, T. H. Clark. "ATE J." Jan. 1957. 14 pp. This article described the design of a 200-line electronically controlled crossbar exchange. A magnetic drum is the memory of the electronic controller, and provides a register for every subscriber. The drum also stores the state of the trunking of the exchange, and is used to indicate suitable routes to establish connections between subscribers.

12-Channel Carrier System for Open-Wire Lines, J. R. Cannon, C. F. Campbell, and J. B. McCuster. "ATE J." Jan. 1957. 25 pp. This article describes the latest A.T.E. type of 12-channel carrier telephone system for use on open-wire lines. The equipment embodies many advances in design over the earlier system which was described in the Strowger Journal. Reduced size has been combined with greater ease of maintenance by the use of jack-in panels of Unit Construction Practice.

Intelligibility of Synthetic Language, O. Warens. "FREQ." Vol. 11, No. 6. June 1957. 6½ pp. This article provides some information on voice communication by means of coded binary information. The author describes a "voice switch" and a "voice expander" which permits the synthetic reproduction of characters and syllables. The author estimates that it would take approximately 700 to 1100 sound elements to construct a complete synthetic language. Forty bits per second would be required for the transmission of this language. The article also contains tables which show the percentage of correctly-understood letters and words created by the device and tested on a listening audience.

Transformers for Carrier Systems. "Demodulator." February 1957. 7 pp. This article discusses the basic theory of transformers and describes the steps in their design and construction for carrier system use.

Communications by Railways of Canada, J. R. White and G. H. Pescud. "Wire and Radio Communications." May 1957. 4 pp.

Improvement of Binary Transmission by Null-Zone Reception, F. J. Bloom et. al. "Proc. IRE." July 1957. 13 pp. This article considers schemes in which the binary data receiver prints out one of three symbols or one of four symbols. The extra symbols permit indication or nearly equal probabilities of the two transmitted states. Improvement of information rate is demonstrated.

Telegraph Signalling and Distortion, E. R. McGuire. "ATE J." April 1957. 11 pp. This article gives a brief outline of printing telegraph systems and the causes of distortion in line telegraph circuits. The methods of measuring distortion are given with reference to a telegraph distortion measuring set Type T.D.M.S. 6B. The composition of 5-unit start-stop telegraph signal is stated and the band speed defined. A brief survey of signalling systems for double- and single-current working, and the method of determining the mark polarity in single-current systems for both forward and reverse keying is explained.

Design Considerations in the First Stage of Transistor Receivers, L. A. Freedman. "RCA" June 1957. 18 pp. The paper presents a discussion of noise performance of transistor rf stages utilizing capacitive antennas and of transistor mixer stages utilizing loop antennas. Examples and comparisons between different circuits are included.

The Guided Radio Telephone, W. H. Hill. "ATE J." April 1957. 6 pp. Some typical instances of the need for improved communications in coal mining are mentioned in this article, which describes experimental observations leading to an inductive communication system. An early experimental transmitter-receiver is mentioned and the development of a satisfactory portable set is described.

COMPONENTS

Development of the Permissive-Make Relay, B. J. Greenblott and J. E. Wallace. "IBM J." July 1957. 14 pp. The development of a new relay is described which meets the need for an improved general-purpose relay for use in existing and future business machines.

Micro-Miniature Techniques, W. W. Hamilton, "El Des." July 1, 1957. 2 pp. The author describes the contributions of the watch industry to micro-miniaturization.

Modern Methods of Winding Toroidal Coils. "Demodulator." February 1957. 5 pp.

Microwave Printed Circuits—A Historical Survey, R. M. Barrett. "P. AIRE" April 1957. 10 pp.

Insulation Engineerng Fundamentals—No. 11, Construction of Coils and Windings for Electric Machinery, G. L. Moses. "Insul." December 1956. 6 pp.

Silicon Rectifier, E. Nitsche. "El Rund." July 1957. 3 pp. Among the semiconducting elements of the 4th group of the periodic system silicon is particularly suited for the production of rectifiers. The silicon rectifier admits a higher operation temperature and a higher maximal blocking voltage than the germanium rectifier.

Some Problems Associated With The Charging of Dry Batteries, P. H. Adams. "P. AIRE" April 1957. 6 pp. The effects of the periodic application of a reverse E.M.F. to dry batteries, with the object of increasing their service life, are discussed and the optimum conditions to minimize the possibility of damage to both flat and round cells are laid down. The application of this process in AC/battery portable radio receivers is examined and it is shown that the extent to which battery service life is likely to be dependent on the conditions of use of the receiver in question.

Mineral Insulated Cables. "El Energy" June 1957. 2 pp. Fabrication techniques have been developed which permit forming mineral-insulated cables capable of operating without derating at temperatures high enough to raise the copper sheath to a red heat. Breakdown causes no permanent damage to the magnesium oxide powder commonly used as insulating material. The cables are virtually non-ageing and are highly resistant to corrosion.

Component Development for Micro-Miniaturization, H. A. Stone, Jr. "El. Des." July 1, 1957. 5 pp.

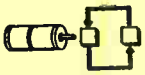
Microwave Triode Oscillators, C. L. Andrews. "Rev. Sec." June 1957. 5 pp. Coaxial and rectangular wave-guide oscillators are described which yield frequencies of 4 to 6 kilomegacycles per second. A metal cap fitted around the anode end of the tube confines the anode grid cavity entirely inside the tube. Studies of efficiency indicate that the upper limit in frequency of the GL-6299 tube is imposed by the circuit inside the tube and not by the electronics of the tube.

Use Logical Research Methods for Component Specification, D. Shainin. "Auto. Con." June 1957. 4 pp. The author urges use of statistical methods to prevent incorrect engineering conclusions based on what appears to be a cause-and-effect relationship in the specification of certain parts and components for control equipment and sub-systems.

The Characteristics of Magnetic Recording Heads and Tapes, H. P. Spring. "J. BIRE." April 1957. 18 pp.

Millimicrosecond Time-to-Pulse Height Converter Using an RF Vernier, R. L. Chase and W. A. Higinbotham. "Rev. Sec." June 1957. 4 pp. A time-to-pulse-height converter is described which uses an rf vernier technique to facilitate the timing of an event with respect to the phase of a high-frequency clock. The event starts an oscillator whose frequency differs only slightly from that of the reference clock. The phase of the low-frequency beat note is used as an index of the phase of the clock at the time the event occurred.

Loudspeaker Design and Application, A. McLean. "IRE Trans. PGA." March-April 1957. 11 pp. This paper is concerned with the problems involved in the design of loudspeakers and in the assessment of their performance. The incorporation of design data into speaker applications is also discussed.



CONTROLS

***Missile Control Demands Stabilization and Guidance, G. Reehl. "El. Ind." Sept. 1957. 4 pp.** Control about three axes, roll, pitch, and yaw must be accurately maintained in a successful missile. The author designs, develops, and tests a hypothetical system, giving full treatment of the problems encountered in the exercise.

Optimum Transient Response In Saturating Power Systems, E. A. Rozenman. "Avtomatika i Telemekhanika," June, 1957. 16 pp. The paper solves the problem of the form of the most rapid transient in a saturating power system. It is demonstrated that the optimum law governing the current variation in the actuating motor is close to being linear for large heating time-constants. A family of isochrone areas is plotted and a comparison is made between the optimum response in the above case and the optimum response for current saturation. It is proven that the use of the optimum law makes possible a considerable decrease in the transient response time for the same power output.

Determining The Coefficients Of The Transfer Functions For Linearized Automatic Control Sections and Systems, M. P. Simoiu. "Avtomatika i Telemekhanika," June, 1957. 15 pp. A method is developed for determining the coefficients of the transfer functions from experimental curves of the transient responses of linearized sections and systems. A method is given for applying this analysis to the approximation of complex transfer functions by simpler ones. Examples are given to illustrate the method.

Automatic Adiabatic Calorimeter Shield Control, M. G. Zabetakis, R. S. Craig and K. F. Sterrett. "Rev. Sci." July 1957. 5 pp. An automatic adiabatic calorimeter shield control has been built and operated successfully for approximately 700 hours. It has been used with an existent low temperature (10 to 300°K) intermittently heated calorimeter in runs of up to 100 hours duration.

Digital Process Control, M. L. Klein, F. K. Williams and H. C. Morgan. "Instruments & Automation." October 1956. 6 pp. The analog-to-digital converter, trunking matrix, and comparison matrix can be used to control valves at any desired level of a variable, and at any desired accuracy. Here are the principles, techniques, and design considerations for complete digital process control.

Backlash and Hysteresis Effects in Automation Systems, L. M. Vallese. "J. BIRE." June 1957. 4 pp. Non-linearities of backlash and of hystersis type provide generally different types of stability limits in feedback control systems. These limits and the corresponding frequencies of oscillation may be expressed in terms of characteristic adimensional system parameters. Examples of application to second and third order systems are shown.

The Logic of Automata—Part II, A. W. Burks and Hao Wang. "J. of Assoc. for Computing Machinery." July 1957. 19 pp.

INDUSTRIAL ELECTRONICS

***Electronics in the Automobile Industry, Dr. A. V. J. Martin. "El. Ind. Op. Sect." Sept. 1957. 3 pp.** European interest is high over the application of electronics to automotive ignition systems. The author considers some recent automotive electronics ideas which are past the lab stage.

International ELECTRONIC SOURCES

Thyratrons Stabilize Induction Heaters, H. J. Fraser and E. G. Hopkins. "El." July 1, 1957. 2 pp. Equipment used to closely control heating of receiving tube electrodes during automatic exhaust is described.

Ultrasonics Bubbles Beer in Brewery, A. S. Davis. "El." July 1, 1957. 3 pp. Ultrasonic foaming is utilized to drive out unwanted air from beer bottles just prior to sealing.

Ultrasonic Machining I, E. A. Neppiras and R. D. Foskett. "Phil. Tech." May 9, 1957. 10 pp. This article gives an introduction to the technique of drilling by means of ultrasonic vibrations. The actual cutting action consists of a continuous chipping of the work by abrasive particles in suspension, fed between tool and work. A vibration frequency in the ultrasonic region (20 kc/s) is used, both for silent operation and in order to get reasonable cutting rates.

