ELECTRONIC INDUSTRIES

NEW CONNECTOR DESIGN!

HERMAPHRODITIC CONNECTORS—
Improve Reliability, Speed Operations
—See page 51

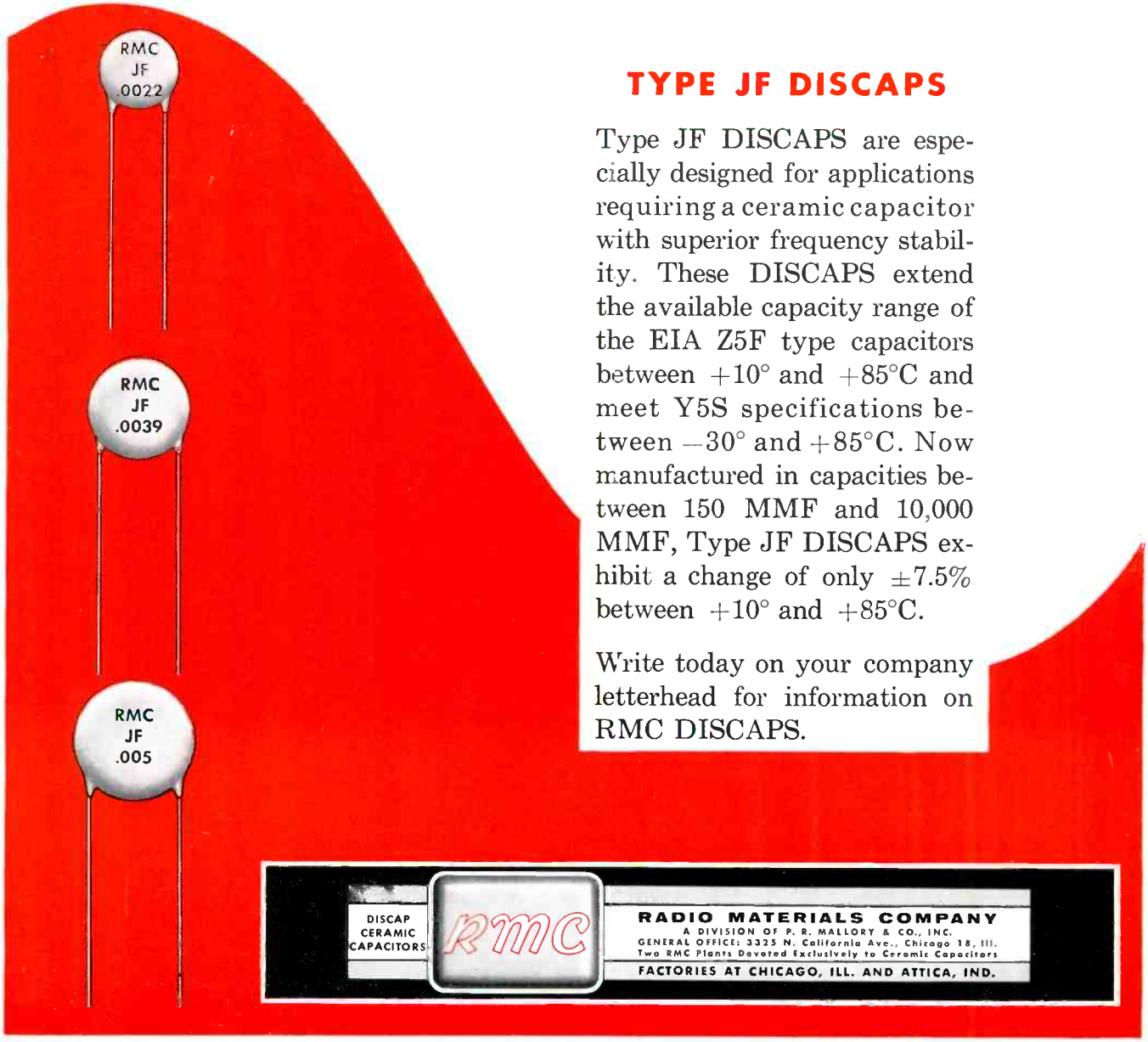
WIRE—In The Electronic Industries . .

December • 1958

A Chilton Publication

FREQUENCY STABILITY

WITH RMC DISCAPS



TYPE JF DISCAPS

Type JF DISCAPS are especially designed for applications requiring a ceramic capacitor with superior frequency stability. These DISCAPS extend the available capacity range of the EIA Z5F type capacitors between +10° and +85°C and meet Y5S specifications between −30° and +85°C. Now manufactured in capacities between 150 MMF and 10,000 MMF, Type JF DISCAPS exhibit a change of only ±7.5% between +10° and +85°C.

Write today on your company letterhead for information on RMC DISCAPS.

DISCAP CERAMIC CAPACITORS

RMC

RADIO MATERIALS COMPANY
A DIVISION OF P. R. MALLORY & CO., INC.
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 83

ELECTRONIC INDUSTRIES

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

Today's Electronic Engineer

As a part of our continuous readership-study program, we recently conducted a survey to determine some of the personal characteristics of today's electronic engineer. The survey was conducted by mailing a 4-page questionnaire to every eighth engineer on our circulation list in the OEM field. There were 139 multiple choice questions. We thought you might be interested in some of the results tabulated thus far.

Age Groups

	%	
Under 25	4	
25 - 29	18	75% under 40 years of age
30 - 34	32	
35 - 39	21	
40 - 44	12	
45 - 49	6	
50 - 54	4	
55 and over	3	

Education

Degrees 92%
B.A., B.S. 71% hold one or more (44% hold B.S.E.E.)
M.A., M.S. 18% hold one or more
Ph.D. 3% hold one or more

Engineering Information Sources

Trade magazines	95%
Conversation with others	79%
Engineering Association	54%
Engineering Conventions	52%
Trade Shows	47%
Post-graduate course	34%
Company training program	33%

Automobiles

99% own 1 or more
of these 67% own 1
and 33% own 2 or more

Military Service

67.6% have served in the armed forces
A. Navy 41%
B. Army 39% (3% served in more than 1 branch)
C. Air Force 20%
D. Marines 3%

Income

Average salary 5 years ago	$ 5,700
Average present salary	10,000
Average salary anticipated in 5 years	13,700

Pensions by Company

82% have pension plans
95% have health benefits

Home

75% own
25% rent
Aproximate value of home $20,000.

Miscellaneous Information

16% are ham operators
8% are licensed pilots
73% prefer classical music
90% are married
59% attend church

We're now processing these cards to cross-correlate the seemingly unlimited amount of information that has been available, and we shall be rendering another complete report to you in our March IRE issue. Meanwhile, for those who are interested, duplicate IBM card decks may be purchased from ELECTRONIC INDUSTRIES. The cards are broken down by state and zone. Age may be related to income, title to age or to income. Number of jobs to state, income, age, etc.

TV Shock Hazard

Recent newspaper accounts relate another story of TV-electrocution. An elderly man was killed and his friend received a severe shock as they attempted to lift a TV receiver up onto a shelf in a trailer in Miami. The circumstances parallel last year's case of the young boy who, too, was electrocuted when he came in contact with the metal cabinet of a portable TV receiver. This second death again emphasizes the shock hazard dangers in releasing transformerless receiver designs to the public. (See "Polorize the Plug," p. 53, Sept. 1957 issue of ELECTRONIC INDUSTRIES.)

We were happy to note that this year one major manufacturer went back to transformer-type power supplies in all of their new TV models. This effectively isolates the receiver chassis from the input power supply. We hope all manufacturers will initiate adequate design measures to properly assure the safety of the user public.

ROBERT E. McKENNA, Publisher
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ELECTRONIC INDUSTRIES

Vol. 17, No. 12 December, 1958

MONTHLY NEWS ROUND-UP

NEW PRODUCTS & TECH DATA

DEPARTMENTS

Highlights

Of This Issue

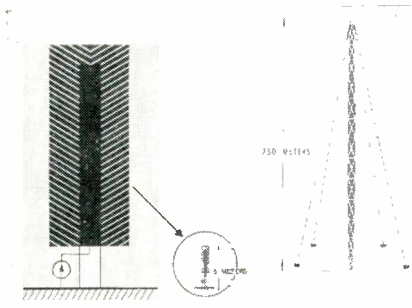
Hermaphroditic Connectors! page 51

In this new family on connectors there are no male or female members; all are exactly alike at their mating faces. Provisions have been made to maintain correct polarity, hot lead protection, sealing and coupling. Inter-connecting cables may be run without worry about having the correct connector on the right end. They can also be very easily mated in total darkness.

"Sexless" Connectors

The USAF Looks To Solid State Devices page 58

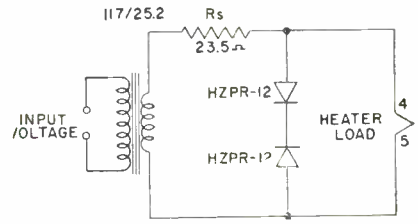
Although research continues in vacuum tubes, ion and electron ballistics and basic emission phanomena the Air Force is looking to solid state devices to supply the electronics necessary for space travel. The advantages include higher reliability, greater simplicity, size and weight reduction and better operating efficiency.