Ultrasonic Machining, Part II, E. A. Neppiras and R. D. Foskett. "Phil. Tech." June 1957. 13 pp. This second article on ultrasonic machining deals in some detail with cutting speeds, accuracy and surface finish. The various factors affecting cutting speeds are considered with the help of graphs and tables. Cutting speeds increase almost linearly with static load until an optimum value (dependent on vibration amplitude and frequency) is reached. For tools of small area the adjustment to optimum load is critical.

Extending Valve Tube Life in X-Ray Apparatus, D. Kirka. "Cathode Press." Vol. 14, No. 1, 1957. 5 pp.

MATERIALS

Alloying Properties of Germanium Free of Edge Dislocations, C. W. Mueller "RCA Rev." June 1957. 8 pp. Experiments are described showing the effect of surface tension and germanium crystallographic plane on indium alloy dot diameter.

The Dissolution of Germanium by Molten Indium, B. Goldstein. "RCA Rev." June 1957. 8 pp. When the dissolution rates are varied by temperature or by solvent constitution, it is found that as the over-all dissolution rate increased, the rates in the three major crystal directions become more nearly equal.

Change in Permanent Magnet Pole Strength, E. M. Briscoe. "El. Energy." July 1957. 4 pp. Permanent magnets used in measuring instruments required to be very stable and factors affecting their long-term stability are discussed in this article. In order to facilitate this work it is necessary to carry out very precise magnetic measurements and for this purpose a Magnet Balance has been developed, and is described.

Multihole Ferrite Core Configurations and Applications, H. W. Abbott and J. J. Suran. "Proc. IRE." Aug. 1957. 13 pp. Combined gating and memory functions may be performed by the use of multihole ferrite cores called transfluxors. By proper topological design, transfluxors may be made noncritical to control pulse amplitude. In addition, by use of novel compensation and ac driving techniques, the transfluxor may be operated noncritically over an ambient temperature range from —50°C to +200°C. By making full use of multiple path geometries single multihole discs referred to as logicors have been designed to perform such complex logical operations as sequential pulse gating, odd parity checking, binary half adding, selective channeling, etc. One such logicor may replace as many as twelve switching devices in a logical circuit.

MEASURING & TESTING

***Offset Recorder Checks Frequency,** H. D. Tanzman. "El. Ind. Op. Sect." Sept. 1957. 4 pp. Variations in path length cause frequency fluctuations in received WWV carrier. Offset between WWV time pulses and locally derived pulses can be measured and averaged to determine accuracy of the local frequency standard.

***Temperature Measurements Near Absolute Zero, Dr. H. B. Sachse.** "El. Ind." Sept. 1957. 4 pp. Increased interest in near-zero temperatures has spurred research into thermometry below 4°K. The author reports progress in this range, and predicts future developments in low temperature thermometry.

Ultrasonics in Medicine and Dentistry, W. Welkowitz. "Proc. IRE." Aug. 1957. 11 pp. This paper discusses some of the projects being carried out in the fields of diagnosis, therapy, dentistry, and bacteriology. The diagnostic investigations presented include brain tumor detection, soft tissue visualization, and analysis of cancers for malignancy. The therapy studies include tissue diathermy, brain surgery, and tumor inhibition. Drilling of teeth is the application discussed in dentistry. In all cases attempt is made to elucidate the mechanisms pertinent to the applications.

A Device for the Direct Indication of the Exhaust Velocity in High-Vacuum Systems, H. Klumb and H. Baum. "Vak. Tech." Issue 2/3, April 1957. 5 pp. The article describes an instrument which indicates pump efficiency and gas velocity in exhaust tubes. The device is based on the design of a radio-flow meter which operates in conjunction with a thermo-molecular manometer. The instrument has an operating range from 10^{-0} to 10^{-6} Torr (1 Torr = 1/760 atm), and has a maximum sensitivity of 10^{-8} gms/cm per scale increment. The calibration of the instrument, as well as its dependence upon pressure, molecular weight, and viscosity are outlined. The article also illustrates a practical application and the results obtained.

A New High-Frequency Mass-Spectrometer, G. Falk and F. Schwering. "Vak. Tech." Issue 2/3. April 1957. 1½ pp. Described is a mass-spectrometer which uses for its separation the electric field of a cylindrical condenser to which is applied a DC voltage, as well as a high-frequency AC voltage. Under the influence of the static electrical field the ions follow a mean helical path; the frequency of their oscillation depends upon their mass. Through the superposition of an AC field of the proper frequency, it is possible to resonate the ions of one specific mass, and thus eliminate them from the remaining ion mixture. The measurement of the ion current leaving the instrument provides the mass absorption spectrum.

Calibration of Ionization Manometers, H. Moesta and R. Renn. "Vak. Tech." Issue 2/3. April 1957. 1 p. To measure low pressures with an ionization manometer, one needs conversion tables and new calibration factors when gases other than air are used. Such calibration tables normally exist only for inert gases. The calibration for a number of frequently used gases are provided for the ionization manometer EM-1 (Leybold), which is used extensively in Germany.

A New Approach to Signal Analysis in Electroencephalography, Bernard Saltzberg, Neil R. Burch, Miles A. McLennan and Edward G. Correll. "IRE Trans PGME." July 1957. 7 pp. This paper describes the theoretical aspects of the work done in an Air Force research program on the analysis of electroencephalographic waveforms (brain waves).

Human Occupancy in the Environmental Chamber, S. Giles. "Environmental Quarterly." Third Quarter 1957. 3 pp. The relationships among the factors of number, activity, age and physical condition of those who must work together in a given environmental chamber are all variables that are difficult to determine and evaluate. The purpose here is to point out some of the hazards that the operating engineer should be aware of while supervising personnel within an environmental chamber.

A Self-Balancing Direct-Current Bridge for Accurate Bolometric Power Measurements, G. F. Engen. "NBS J." August 1957. 5 pp. Until recently, the most accurate microwave power measurements of the bolometric type have required the use of a manual d-c bridge. A self-balancing d-c bridge has been developed that preserves the inherent accuracy of the manual bridge, extends the dynamic range of operation, and greatly simplifies the operating procedure.

Measurement of Short Time Intervals, F. K. Priebe and H. D. Tanzman. "Instruments & Automation." October 1956. 4 pp. Two time-interval-measurement systems whose counting oscillators are checked at 10-minute intervals. The instrumentation and check procedures are described in detail.

A Rapid Response Heart-Rate Meter, D. G. Wyatt. "El. Eng." July 1957. 2 pp. An instrument is described which is suitable for measuring the rate of incidence of equally spaced pulses. It is intended for use in physiological research, and covers the range 10p/min to 500p/min. The response time is short, and permits rapidly varying pulse rates to be recorded.

How Environmental Test Conditions Influence Reliability, C. T. Morrow. "Environmental Quarterly." Third Quarter 1957. 3 pp.

Cathode-Ray Display of Complex Quantities at Varying Frequencies. "Phil. Tech." June 4, 1957. 4 pp. An apparatus is described which automatically presents a picture of a complex vector diagram, for an adjustable frequency range, on the screen of a cathode ray tube.

Time-Signal Broadcast Sets Electric Clock, R. L. Ives. "El." July 1, 1957. 3 pp. A hand-set clock is relay-started at the start of the WWV tone transmission.

Electron Model Fixed Field Alternating Gradient Accelerator, F. T. Cole, R. O. Haxby, L. W. Jones, C. H. Pruett, and K. M. Terwilliger. "Rev. Sec." June 1957. 18 pp. A radial sector FFAG accelerator has been constructed and successfully operated. In this 8-sector accelerator, electrons are betatron accelerated from 25 to 400 kev using both continuous and pulsed injection. The number of radial betatron oscillations per revolutions may be varied from 2.3 to 3 and the number of vertical oscillations per revolution from 1 to 3. Calculations of these oscillation frequencies using various approximations are described and discussed.

Testing in the Environment of Time, E. F. Peacox. "Environmental Quarterly." Third Quarter 1957. 3 pp. This article describes the basic life-test technique, suggests two ways for shortening testing time, and shows a simple technique for estimating the probability of survival for any given period of time.

Tropicalization — Results of Experiments on Sealing Capacitors, C. V. Ganapathy, R. Krishnan and T. V. Ramamurti. "J. ITE." March 1957. 7 pp. To test the efficacy of sealing ceramic capacitors against the ingress of moisture and consequent deterioration in its electrical characteristics, capacitors were coated with different materials and of varying thickness and subjected to standard accelerated tests in a humidity chamber.

Bridge Sorts Capacitors to Tolerance, S. D. Breskend, J. I. Cooperman, and P. J. Franklin. "El." July 1, 1957. 3 pp. An automatic tester-sorter gives accuracy of better than 1 percent in sorting 1,000-micromicrofarad capacitors.

The Sonic Valve Pressure Gauge, F. W. Noble. "IRE Trans PGME." July 1957. 8 pp.

The Bubble Chamber, C. Dodd. "Endeavour." October 1956. 4 pp. Modern machines can provide pulses of high-energy particles at intervals of a few seconds, which is considerably more rapidly than the detecting devices hitherto in use can be operated. An important feature of the newly developed bubble-chamber detectors is that they can keep pace with the new particle accelerators. They possess the further important features that they have no background of irrelevant tracks and that, because of the high density of the medium, there is a relatively high probability of a collision being recorded.

Dielectric Recorder, V. C. Anderson. "Rev. Sci." July 1957. 6 pp. A description is given of the dielectric recording technique wherein information is stored as a surface charge on a rotating dielectric coated drum. The specific application of the technique to a multiple channel recorder is shown.

Measuring Instruments, Open and Closed Loop Control Systems—Electronic Counters, G. Rose and W. Gundelach. "El. Rund." July 1957. 4 pp. Referring to examples progress gained at the development of new measuring methods and instruments for determination of magnitudes hitherto partly not yet satisfactorily measurable is shown. Magnetic amplifiers, cold cathode gates, pneumatic signal transmission equipment, setting means for operational magnitudes of control systems, etc., find new applications described with reference to examples.

Boron-Loaded Liquid Scintillation Neutron Detectors, L. M. Bollinger and G. E. Thomas. "Rev. Sci." July 1957. 8 pp. The general problems involved in constructing boron-loaded liquid scintillation neutron detectors are considered. The characteristics of particular counters which have been successfully used in neutron transmission measurements by the time-of-flight method are then described. The design of these counters was guided by the results of a Monte Carlo study of neutron capture in a boron-poisoned medium.

Automatic Microwave Transmission Measuring Equipment, J. B. Linker, Jr. and H. H. Grimm. "Rev. Sci." July 1957. 5 pp. A microwave measurement system has been built which makes possible the quick measurement and automatic recording of the phase and amplitude response of a general four-terminal network. This system was set up to measure in particular the phase and attenuation properties of samples of ferrite materials in wave guide for two opposite directions of applied dc magnetic field at both X and S bands.

Buoy Telemeters Ocean Temperature Data, R. G. Walden, D. D. Ketchum, and D. N. Frantz, Jr. "El." June 1, 1957. 4 pp. A transistorized control receiver in the oceanographic survey buoy triggers transmission of water temperatures when queried from distances up to 600 miles.

An Instrument For The Visual Observation And Measurement Of The Frequency Responses Of The Group Propagation Time, The Phase Shift And The Transmission-Coefficient Modulus (A Frequency Characterograph), I. T. Turbovich, A. V. Knipper, V. G. Solomonov. "Radiotek," Jan. 1957. 12 pp. The paper analyzes the principles of designing an instrument for the rapid measurement of frequency responses. The errors of measurement are investigated, and the block diagrams (and circuit diagrams) of certain sections of the instrument are described.

Magnetically Deflected 21-Inch Oscilloscope, H. E. O'Kelley and W. H. Todd. "El." July 1957. 3 pp. Economical construction of large-screen display units for classrooms from ordinary television receiver components and tubes is discussed.

Evaluating Relays for Military Uses, D. D. Zimmerman. "Auto. Con." June 1957. 2 pp.

Detection of Pulse Signals in Noise: The Effect on Visual Detection of the Area of the Signal Paint, J. W. R. Griffiths. "J. BIRE." June 1957. 9 pp. The problem of trace-to-trace correlation is reviewed in the light of some physiological experiments on the relationship between the area of an illuminated patch and the contrast required for its detection.

Detection of Pulse Signals in Noise: Trace-to-Trace Correlation in Visual Displays, D. G. Tucker. "J. BIRE." June 1957. 11 pp. Available experimental data are reviewed, and some theoretical considerations discussed, with a view to establishing the nature of the phenomena whereby side-by-side presentation of traces, or serial presentation of p.p.i. pictures at intervals great enough to eliminate electrical or visual integration, gives much superior detection to that obtained by true integration.

Applications of a Synchro-Voltmeter, D. L. Davies. "El. Energy." June 1957. 3 pp. Various applications of a specialized valve-voltmeter are described, with particular reference to the testing of synchros. Other uses, which make use of the special features of the instrument, are illustrated by a few simple examples.

A Voltage Gain Nomogram for Transistor Circuit Design, R. Wellsand. "El. Des." July 15, 1957. 3 pp. Gain variations with changes in circuit values can be found with the nomograms given in this article.

Some Nucleonic Instruments for Clinical Use, E. W. Pulsford and N. Veall. "J. BIRE." June 1957. 9 pp. The electrical and mechanical requirements are discussed from the points of view of designer and user.

A Constant Voltage D.C. Source, W. L. Marks. "El. Energy." July 1957. 4 pp. The design of a constant voltage d.c. source is described, using a three-phase magnetic amplifier. The load is decoupled by an accumulator so that the voltage supplied by the device is held constant, even for a very considerable current demand.

A Wide-Band Level-Measuring Set, R. C. Bolt. "ATE J." April 1957. 6 pp. This article describes a self-contained portable instrument for indicating the power in a transmission circuit. The indication is given on a meter calibrated in decibels relative to one milliwatt. Balanced or unbalanced measurements can be made with or without internal terminations. The instrument is untuned, and covers a frequency range from 200 c/s to 612 kc/s. This makes it particularly suitable for testing multichannel carrier telephony systems.

Monoenergetic Absorption Peaks Obtained with a Scintillation Spectrometer, J. R. Haskins. "Rev. Sec." June 1957. 2 pp. The effect of finite channel width in distorting intensities of monoenergetic lines in a scintillation spectrometer is considered. It is found that peak area divided by channel width gives the rate of monoenergetic absorptions in the crystals. A correction to intensities proportional to the square root of the pulse height is not applicable.

A Versatile Source of Millimeter Waves, C. F. Hempstead and A. R. Strand. "Bell Rec." July 1957. 5 pp. Latest versions of the backward-wave oscillator can deliver 5 to 10 mw between 45,000 and 57,000 mc, and oscillation has been achieved at 200,000 mc.

The Ultimate Performance of the Single-Trace High-Speed Oscillograph, M. E. Haine and M. W. Jervis. "Proc. BIEE." July 1957. 6 pp. It is shown that considerable improvements over the best present-day designs are theoretically possible. The results indicate the design trends which should achieve the improved performance.

Xeroradiography, D. B. Slauson. "IRE Trans. PGME." July 1957. 5 pp.

Electronic Applications in Cardiovascular Surgery, J. A. Hopps. "IRE Trans. PGME." July 1957. 9 pp. The role of electronics for diagnostic and therapeutic use in heart surgery at lowered body temperature (hypothermia) is discussed.

Muscles Control Iron-Lung Operation, L. H. Montgomery. "El." July 1, 1957. 2 pp. Nerve impulses are picked off to trigger the control circuit of the artificial respirator. Safeguards are built in to initiate automatic respiration if respiratory impulses cease or are too long delayed.

The Design and Performance of a New Experimental Single-Transient Oscillograph with Very High Writing Speed, M. E. Haine and M. W. Jervis. "Proc. BIEE." July 1957. 5 pp. A demountable construction is used which permits various types of deflector systems to be employed, and allows the current in the final spot to be measured by a Faraday cage moved to intercept the beam.

Electronics in Medicine, W. E. Hodges. "IRE Trans PGME." July 1957. 9 pp. Review of the reasons why the audiometer is necessary in terms of the physiological function of the human ear.

RADAR, NAVIGATION

The Problem Of The Position-Finding Accuracy Characteristic In Radionavigation, A. G. Saibel'. "Radiotek," May, 1957. 5 pp. The position-finding accuracy characteristic is examined in various forms, and on the basis of the derived functions the error-probability distributions are compared for elliptic scattering.

Problems in Protection of Radar Receivers, G. D. Speake. "El. Eng." July 1957. The protection of a radio receiver from damage caused either by the associated system transmitter or from external sources is discussed. The main emphasis is placed on t.r. devices based on a gas discharge, and the advantages and limitations of these components are outlined.

Back Scattering from Water and Land at Centimeter and Millimeter Wavelengths, C. R. Grant and B. S. Yaplee. "Proc. IRE." July 1957. 7 pp.

Microwave Remotes Aid Air Traffic Control, E. K. Peterson, H. R. Ulander, R. N. Hargis, and E. Hajic. CAA is constructing a microwave system to remote radar information for air traffic control. The various controls and equipment involved are discussed.

Remote Presentation of Radar Information by Microwave Link, G. J. Dixon and H. H. Thomas "J. BIRE." April 1957. 17 pp. The problems inherent in the transmission of radar information are reviewed. The bandwidth required by the information content is shown to be very low and some methods of bandwidth compression of the original radar signals are discussed briefly. The problems of transmitting a complete radar signal are then considered.

International ELECTRONIC SOURCES

SEMICONDUCTORS

*The "Spacistor." "El. Ind." Sept. 1957. 1 p. A new semiconductor device is being developed which is potentially capable of operation at frequencies to 10 KMC. Further advantages of the spacistor include possibilities of using materials with shorter carrier lifetimes than garmanum or silicon.

Some Characteristics of Saturated Diodes with A.C. Heating, F. A. Benson and M. S. Seaman. "El. Eng." July 1957. 5 pp. Some characteristics of saturated diodes, types 29C1, AV33 and A2087, when operating with a.c. filament supplies, have been examined. The investigations have been concerned with the shapes of anode-current/anode-voltage curves, the variations of mean emission currents vary with supply frequency and the way in which ripples superimposed on the emission currents vary with frequency and emission current.

The Effect of Nuclear Radiation on Selected Semiconductor Devices, G. L. Keister and H. V. Stewart. "Proc. IRE." July 1957. 7 pp. The authors investigate the relative sensitivity of germanium and silicon transistors to nuclear radiation, and the type and extent of damage that results.

Very Narrow Base Diode, R. H. Rediker and D. E. Sawyer. "Proc. IRE." July 1957. 10 pp. A combination of high-frequency capability and low forward-voltage drop is attained with the extremely thin base widths produced by a new etching technique.

Compensating Silicon Transistor Amplifiers, S. H. Gordon. "El." July 1, 1957. 2 pp. Compensation for thermal sensitivity of silicon transistors is necessary. The author discusses effects of impedance mismatch, feedback, and thermistor compensation for the grounded-emitter configuration over a range of 20 to 100°C.

Transistor Characteristics at Very Low Temperatures, Shintaro Uda. "J. Ite." March 1957. 13 pp. Terminal characteristic curves of common-base p-n-p junction transistors at liquid air temperature and liquid helium temperature are given and compared with those obtained at room temperature. As specimens, three p-n-p junction transistors made by different companies have been tested.

New Frontiers in Solid-State Physics, M. H. Hebb. "El. Des." July 15, 1957. 2 pp. The author surveys recent developments in this field.

Influence of Surface Oxidation on Alpha of Germanium P-N-P Transistors, J. T. Wallmark. "RCA Rev." June 1957. 17 pp.

Junction Transistors in Switching Applications, G. Forshaw, and N. W. Morgalla. "ATE J." Jan. 1957. 25 pp. This article is mainly concerned with describing transistor circuits applicable to relay and electronic telephony, without considering the commercial aspects involved. Electrical properties of the device are investigated, with special reference to switching in the saturated mode. A functional switching equivalent circuit is derived in terms of a relay. Numerous examples of practical and theoretical circuits are given, and the possibilities of application in the electronic computing field are shown. Switching parameters are discussed, and ways of specifying the device for use in telephony are broadly suggested.