The USAF & Solid State

Zener Diodes In Heater Circuits page 64

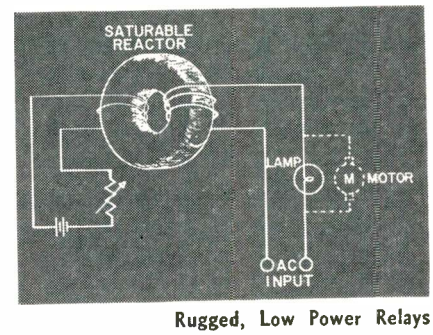
Zener diodes are now being used to regulate tube heated voltages. With regulated heater voltage, the tube plate voltage remains quite stable with large input changes. Heater regulation also greatly increases tube life. Typical applications of the regulators are given.



Zener Diodes

Magnetic Amplifier Operated Relays page 72

Good reliability, high vibration and shock resistance, and low control power requirements for handling large loads make the magnetic amplifier operated relay particularly attractive in aircraft and missiles. Here are design hints on how they can be incorporated in circuits.

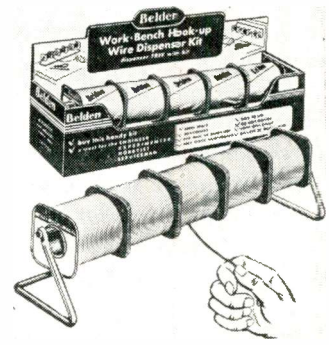


Rugged, Low Power Relays

WIRE—In the Electronic Industry page 89

For the design engineer here is a presentation of significant wire information. Included are: ASA & ASTM wire gauge standards; a general summary of Mil Specs; a graphical summary of MIL-W-76A color coding for hook-up and component interconnection wire; aircraft wiring code designations; and a flexible wire chart for consumer electronic equipment and appliances per Underwriters' Labs.

Electronic Wire



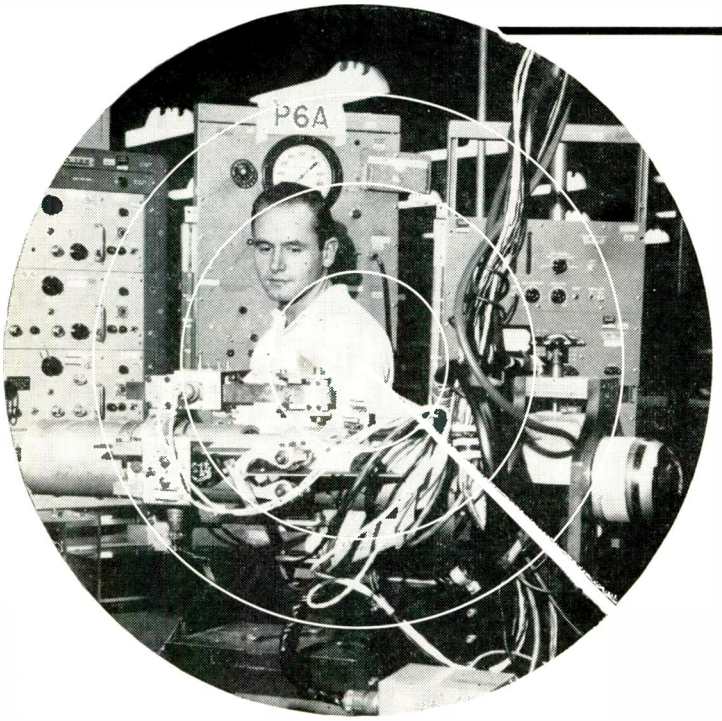
Coming Next Month—

"1959 STATISTICS OF THE RADIO-TV-ELECTRONIC INDUSTRIES"

A statistical summary of the past year in the electronic industries, with significant data and sales projections for the year ahead. Information will include:

- Consumer Goods
- Military & Government
- Industrial
- Commercial Communications
- Radio-TV Service
- Radio & TV Production
- Tape Recorder Sales
- Phonograph Sales
- Electronic Component Production
- Radio & TV Talent Costs
- Broadcast Stations
- Military Expenditures
- Semiconductor Sales

RADARSCOPE



MISSILE CHECK-OUT

At Philco's G&I Div., Phila. the complete guidance and control system of "Sidewinder" is checked out on simulated flight test equipment. The missiles are in use against Chinese jet aircraft.

1958 FACTORY OUTPUT of electronic equipment and components is expected to be around 6.9 billion dollars, or approximately 100 million less than the record 7 billion registered last year. The poor first half, which was marked especially in consumer electronics production, was almost balanced by a spurt in the latter half of the year which was spearheaded by the expanding military production and greater-than-seasonal upswing in radio and TV receiver output.