Using a Curve Tracer for Transistor Circuit Design, N. B. Saunders. "El. Des." July 15, 1957. 4 pp. The author describes the entire process involved in obtaining design information with a curve tracer.

The Capacitance Between Diode Electrodes in the Presence of Space Charges, C. S. Bull. "Proc. BIEE." July 1957. 5 pp.

Two-Collector Transistor for Binary Full Addition, R. F. Rutz. "IMB J." July 1957. 11 pp. Details are given of the design and operational features of two versions of a new multielectrods transistor which serves as a full adder for binary numbers in computer circuits.

A Precision Two-Point Probe for Measuring Resistivity of Semiconductors and Metal-to-Semiconductor Contact Resistance, J. Oroshnik. "Sylvania Technologists." January 1957. 4 pp. A two-point probe is described in detail which largely overcomes the major experimental difficulties in making resistivity measurements. Its adaptation to measuring the dc characteristics of soldered contact to semiconductors is also covered.

Behavior of Noise Figure in Junction Transistors, E. G. Nielsen. "Proc. IRE." July 1957. 7 pp.

TELEVISION

Photographing the Television Image, "Amer. Cinematographer." October 1956. 3 pp. Film records made of television programs are recorded by motion picture cameras having special shutters.

Automatic Level Control for TV Slide Chains, E. W. Lambourne. "El." July 1, 1957. 2 pp. A simple three-tube circuit is described which keeps peak-to-peak video-signal output from the iconoscope slide chain at a constant predetermined level.

Transistors Synchronize Portable TV Camera, K. Kinoshita, Yasushi, Fujimura, Y. Kihara, and N. Mii. "El." July 1, 1957. 2 pp. A crystal-controlled transistor divider uses flip-flops to produce the field frequency of 60 cps.

Miniature TV Camera with Drift-Transistors, H. Lennartz. "El. Rund." July 1957. 2 pp. The operation of drift transistors is briefly explained. They yield in emitter base circuits an amplification of 45 db at 1.5 MC. and of 24 db at 5.7 MC. They are suited for application in video amplifiers of miniature tv cameras for industrial closed circuit tv.

Electron-Optical Method For Varying the Scale of a Television Image, I. I. Tsukkerman. "Radiotek." March 1957. 6 pp. The electron-optical method for varying the scale of a television image is applied to an orthicon by transferring the electron image. The transfer section of this transmitting tube is converted into an electron-optical system with a variable magnification without inverting the image. The electron-optical system is computed. Characteristics are given for the transmission of small details when the scale is varied.

Videorecording, M. O. Gliklikh and M. I. Tsiklis. "Radiotek." March 1957. 8 pp. The paper examines the principles governing the design of television recording systems; the optimum variants of such systems are analyzed. The following types of systems are discussed: 1) systems for recording upon a continuously moving tape, 2) recording systems which use intermittent exposure of the tape.

One Method For Obtaining A Highly Accurate Frame Sweep, L. L. Santo. "Radiotek." March 1957. 7 pp. The paper determines the accuracy requirements governing the coincidence of the two rasters when the television signal is rerecorded. A circuit is proposed for the oscillator which supplies the control-voltage waveshape, and experimental data are cited.

A Helical Television Sweep, L. D. Feldman and M. Z. Iudich. "Radiotek." March 1957. 6 pp. The paper discusses the principles of operation, the advantages and disadvantages of a number of helical sweeps. Certain of them have found application in the industrial television equipment of the French company "Laboratoire Derveaux." Two types of sweep circuits are proposed.

The Network of Local TV Cables in West Berlin, R. Hoffmann. "Nach. Z." May 1957. 6 pp. A widespread network of TV cables, interconnecting the studio, the transmitter, the radio link terminal, and many terminals for outside broadcasts has been installed in West Berlin. The design and the circuit facilities in this network are described. Test and measuring equipment used during operation as well as some typical results from measurements are reported.

Use Of Computers For The Statistical Analysis Of Television Communication, E. I. Galitskaia, V. A. Garmash, D. S. Lebedev. "Radiotek." March 1957. 4 pp. The paper shows that it is possible to use computers in order to obtain multi-dimensional probability distribution functions for the brightness gradations of the television communication. Fragments of motion-pictures were used in the capacity of the television communication. For two frames the paper provides a unidimensional probability distribution function, the correlation function and the value of the entropy as computed according to a two-dimensional probability distribution function.

The Selection Of Videoamplifiers, Iu. N. Prozorovskii. "Radiotek." March 1957. 5 pp. The paper demonstrates the regions in which it is practical to utilize compensated RC amplifiers and amplifiers with distributed constants. The most advantageous number of stages is determined, as well as the minimum duration of the leading edge of the transient response of the compensated amplifier; the conditions governing a rational arrangement of the tubes in a multistage amplifier with distributed constants are analyzed.

The Vectorscope, N. N. Parker Smith and C. J. Matley. "E&R Eng." June 1957. 9 pp. The vectorscope has been designed to display the chrominance component of the color TV signal as a pattern of vectors. Use of the instrument for color work is analogous to that of the normal waveform monitor employed for monitoring black-and-white signals.

Junction - Transistor Bootstrap Linear - Sweep Circuits, K. P. P. Nambiar and A. R. Boothroyd. "Proc. BIEE." May 1957. 14 pp. Junction-transistor linear-sweep circuits of the 'bootstrap' type are described for which deviations from perfect sweep linearity of much less than 1% are estimated to be possible. Fast, yet accurate, linear sweeps are shown to be possible, examples being given of circuits generating sweeps of less than 1 microsec duration.

Filter and Delay Equalizer Networks for TV Cables, H. Keil. "Nach. Z." Vol. 8, 7 pp. Filters and delay equalizer networks incorporated into the repeater stations of a vestigial sideband TV system are discussed. Three control frequencies are transmitted. The width of the Nyquist band is ±500 kc. Compensation circuits for distortions due to aging of tubes, temperature variations, etc. are described and a method for the calculation of a delay equalizer network by means of punched cards is presented.

Slow-Scan Adapter for Conventional TV Signals, S. K. Altes and H. E. Reed. "El." June 1, 1957. 3 pp. A conversion method has been devised by which standard scan signals can be converted to slow scan for transmission over limited bandwidth lines.

Bandwidth Compression of a Television Signal, G. G. Gouriet. "Proc. BIEE" May 1957. 8 pp.

$\Delta G = \Delta G / \epsilon n i \mu p \delta$

THEORY

***Is Portable Test Equipment Portable?**, Dr. R. Bilinski. "El. Ind." Sept. 1957. 2 pp. Technicians often fail to carry proper test equipment to the job simply because it is too clumsy or too heavy. The author is studying the relationship of optimum size and weight in relationship to the average technician's physicial dimensions.

The Computation Of Spectra Of Random Processes, A. A. Kharkevich. "Radiotek," May, 1957. 7 pp. The paper analyzes the methodological problems pertaining to the spectral representation of both stationary and nonstationary random processes. The analysis is based upon the Wiener-Khintchine Theorem.

A Contribution on the Triode System of the Cathode Ray Tube Electron Gun, M. E. Haine. "J. BIRE." April 1957. 6 pp. By analysis of published experimental data it is shown that the triode system of the conventional electron gun is very inefficient from an electron-optical viewpoint. It is deduced that the deficiency arises from spherical aberration arising from the strong curvature of field immediately in front of the cathode, essentially still in "object space."

On the Nonlinear Behavior of Electron-Beam Devices, F. Paschke. "RCA Rev." June 1957. 22 pp. With the simultaneous linear differential equations given, it is possible to treat nonlinear phenomena in traveling wave-tubes.

Meteoric Dust Erosion Problem and Its Effect on the Earth Satellite, S. A. Hoenig. "Aero. Eng. Rev." July 1957. 4 pp. The hazards of meteoric dust for space flight are reviewed, and it is indicated that for short-lived vehicles the hazard is negligible.

Ion Oscillations in Electron Beam Tubes; Ion Motion and Energy Transfer, R. L. Jepsen. "Proc. IRE." August 1957. 12 pp. Calculations aimed at establishing a useful picture of ion oscillations in gridded drift tubes are presented, and a plausible physical picture of some possible ion motions is obtained.

On Multimode Oscillators with Constant Time Delay, V. Met. "Proc. IRE." Aug. 1957. 10 pp. Special emphasis is paid to narrow-band systems with small number of modes, and to high switching speed.

Microwave Amplification by MASER Techniques, W. C. Smith. "IBM J." July 1957. 7 pp. The present note presents an elementary analysis of MASER operation, including its potentiality for broadband, short-transit-time amplification.

Heat Loss in Grooved Metallic Surface, E. A. Marcatili. "Proc. IRE." Aug. 1957. 6 pp. This paper describes an elementary and powerful way to calculate the conduction current losses in metallic waveguide walls, that have parallel periodic grooves of semicircular cross section, when the diameter of the circles is small with respect to the wavelength, but long with respect to the skin depth. The helix circular-electric waveguide falls in this class, and its circular-electric wave losses have been estimated.

Power Spectrum of a Carrier Modulated in Phase or Frequency by White Noise, R. Hamer and R. A. Acton. "E. & R. Eng." July 1957. 8 pp. A combination of measured and theoretical results is used to prepare generalized curves of FM and PM noise spectra.

On the "Best" and "Least Qth" Approximation of an Overdetermined System of Linear Equations, A. A. Goldstein, N. Levine and J. B. Hereshoff. "J. of Assoc. for Computing Machinery." July 1957. 7 pp.

Design of Oscillators—1, K. A. Pullen, Jr. "El. Des." July 1, 1957. 4 pp. A general discussion of oscillators.

Optimizing the Dynamic Parameters of a Track-While-Scan System, J. Sklansky. "RCA." June 1957. 23 pp. A common type of track-while-scan system is characterized by two dynamic parameters, one parameter correcting the position error, and the other correcting the velocity error. Such a system is analyzed in this article, and a scheme for optimizing the two dynamic parameters is suggested. Tools are derived for the optimization scheme in the form of charts and formulas describing the stability, transient response, noise, and maneuver error as functions of the dynamic parameters.

The Characteristic Value-Vector Problem, W. Givens. "J. of Assoc. for Computing Machinery." July 1957. 10 pp. The purpose is to suggest the impossibility of divorcing questions of scaling, as implied by the indiscriminate use of floating point operations, from questions of accuracy.

Application of the Smith Chart to General Impedance Transformations, H. N. Dawirs. "Proc. IRE." July 1957. 3 pp. The author extends the Smith chart to cases involving complex characteristic impedances, thus making the Smith chart adaptable to any linear, passive, bilateral two terminal-pair network.

Micro-Miniaturization Requires New Thinking, C. Brunetti, O. Stuetzer, J. W. Buffington, and L. K. Lee. "El. Des." July 1957. 4 pp. A survey of engineering approaches to micro-miniaturization.

The Behavior of Modulators, Feeding Complex and Selective Terminals, J. Gensel. "FREQ." Vol. 11, No. 6. June 1957. 10 pp. A detailed, thorough mathematical analysis is made of modulators feeding four terminal networks.

How to Improve Systems Engineering, J. N. Warfield. "Aero. Eng. Rev." July 1957. 2 pp. The problems which arise in engineering large and complex systems require solutions if technical resources are to remain adequate to meet demands on our technology. Some possible solutions to the multidiscipline, communication, and coordination problems are suggested.

Theory of Dipole Orientation Process in the dielectric Based on the Concept of a Visco-Elastic Model—Part II, S. Sharan. "J. ITE." March 1957. 7 pp. The theory developed in Part I has been refined to include an elastic turning of the molecule in conjunction with the viscous turning and it has been shown that the phenomenological viscosity envisaged in Part I is not pure viscosity but is a complex one. The introduction of this factor modifies the relaxation equations commonly known as the Debye equations.

A Set of Electronic Circuit Elements for Use with Symbolic Design Techniques, R. Beaufoy. "ATE J." Jan. 1957. 13 pp. In the application of time-division computer techniques to telephone switching problems, a set of electronic units has been developed which permits the design of a system to be conducted on a purely logical basis. The translation from logical design to electronic circuitry is sufficiently straightforward for this to be done by the wiremen.

Propagation of the Circular H_{01} Low-Loss Wave Mode Around Bends in Tubular Metal Waveguide, H. E. M. Barlow. "Proc. BIEE." July 1957. 7 pp. An examination of the conditions required to maintain as nearly as possible the appropriate field distribution at a bend leads to the important conclusion that the wavefront, represented by an equi-phase plane, must remain radial with respect to the centre of curvature.

The Linear Hall Effect, P. J. Price. "IBM J." July 1957. 10 pp. A new method for handling the Boltzmann equation is used to obtain, without approximation, a general formula for the linear Hall effect in a solid electronic conductor.

Spatial Variation of Currents and Fields Due to Localized Scatterers in Metallic Conduction, R. Landauer. "IBM J." July 1957. 9 pp. Localized scatterers can be expected to give rise to spatial variations in the electric field and in the current distribution.

On Bateman's Method for Solving Linear Integral Equations, G. Th. Thompson. "J. of Assoc. for Computing Machinery." July 1957. 15 pp.

Psychological Tests and Selection of Computer Programmers, T. C. Rowan. "J. of Assoc. for Computing Machinery." July 1957. 6 pp.

TRANSMISSION LINES

Determination Of Periodic Regimes In Systems Containing Sectionally-Linear Characteristics That Are Composed Of Elements Which Are Parallel To Two Specified Straight Lines. II, M. A. Aizerman, F. R. Gantmakher. "Avto. i Tel." March 1957. 8 pp. The method which was analyzed in Part I for finding periodic solutions in the form of complete Fourier series (without neglecting the harmonics) is extended to apply arbitrary sectionally-linear characteristics that are composed of segments which are parallel to two specified straight lines, as well as to arbitrary types of periodic regimes.

Propagation Characteristics of Low-Loss Tubular Waveguides, H. E. M. Barlow and H. G. Effemey. "Proc. BIEE" May 1957. 7 pp. Tubular metal waveguides of circular cross-section are known to be capable, in ideal circumstances, of providing a screened microwave channel having an attenuation of only a few decibels per mile. This article is concerned with the practicability of this arrangement using straight lengths of copper and aluminum tubing made and installed to commercial tolerances.

Transmission Line Impedance Measurement, H. F. Mathis. "El." June 1, 1957. 1 pp.

Design Of An Absorption Transmission Line, B. S. Melnikov. "Radiotek." Jan. 1957. 3 pp. The paper provides an analysis of an absorption line which is designed in such a manner that the absorption of energy per unit length is constant along the entire line.

TUBES

Tesla-Noval Tubes or Valves, Jaroslav Zuzanek and Jiri Deutsch. "KOVO Export." Nov. 1956. 6 pp. This is a description of Czechoslovak counterparts of our 12AU7, 2C51, 6CL6, etc.

A Survey of Methods Used to Determine Contact Potentials in Receiving Tubes, E. R. Schrader. "RCA Rev." June 1957. 12 pp. This paper describes the method of determining true grid-cathode contact potential by extrapolation of portions of the grid-characteristic curve, as well as two direct methods of measurement which are generally used in preference to the extrapolation method because of their relative simplicity.

International ELECTRONIC SOURCES

The Effects of Overload and Operation at High Altitudes on Electron Tube Life, H. C. Pleak and A. V. Baldwin. "Sylvania Technologists." January 1957. 8 pp.

30 Kc/s & 15 Kc/s Narrow Channel Test in the V.H.F. Band, D. Roddy. "El. & Comm." January 1957. 3 pp. Tests described in this article were made to demonstrate the effectiveness of recently developed equipment under practical conditions and were witnessed by members of the Department of Transport and the Federal Communications Commission of the United States as well as engineers from many of Canada's largest user organizations.

Life Considerations of Thoriated Tungsten Filament Valves, C. Kirka. "Cathode Press." Vol. 14, No. 1, 1957. 4 pp.

Survey of Developmental Position and Operation of Microwave Tubes II, R. Muller and W. Stetter. "El. Rund." July 1957. 6 pp. A survey is given of the operation of transit-time tubes (without static traverse fields). The article begins with describing the basic transit-time effects, i.e., phase focussing in field free space and reciprocal effects between an electron beam and a wave travelling along a line.

A Traveling-Wave Frequency Multiplier, D. J. Bates and E. L. Ginzton. "Proc. IRE." July 1957. 7 pp. The tube uses two helices in cascade. A simple adjustment of the second helix voltage selects and amplifies a particular harmonic of the input frequency.

Backward-Wave Oscillators for the 17 to 41 KMC Band, J. A. Noland and R. D. Lepic. "Sylvania Technologist." January 1957. 4 pp. Two backward-wave oscillators have been developed for use as voltage-tunable local oscillators. One operates over the frequency band 17 to 27 KMC, the other at 26.5-41 KMC, the voltage tuning ranges being 500 to 2000 volts. The circuit element employed in each case is a unifilar tape helix.

A Novel Cold-Cathode Tube, D. W. Hill. "ATE J." April 1957. 4 pp. Attention is drawn to the need for a current-operated cold-cathode tube in electronic telephone exchanges, for instance in the subscribers' line circuits. A suitable tube, having a movable trigger electrode of magnetic material is described, together with its associated operating coil and mounting.

A Low-Noise Klystron with High Power Output, R. A. La Plante and G. A. Esperson. "Phil. Tech." June 4, 1957. 8 pp. The flexible diaphragms with which most tunable klystrons are equipped are the most important source of noise in these tubes. Owing to the demand, in a certain application, for a tube with a much lower noise level, a non-tunable klystron has been developed in which these diaphragms are absent.

The Wamoscope—A Microwave Display Device, D. E. George. "Sylvania Technologist." January 1957. 3 pp. A microwave tube which gives a direct display of wide-band information on a cathode-ray tube screen is described. In this tube the amplitude-modulated microwave signal is fed to a helix of a forward-wave traveling wave amplifier. Energy is transferred to the electron beam in such a way that it becomes velocity and current modulated. Where the collector of a normal traveling wave tube would be, a velocity-sorting retarding-field electrode system is substituted.

Pulse-Firing Time and Recovery Time of the 2D21 Thyratron, J. A. Olmstead and M. Roth. "RCA Rev." June 1957. 13 pp.

The Design and Operation of High-Power Triodes for Radio-Frequency Heating, W. J. Pohl. "Proc. BIEE." July 1957. 7 pp. The relations between Class C oscillator performance and valve characteristics lead to relatively simple design principles.

U. S. GOVERNMENT

Research reports designated (LC) after the PB number are available from the Library of Congress. They are photostat (ph) or microfilm (mi), as indicated by the notation preceding the price. Prepayment is required. Use complete title and PB number of each report ordered. Make check or money order payable to "Chief, Photoduplication Service, Library of Congress," and address to Library of Congress, Photoduplication Service, Publications Board Service, Washington 25, D. C.

Orders for reports designated (OTS) should be addressed to Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. Make check or money order payable to "OTS, Department of Commerce." OTS reports may also be ordered through Department of Commerce field offices.

Higher-Order Radiative Corrections to Electron Scattering, D. R. Yennie and H. Suura, Stanford University. Nov. 1956. 15 pp. Mi $2.40, ph $3.30. (PB 124917, LC).

Long Persistent Exponential Decay Phosphors, J. F. Elliott, General Electric Co. Feb. 1956. 57 pp. $1.50. (PB 121527, OTS). The results of the project to develop a cathode-ray phosphor having a long persistent exponential decay characteristic with a time constant of the order of 0.5 sec to 2.5 sec or a phosphor having a concave downward decay characteristic with a similar decay time are reported. The effort was directed toward the development of a long persistent exponential decay phosphor. The decay and emission characteristics of phosphors using a strontium, barium or calcium silicate matrix and rare earth elements as activators are reported. A phosphor having the desired decay properties was not found.