EFFECTS OF THE CONSENT DECREE entered into last month by RCA with the Justice Dept. are only hinted at in statements made by both parties at the time of the settlement, but a few cold facts do emerge. Perhaps most important is the general agreement that the decree "could get color television off the ground." RCA was forced to throw all of its color television patents into a "pool" open to any firms wishing to manufacture color TV sets or components. The only requirement is that any color TV patents that the firm itself might possess could also be picked up royalty-free by other members. If a company does not own a color television patent, it can join the pool simply by seeking entry. A company not wanting to join the pool at all, still can gain access to RCA color patents by paying a "reasonable" royalty, without putting its own patents into the pool.

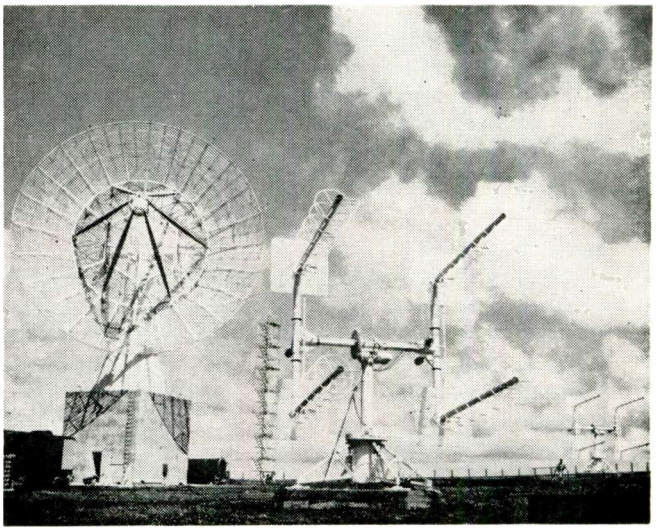
As a result of the consent decree no firms now need pay RCA royalties or existing "radio purpose" patents, except the public utilities. The consent decree, however, does not affect the RCA patents in other fields, such as automation, computers, atomics, tape recorders, and medical electronics.

RECEIVING TUBE SALES will continue to rise despite the increasing use of transistors, and sales projections call for production of about 450 million tubes a year in the near future—an increase of about 30 million over the current production. These figures were projected by Sylvania's Don Mitchell in dedicating Sylvania's 190,000 sq. ft. receiving tube plant in Altoona, Pa. While transistors are replacing vacuum tubes in many applications, the large number of TV receivers in use and other older equipment point to a substantial market for vacuum tubes for many years ahead. Some 40% to 50% of the industry's tube output for the next five years is expected to be used for replacement purposes in TV, radio and photograph sets.

A STANDARD METHOD of testing insulation resistance and printed wiring boards will be sought by a new joint steering committee composed of representatives of the Printed Circuit Section, EIA parts division, The Nat'l Electrical Manufacturers Ass'n. and the American Society for Testing Material. A research facility will be established at the University of Delaware with the work to start February 1959. The objective is to develop a standardized reproducible method of testing surface resistance in printed wiring boards such as those used in radio and TV receivers, computers, and advanced military electronic systems.

"MOON PROBE" PROBER

Information on the location of the Air Force's moonprobe missiles comes from widely scattered monitoring stations such as this tracking station in Hawaii. Shown are the 60-ft. parabolic antenna and two helical antennas in tracking position.



STEPPED-UP PROGRAM of training engineering technicians is provided for in the new National Defense Education Act of 1958. $60,000,000 has been set aside for vocational educational programs across the country. Engineering circles feel very hopeful for fulfillment of the "engineering team" concept.

AIR-TO-GROUND TELEPHONE, much discussed and experimented with up and down the East Coast, is approaching coast-to-oast commercial reality. The first installation will be a telephone "corridor" from the East Coast to 100 miles west of Chicago. An estimated 40 to 50 FM channels will be necessary to provide adequately for the traffic which will develop in the next 8 to 10 years. Frequency band being most favored is between 100 and 500 MC.

UPWARD REVISION of the estimates on this year's operation have been made by the Communications Industries Div., Business and Defense Service Administration. The new predictions call for approximately 7.3 million telephones to be produced this year against the less-than 6 million forecast by the division earlier. There will be about 2.8 million installations added in 1958, 600,000 more than the division estimated last fall. The long distance business is about 7% greater than 1957.

STEREO

NEW STEREO BROADCASTING SYSTEM demonstrated by RCA last month, almost ridiculously simple, uses the two sidebands of the conventional AM signal. Engineers see only minor revisions of existing station equipment necessary to enable any AM station to switch to stereo. No additional channel space would be needed. Full engineering evaluation is still to be made but the significance to the industry has many quarters anxiously watching developments. Even within the confined frequency range of AM broadcasting stereo would be very attractive to the public. First to suffer would be the FM'ers who up to now have been considered the main hope for stereo broadcasting. Chief benefactors would be radio set manufacturers who could look forward to an unprecedented boom.