Diffraction and Shielding Effects of Radar Screens, A. W. Randall and R. L. Williams, CAA. Mar. 1957. 12 pp. 50 cents. (PB 121918, OTS). This report describes the results of tests to determine the effectiveness of shielding screens for surveillance radars in reducing the strength of ground-clutter signals in critical areas. Although the scope of the experimental tests were very limited, it was found that properly designed screens can provide a worthwhile reduction in ground-clutter signal strength in areas where the sub-clutter visibility performance of the radar is inadequate.

Electron Tube Operation as Influenced by Temperature and Voltage, T. H. Briggs, Wright Air Development Center. Jan. 1956. 91 pp. $2.50. (PB 121798, OTS). A review of factors influencing tube reliability is undertaken primarily from the point of view of temperatures. Consideration is given to each tube part and the normally used materials, their design and processing. From these basic effects, the influences of tube operation and environment are reviewed as regards tube performance. For optimum tube performance and reliability it is shown that: a) heater and cathode temperatures should be maintained as closely as possible to published design centers; b) other electrode and environmental ambient temperatures should be as conservative as possible; c) no sharp line of demarkation exists between good and poor conditions, but all effects must be considered statistically; d) recognition of the physics involved in tube operation can yield improved circuit and applications reliabilities of as much as several orders of magnitude.

Experimental Counterrotating Marker Beacon, H. J. C. Pearson and M. S. Gilbert, CAA. Feb. 1952. 9 pp. Mi $1.80, ph $1.80. (PB 123571, LC).

Phase Retardation Design Curves for Solid Lossless Dielectric Panels, E. J. Luoma, Wright Air Development Center. Feb. 1956. 27 pp. 75 cents. (PB 121783, OTS). This report contains a series of graphs of phase retardation design curves for solid lossless flat dielectric sheets. The thickness of the flat dielectric sheets is plotted as a function of incidence angle for both perpendicular and parallel polarization and for the following constant phase retardation values: 45°, 90°, 135°, and 180°. The curves are plotted for a series of dielectric constants. For reference purposes on the same graphs the thickness of the flat sheets are plotted as a function of incidence angle for the following cases: 1) with the electrical thickness equal to 360°, the transmission efficiency is again a maximum for both polarizations. The graphs are intended for use as a design tool by radome designers.

Thermal Image Tube, J. Burns, Chicago Midway Laboratories. June 1956. 61 pp. Mi $3.90, ph $10.80. (PB 124111, LC). Two methods of reading surface potentials are analyzed in sufficient detail to show that they are, in principle, capable of reading potential differences as small as one millivolt. A third method, abberation modulation, is also discussed qualitatively. Sufficient data were not available to evaluate this technique thoroughly, however. In principle, it appears that both detection and measuring techniques are available, or under development, which on the basis of present knowledge should make feasible a thermal image tube capable of giving a picture of substantially television quality having sufficient sensitivity to permit detection of objects differieng by as little as one degree from background temperature.

Time Delay Relay, F. B. Foody, General Electric Company. Sept. 1954. 101 pp. Mi $5.70, ph $16.80. (PB 124798, LC). This report describes the development of a new type of time delay relay. All known types of timing elements were considered with respect to the specifications; models were built around several types. The development was unsuccessful in meeting all the requirements of the specifications, but a new type of thermal timing element was evolved.

Backward Wave Amplifier, a Voltage Tunable Microwave Amplifier, Daniel G. Dow, Wright Air Development Center. Sept. 1955. 16 pp. 50 cents. (PB 121797, OTS). A new form of microwave amplifier known as the backward-wave amplifier has recently become feasible due to new discoveries. This electron tube is capable of covering a wide band of frequencies, but is actually a narrow band filter which is tunable by varying the anode voltage. In addition to the filtering effect, the tube can have as much gain in the pass band as the better known traveling-wave amplifier. The history of the backward-wave amplifier is briefly discussed, its present status is outlined, and possibilities for future work are suggested.

Bright Display Equipment for Surveillance Radar, A. W. Randall and J. S. Marshall, CAA. June 1952. 12 pp. Mi $2.40, ph $3.30. (PB 123573, LC) Techniques and equipment used to provide a bright display of radar information are described in this report, together with a technical evaluation of the results obtained from experimental equipment. Performance requirements for the display equipment are discussed, with consideration being given to the operational requirements. An analysis is made of the characteristics and limitations of the equipment.

Interaction of an Electronic Beam with a Periodic Circuit, R. W. Gould, California Institute of Technology. March 1956. 28 pp. Mi $2.70, ph $4.80. (PB 120413, LC). A field theory of a space-harmonic traveling wave tube is developed using a stationary field matching procedure. The circuit is the circularly symmetric disc loaded waveguide.

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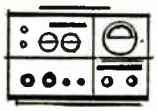
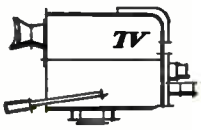
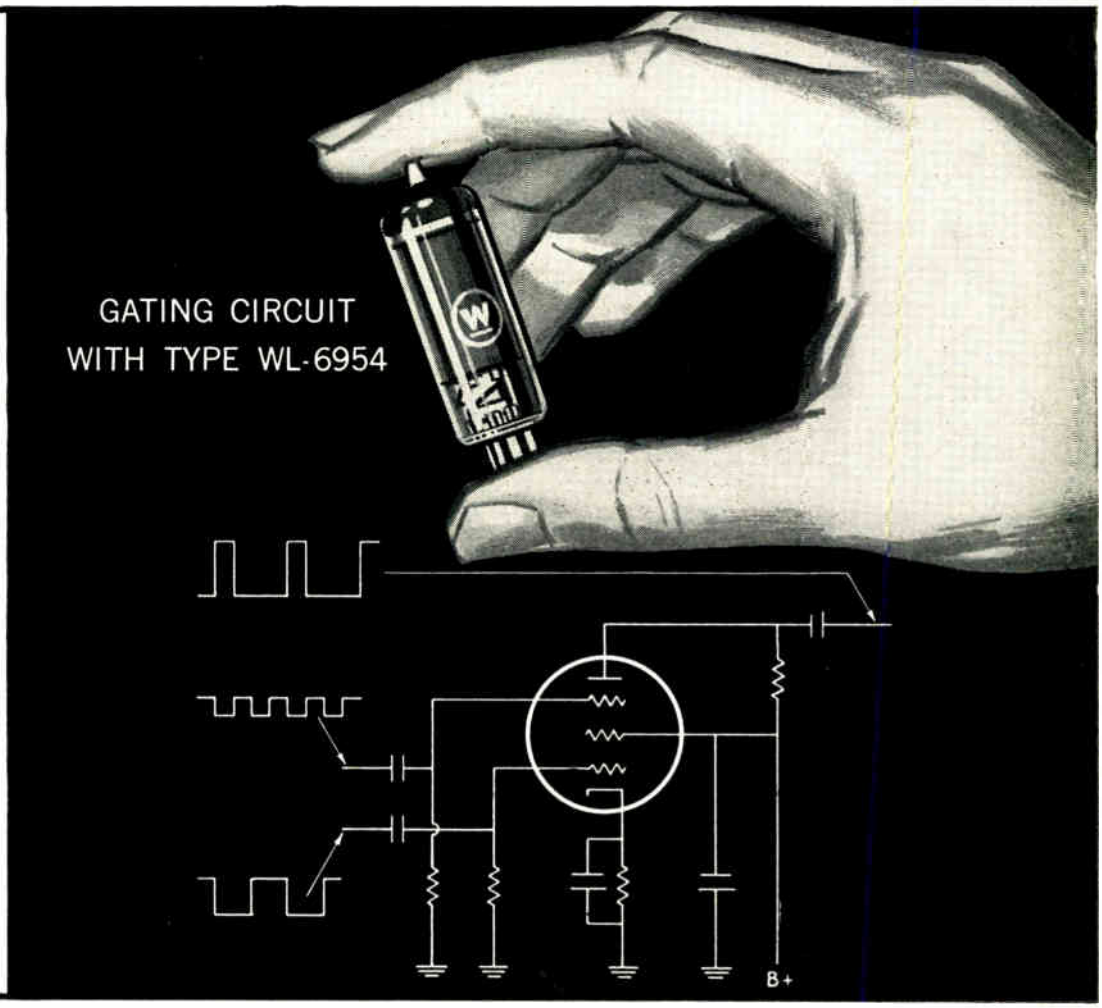


Test Equipment



Closed Circuit TV



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Black Light (*Continued from page* 63)

is insufficiently precise. Black light offers interesting possibilities because it can be pulsed and modulated by optical as well as by electronic means.

Future Possibilities

Many misconceptions have existed concerning black light and its use. The first man who suggested that ultra-violet light might give better results in recording sound for motion picture film was properly squelched because ultra-violet "just won't go through glass lenses." Later, by accident, it was observed that longwave ultra-violet light does indeed go through glass as easily as does white light. Thus was born a patent which served the film industry over its alloted span.

Even now when it is suggested that underwater communication or observation might be possible with black light, objections are occasionally heard that this is impossible because "ultra-violet light just won't go through water." Actually, water is extremely transparent to ultra-violet, all the way down to 2000 Angstrom units, which is as good or better than the transmission of quartz.

Techniques are needed whereby control of air traffic can be improved. Perhaps black light can offer some answers in this line. There is a need for a means, such as a special pair of goggles or a special windshield, which will permit the user to see by invisible rays. There are needs for many "impossible" innovations.

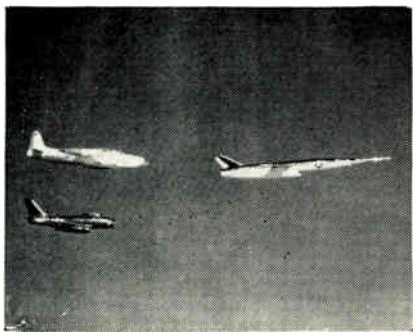
Missile Control

(*Continued from page 57*)

tional to α for small angles. K_{JL} is lift force on the jet vanes. The lift constant K_L is defined as the lift per unit angle of attack with zero rudder angle.