HI-FI MANUFACTURERS are worried over the effect that "stereo" will have on hi-fidelity sales in general. After years of selling the public on the merits of name brand high-fidelity components the sudden all-out push on stereo is confusing. Many people are getting the impression that their 1- or 2-year old hi-fi is already obsolescent. The High Fidelity Advisory Council is being flooded with hundreds of inquiries from persons asking if their record collections and hi-fi installations will be obsoleted by stereo. Heavy public relations drive is needed if the industry is to retain public confidence.

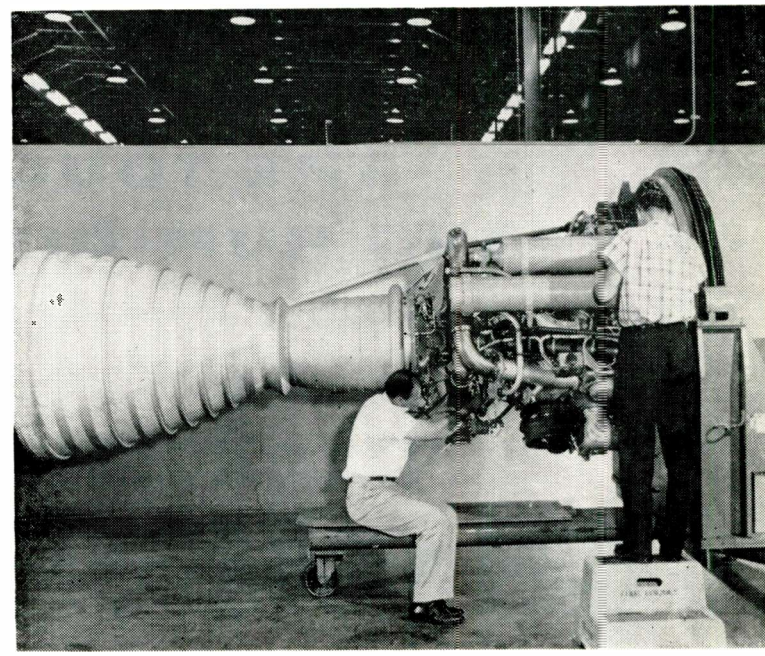
TWO AM BROADCASTERS in Atlantic City, N. J., WFPG and WMID, are cooperating on a stereo arrangement of their own. Thinking behind it is that while there are comparatively few FM receivers around, the average home has 5½ AM sets.

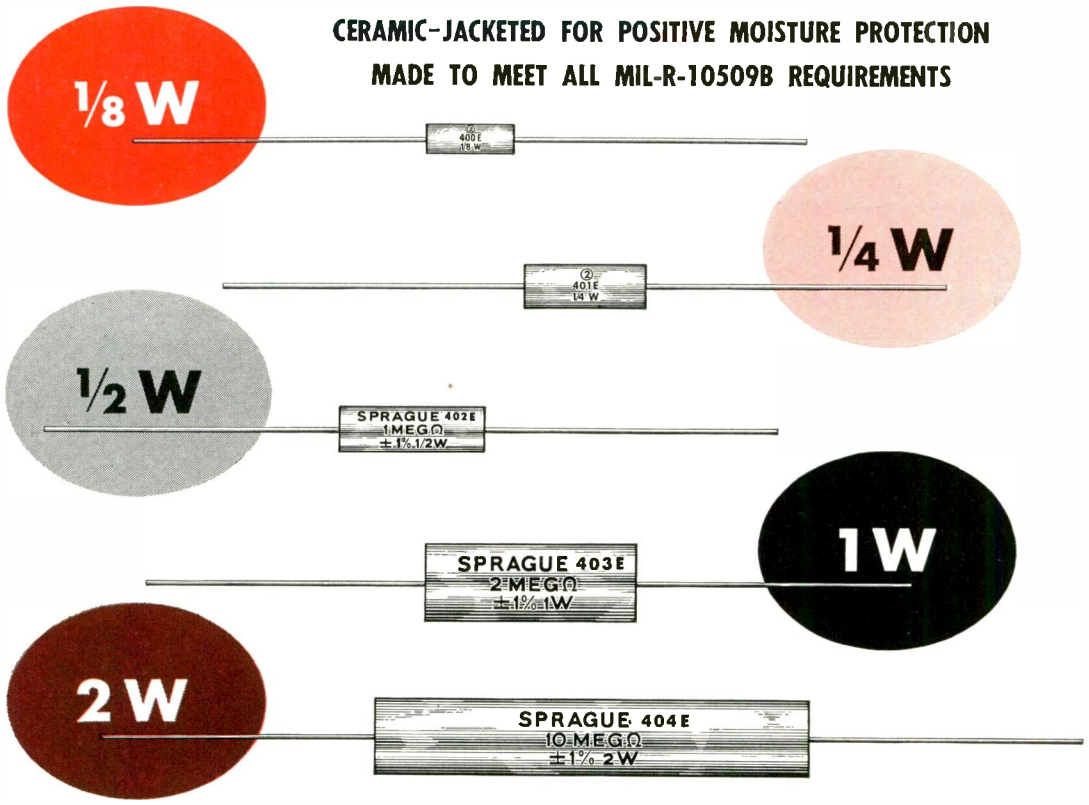
ENGINEERING EDUCATION

ENCOURAGING SIGN in the engineering education picture is the increasing interest on the part of companies in setting up both undergraduate and graduate schools at working locations. It has been quite common to see neighboring universities and industrial firms cooperating on research projects and company-paid tuition for employees. But not until quite recently have we seen requests from firms for complete college curriculums to be established in the plant vicinity by colleges perhaps hundreds of miles away. A prize example of this is a graduate program established by Drexel Institute of Technology, Philadelphia, at The Martin Co. in Baltimore, a hundred miles away. In this program not only the students, but the teachers as well, were drafted from The Martin engineering staff. Westinghouse has organized a similar program at their regional training school in New York City where courses are organized and taught by faculties of many universities. The significance of this trend can hardly be underestimated. For the first time really serious attempts are being made to breach the gap between classrooms and industry. It is vitally important if we are to maintain our technical superiority.

PROFILE OF POWER

Liquid-propellant rocket engine for the Thor IRBM is readied for shipment at the Neosho, Mo. plant of Rocketdyne, div. of North American Aviation Inc.





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233 MARSHALL STREET • NORTH ADAMS, MASSACHUSETTS

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INTERFERENCE FILTERS • PULSE NETWORKS • HIGH TEMPERATURE MAGNET WIRE • PRINTED CIRCUITS

As We Go To Press...

New Radar and Ultra-Sonic Transducer

A simple, and ingenious radar antenna comprised of drapery material, a high power laminated ultrasonic transducer and a "red hot" motor highlighted the line of new developments revealed by Westinghouse at recent ceremonies at their 2-year-old research laboratories in Pittsburg.

The "Helisphere" radar antenna consists of an inflated sphere of metallic-interwoven drapery material and a rotating feed joint. The pattern of the metallic lines is at 45° to the axis of the sphere.

The system takes advantage of the polarization of radar waves. When a grid of parallel wires is held with the wires perpendicular to the electric vector of the radar wave the wave will pass through: when the grid is turned 90° however the wave is reflected.

The rotating feedhorn inside the inflated reflector is cocked at 45°; the pattern of metallic threads on the reflector is also at 45°, for a total of 90° which results in the wave being reflected. On the opposite side of the sphere the grid is reversed 90° so the wave passes through unattenuated. As the feedhorn rotates, then, the inside area of the sphere that it faces acts as a reflector.

The new laminated magnetostrictive transducer demonstrated by Westinghouse steps up the output power by 100% over previous designs. With conventional designs the transducer has a tendency to vibrate in a flexural mode since force is being applied at separate points. But the new Westinghouse transducer gives a clean, piston-like movement making the entire plate surface contribute uniformly to delivering sound energy.

Westinghouse spokesmen see a step up in ultrasonics business within the next 5 years from the present $40,000,000 to $150,000,000.

The "red hot" motor designed by Westinghouse to operate at temperatures up to 1,200°F. uses newly developed insulation compound. Phase and slot insulation

(*Continued on page* 11)

MORTAR RADAR

Special design MPQ-4A Mortar Locator Radar developed for the Signal Corps by G.E. detects mortar shell in flight and computes the location of the enemy's mortor installation.

Channel Master Enters Transistor Radio Field

Channel Master, one of the country's largest TV antenna manufacturers, has announced an agreement with Sanyo Electric Co. in Japan to manufacture 2 6-transistor models under the Channel Master name. Model 6506, which will list for $49.95, has 6 transistors plus one diode. Model 6501, listing at $34.95, also has 6 transistors and a diode.

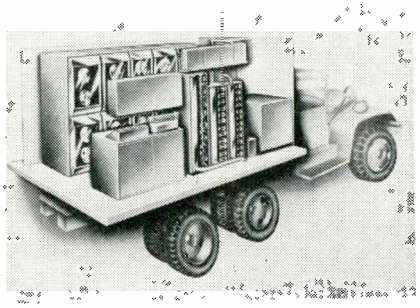
Sales of the new radios will be handled through Channel Master's antenna distribution channels.