Since we are primarily concerned with dynamic or transient response, we can neglect the steady-state part of the lateral force equation which consists of a balance between the missile weight and a constant lift force. The angles are then small deviations from the steady-state values. The sum of the lateral forces is equal to the mass times the lateral or centripetal acceleration. Both the moments and the lateral forces are functions of dimensionless aerodynamic co-efficients and other quantities previously defined.

If we make the following substitutions in the moment and lateral force equations



Navy jet fighters ride herd on the Navy's new Regulus II test vehicle in flight.

$$\omega_C^2 = \frac{K_C}{I} \qquad (2)$$

$$\omega_s^2 = \frac{K_s}{I} \qquad (3)$$

$$\omega_D = \frac{K_D}{I} \qquad (4)$$

$$\omega_L = \frac{K_L + F}{mV} \qquad (5)$$

$$\omega_{RL} = \frac{K_{RL}}{mV} \qquad (6)$$

We have 3 equations in 4 unknowns.

$$s^2\theta + \omega_D s\theta + \omega_s^2\alpha = \omega_C^2\delta \qquad (7)$$

$$s\gamma = \omega_L\alpha - \omega_{RL}\delta \qquad (8)$$

$$\alpha = \theta - \gamma \qquad (9)$$

Thus, we can derive a relation between any 2 of the unknowns. The one most useful in autopilot design

(*Continued on page 136*)

(*Continued from page* 135)

is the one relating the missile angle θ to the rudder angle δ. Thus the missile pitch transfer function is

$$G_M(s) = \frac{\theta}{\delta} = \frac{\omega_C^2\left[s + \omega_L - \omega_{RL}\frac{\omega_s^2}{\omega_C^2}\right]}{s[s^2 + (\omega_L + \omega_D)s + \omega_s^2 + \omega_L\omega_D]} \quad (10)$$

Substituting

$$\omega_L^1 = \omega_L - \omega_{RL}\frac{\omega_s^2}{\omega_C^2} \quad (11$$

and noting that $\omega_L\omega_D << \omega_s^2$---, Eq. 10 can be simplified to

$$G_M(s) = \frac{\omega_C^2(s + \omega_L^1)}{s[s^2 + (\omega_L + \omega_D)s + \omega_s^2]} \quad (12)$$

Typical pitch attenuation diagrams are shown in Fig. 7. Referring to the diagram for high q we see that the slope for low frequences is —20 db/dec. which

A Navy Talos missile zooms off to lock onto a target guided by its mechanical brain.

breaks up to 0 db/dec. at a frequency $\frac{1}{\omega_L^1}$. We then have a double break with a resonant peak at approx. ω_S. The cross-over frequency of the —40 db/dec. line is ω_C. The height of the resonant peak depends on the total damping $(\omega_L \div \omega_D)$. The ω_D damping results from the angular motion of the missile and the ω_L damping from the lateral motion of the missile c.g.

As dynamic pressure decreases at high altitudes the attenuation diagram changes as shown by the low q diagram. Thus ω_C, ω_s and ω_L^1 are all much lower and the resonant peak is quite a bit bigger. During a typical flight the resonant frequency ω_S might vary from about 0.2 to 10 rad./sec. The resonant peak may vary from about 3-4 at high q to about 100 at low q.

The third diagram in Fig. 7,

shows the attenuation diagram immediately after launch. In this case ω_S and ω_L are zero due to the absence of aerodynamic forces and ω_C is determined by the jet vanes only. This gives an attenuation diagram with a —40 db/dec. slope similar to roll.

Rudder Actuator Transfer Function

The rudder actuator transfer function is normally combined with that of the rudder and thus depends on the aerodynamic forces which act on the rudder. The deviation of this transfer function is indicated in Fig. 8. This shows the rudder mechanically coupled to the actuator and controlled by the actuator control current i.

This transfer function is derived from the equation of moments about the rudder axis of rotation. The moments acting on the rudder include the control moment proportional to the control current, the hinge moment proportional to rudder angle, and the damping moment proportional to rudder angular rate. K_{jh} is the jet vane hinge moment. The aerodynamic hinge moment is similar to the restoring moment and results from the fact that the center of pressure of the aerodynamic forces acting on the rudder does not in general coincide with the rudder axis. The center of pressure varies with Mach number and is somewhat further aft on the rudder for supersonic flow conditions than for subsonic.

To minimize the size of the actuator it is desirable to design the rudder so that the axis of rotation is near the middle of the range of travel of the center of pressure. This means that K_h is negative for subsonic conditions. In addition to this variation with Mach number, the hinge moment is also proportional to dynamic pressure and therefore varies widely in magnitude during flight.

The damping constant K'_{DR} is the sum of the aerodynamic damping on the rudder and the damping resulting from friction in the actuator. Since the friction damping is generally larger than the aerodynamic damping, this constant does not vary much during flight.

(*Continued on page* 138)

(*Continued from page* 137)

As indicated in Fig. 8, the rudder actuator transfer function has quite a different form depending on whether K_h is positive or negative. With K_h positive, we have a second order underdamped term in the denominator which gives rise to a resonant peak. With K_h negative, the denominator factors into 2 real roots, one of which is positive. The positive root ω_1 is always smaller than the negative one.

Typical rudder actuator attenuation diagrams are illustrated in Fig. 9. Referring to the high q supersonic curve, we see that the response is flat out to the resonant frequency $\sqrt{K_h/J}$. Beyond the resonant peak we have a —40 db/dec. slope which crosses over at a frequency $\sqrt{K_T/J}$. As q decreases, the crossover frequency of the —40 db/dec. line remains fixed, the resonant frequency decreases and the low frequency gain increases. The highest resonant frequency would normally be about 40 rad./sec. The height of the resonant peak does not vary much because the damping does not change very much.

For subsonic flow, the attenuation diagram contains 2 simple breaks at ω_1 and ω_2. We recognize, of course, that ω_1 corresponds to a positive real root and therefore the Bode theorems do not apply. However, since ω_1 is normally much below the loop crossover frequency, the additional phase shift at the crossover frequency is not appreciable.

Lightning Labs

(*Continued from page* 69)

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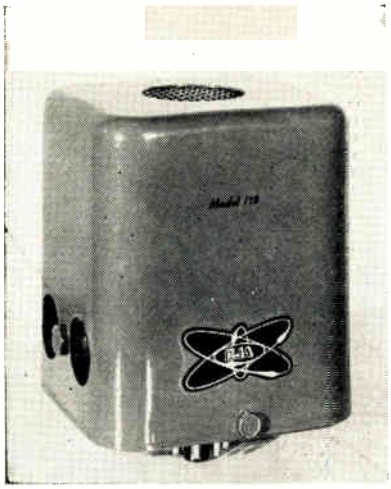

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Circle 95 on Inquiry Card, page 101

Spacistor

(*Continued from page* 60)

voltage changes across the main p-n junction. Measured input and output impedances in early experimental units are approximately 30 megohms. Low-frequency power gain is at least as high as that of present transistors.

Further interesting characteristics of the spacistor are the decoupling of input and output circuits, low capacities, and independence of operation on minority carrier lifetimes—this latter feature may open the way to use of new, high temperature semiconductors such as silicon carbide.

In space-charge regions of reverse-biased junctions, field strength is limited only by the breakdown voltage of the semiconductor body. The Spacistor utilizes these high fields to accelerate the charge carriers so that their transit time is greatly shortened.

A typical experimental Spacistor is shown schematically in Fig. 2. The semiconductor body is a reverse-biased *p-n* junction with a space-charge region *sc*. Injector *I* (here shown as a tungsten-wire pressure contact) and modulator *M* (here shown as a gold-wire alloyed contact containing some p-type dop-

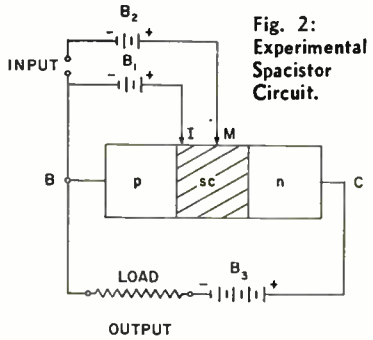


Fig. 2: Experimental Spacistor Circuit.

ing material) are the input points; base *B* and collector *C* are the output points.

I is connected to *B* through battery B_1, which biases *I* negatively with respect to the underlying space-charge region *sc*. (Note that the potential of point *I* is still positive with respect to point *B*.) Electrons are emitted from *I* into *sc*, and the emission is space-charge-limited.

M is connected to *sc* at a point between *I* and the *n* region of the semiconductor body. Since *M* is biased negatively with respect to

sc by means of battery B_2, holes cannot flow from *p* to *sc*; therefore *M* draws practically no current. (Note that the potential at *M* is still positive with respect to *B* and *I*.)

Modulator *M* has two functions. First, it varies the emission of injector *I* by superimposing an a.c. voltage on the d.c. bias. The field produced by *M* penetrates throughout the space charge region to its boundaries.

The second function of modulator *M* is to make the bias of injector *I* practically independent of the voltage applied across *B-C* so as to keep the output impedance desirably high—in excess of 30 megohms for an injected current of 0.3 ma.

Transconductance (g_m) of present experimental Spacistors is considerably below that of good vacuum tubes but with further development it is expected that comparable values will be attained.

A low-frequency power gain of 70 db has already been achieved with experimental Spacistors at low frequencies.

Gyros

(*Continued from page 64*)

instruments in complete isolation. No smoking or eating is permitted. Even a puff of cigarette smoke can contaminate this space.

All cracks and crevices where dust could collect were eliminated. The floors are covered with vinyl sheets that are rolled up on the wall approximately 3 in. Lighting fixtures, electrical, telephone and vacuum outlets are flush mounted and all cracks sealed. Standard kitchen furniture was used in preference to lab furniture due to its lack of dirt catching surfaces. Shaped plastic kitchen counter tops were used on the work tables.

Dental laboratories and the watch - making industry supply most of the trained technicians recruited for this highly precision work. Production tolerances of 10/1,000,000ths of an inch are attained. Much of the work is accomplished with the aid of microscopes. Some of the gyros weigh less than 4 oz. and are only one inch in diameter by two inches.