Combat Computer Will Call Battle Signals

A combat computer and a data processor, completely automated and highly mobile, will be developed for battlefield use with the U. S. Army.

They will provide continuous information during battle on such changing conditions as intelligence, logistics support, fire power and troop strengths.

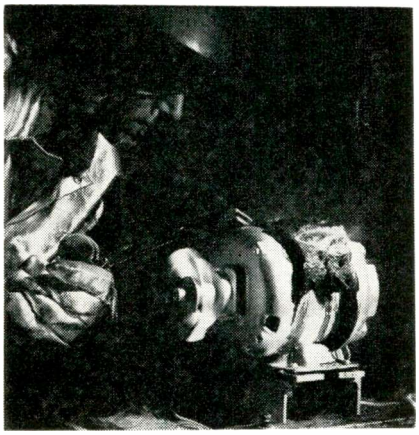
Development work on the two solid-state mass information processing systems of advanced design has been started by IBM under contract to the U. S. Army Signa. Corps.



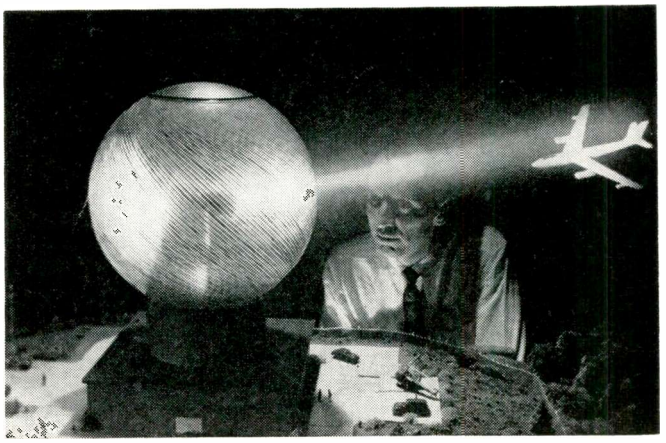
Battle field data processing equipment will follow troops into the field in this truck

Weight of a complete operational computer has been reduced to about 175 pounds. It will be extremely fast; technicians estimate that it will be capable of adding 30,000 ten-digit numbers per second. The systems have been developed to permit relatively inexperienced operators to substitute and replace packaged circuit and logic units with a minimum of disruption to operations.