Modulation Measurement

(*Continued from page* 61)

the face of an oscilloscope, direct measurement of modulation percentage is possible. The graph as shown has a % modulation scale from 0 to 100; however, a graph with any desired scale can be constructed from the formula given.

In use, the envelope maximum is adjusted to touch upper and lower horizontal lines. After the pattern is moved horizontally so that the envelope minimum touches the curves the % modulation is read on the abcissa below this point.

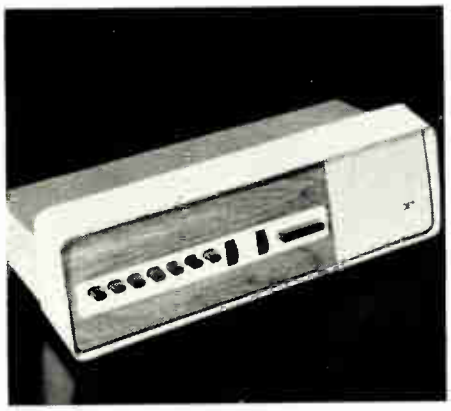
SSB Flight-Tested

The ARC-65, a single-sideband version of the ARC-21, was recently flight-tested by the USAF during a 'round-the-world-flight. The high-altitude, long-range airborne radio communications system incorporates many engineering features of the original double-sideband system, including provisions for 44,000 frequency channels.

New Products

INTERCOM

Special feedback circuits, giving very low distortion and high speaker damping, resulting in a smooth, clear, natural sound are the outstanding features of the new intercom. Avail-

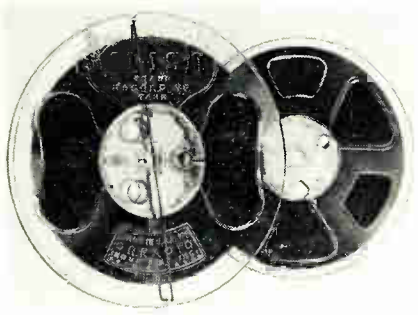


able in either 6 or 12 station masters with remotes. Some of the features are: 100% ac operation for long life; completely balanced 45 ohm lines throughout for noise free operation, instrument quality push button; printed circuits; optional handset for privacy; and a feedback noise cancellation circuit for lower background noise. Fisher Berkeley Corp., 5633 Grove St., Oakland 9, Calif.

Circle 212 on Inquiry Card, page 101

TAPE REEL

New ¾ in. Irish tape reel offers many advantages over the standard 5 in. reel. It has a professional type hub, 2¼ in. diameter which equalizes tension on the tape and makes for smoother, more efficient operation of the recorder. Reel also provides easier access to the threading eye by a larger opening in the reel. An added convenience is 24 sq. in. of indexing



space on the two sides. A rubber band in notches keeps the tape from spilling on the reel. ORRadio Industries, Inc., Opelika, Ala.

Circle 213 on Inquiry Card, page 101

Diana Radar Checks Minitrack Stations

Something new has been added to moonlight. The moon, our natural "satellite," is being "illuminated" by the giant Signal Corps

Signal Corps' Diana radar

radar transmitter, Diana, at Fort Monmouth, New Jersey. Reflected 151 MC energy is picked up at Minitrack stations and used to check them out for later Vanguard duties.

New Products

MAGNETIC TAPE

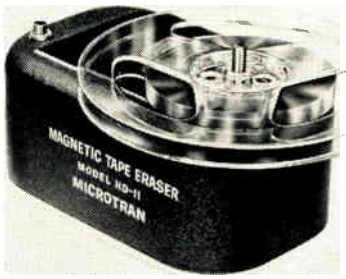
A new magnetic tape for the critical professional user reduces print level by 8 db and increases high frequency response. Tape provides an improvement in short wave length

response of 2 db with no loss in low frequency performance. Specially made for professional recording studios, in the motion picture industry, and in the radio broadcasting field for making recordings which will be stored permanently. The new Scotch brand tape is designated No. 131. Minnesota Mining and Manufacturing Co., 900 Bush St., St. Paul 6, Minn.

Circle 214 on Inquiry Card, page 101

TAPE ERASER

Magnetic tape bulk eraser, Model HD-11, erases recorded signals and noise from magnetic tape below level of standard erase heads. Spindle mounting of reel permits rapid, thorough coverage without missed spots. Usable with magnetic tape reels from 5 in. through 10 in. dia. May also be used for demagnetizing record - playback - erase heads, tools,



and other metal objects. Supplied with baked enamel finish. Size 3 x 5 x 8 in. Weight, 8½ lbs. Microtran Company, Inc., 145 E. Mineola Ave., Valley Stream, N. Y.

Circle 215 on Inquiry Card, page 101

Circle 113 on Inquiry Card, page 101

Circle 114 on Inquiry Card, page 101

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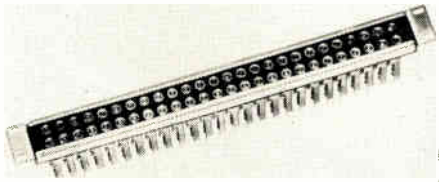
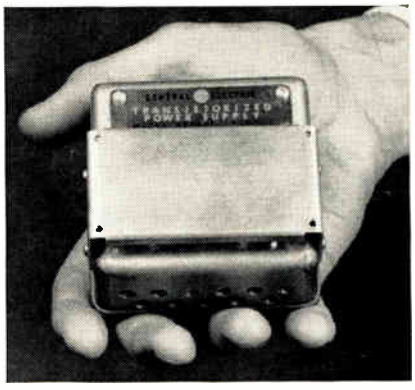


rigidity. It is 1¾ in. wide and fits a standard 19 in. relay rack. Comes complete with 52 ADC type PJ-318 normally closed circuit jacks. Mounting brackets, designation strips and jacks are plated to withstand a 50 hour salt spray test. Jack panel is equivalent to the Western Electric 230A. It is also available without jacks. Audio Development Co., 2833 13th Ave., Minneapolis 7, Minn.

Circle 216 on Inquiry Card, page 101

POWER SUPPLY

A new transistorized power supply has been developed for use with two-way radio systems. It is designed to provide greater reliability in mobile radio equipment and to effect savings in component replacement. The power supply will accomplish cost reductions in maintenance for both small and large fleet users because it replaces the receiver portion



of the power supply. New unit reduces the need for frequent replacement of vibrators. General Electric Company, Electronics Park, Syracuse, N. Y.

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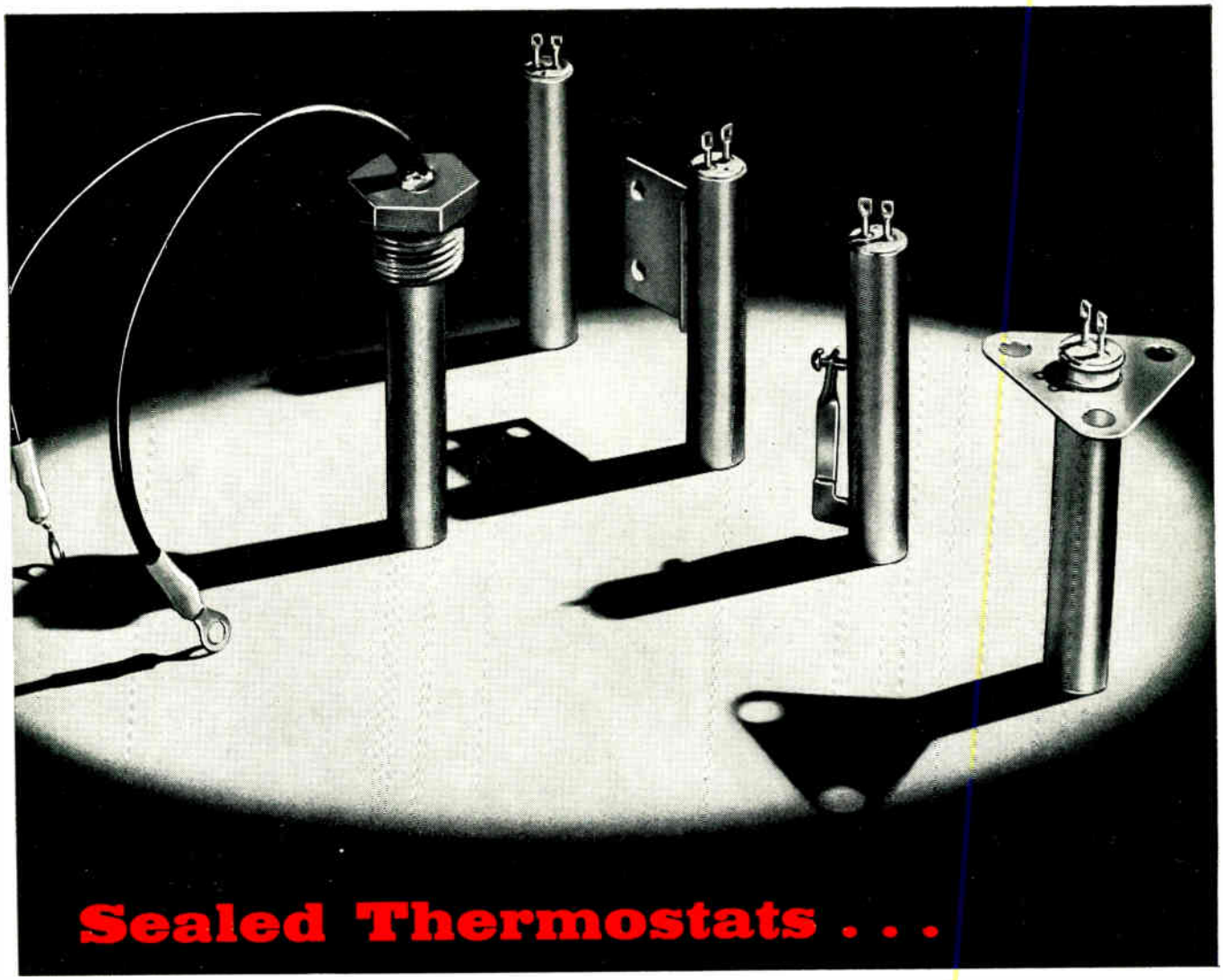

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