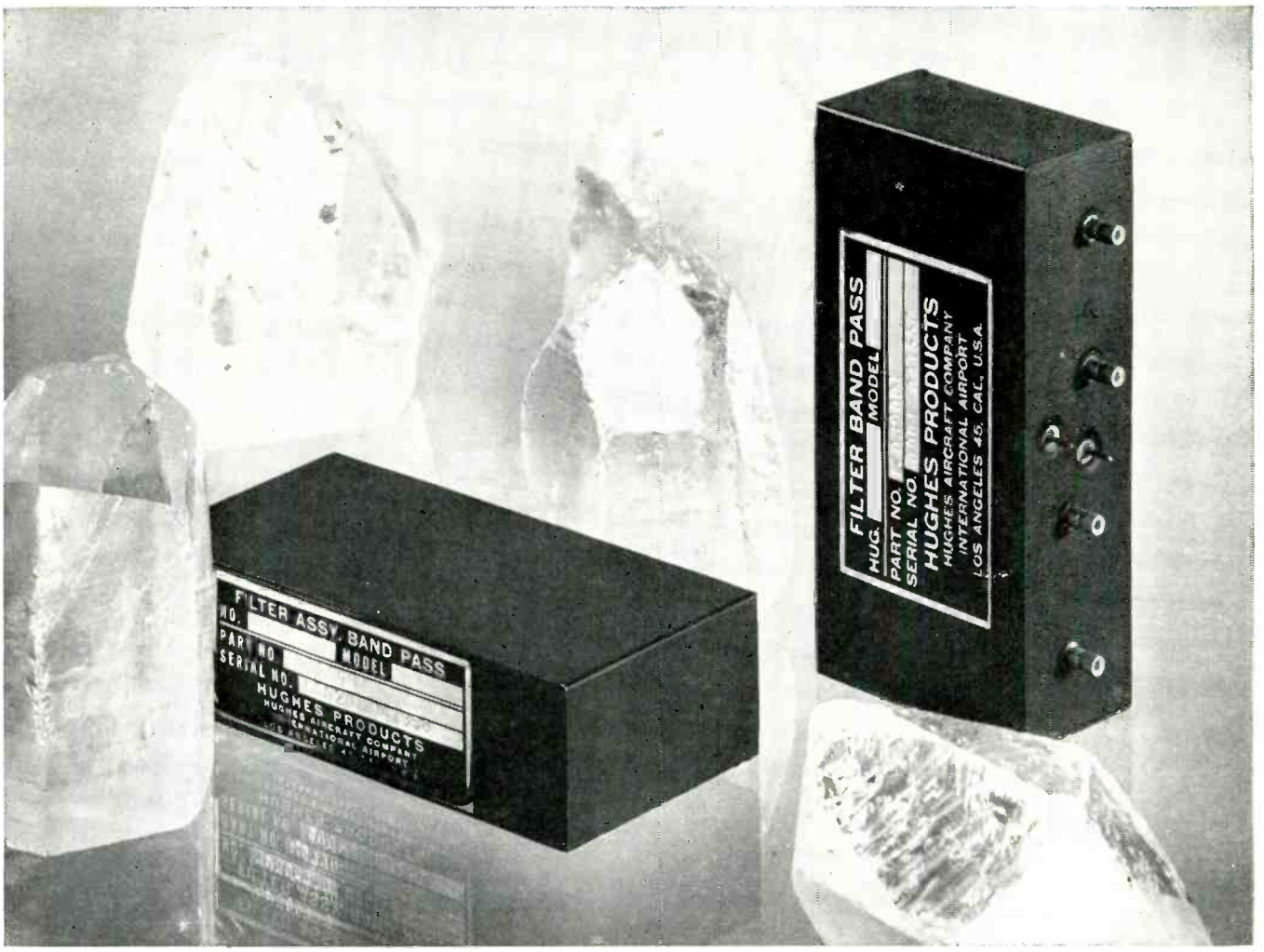
More News on Page 9



Cooking a steak on the motor's shell shows dramatically the high temperature characteristics of Westinghouse's new "red hot" motor.



Scale model with a revolving light beam illustrates the working principle of the "Helisphere" radar antenna.



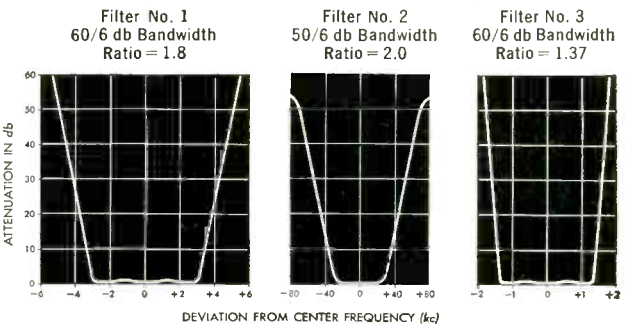
new performance levels set by Hughes precision crystal filters

Hughes Products now offers high performance crystal filters previously available only for special military developmental contracts and Hughes-built systems. Utilizing unique design and advanced manufacturing techniques, these Hughes crystal filters provide a degree of performance previously unattainable.

With center frequencies of 30 kc to 30 mc and fractional bandwidths of 0.01% to 6%, these crystal filters have seven distinct advantages:

1. High frequency filtering
2. High selectivity
3. Low passband ripple
4. Low insertion loss
5. Small size and weight
6. Excellent temperature stability
7. Excellent shock and vibration stability

SPECIFIC PERFORMANCE CHARACTERISTICS FOR TYPICAL FILTERS



	No. 1	No. 2	No. 3
Center Frequency	1.75 mc	10 mc	1.75 mc
6 db Bandwidth	6 kc	70 kc	2.7 kc
Maximum Insertion Loss	6 db	< 2 db	6 db
Maximum Passband Ripple	± 1 db	< 0.25 db	± 1 db
Stopband Attenuation	> 60 db	> 50 db	> 60 db

For further information please write HUGHES PRODUCTS, Crystal Filters, *International Airport Station, Los Angeles 45, Calif.*

Creating a new world with ELECTRONICS

HUGHES PRODUCTS

Signal Corps Unveils 3,000 WPM Teleprinter

The Signal Corps' new teletypewriter, believed to be the fastest general purpose message printer in communications history, types at a rate of 3,000 words a minute.

It prints four full lines of text a second, or 50 times faster than a news service teletypewriter and 45 times faster than an average typist.

Operating at a lower speed of 750 words a minute to meet Signal Corps requirements, the new electronic messenger will be the major unit in the Army's new family of teletypewriter devices, all operating at 750 words a minute. Together they make up the fastest known military teletypewriter network in the world.

New teleprinter spews out 3,000 words/min.

Instead of ordinary keys the new teletypewriter uses formed electron beams which are "fired" at the paper.

After the volley of letters, each line of text passes rapidly over powdered ink and a heated roller, and appears a split second later as clear, readable text.

The machine operates from standard code tape, or can be plugged into long-distance radio or telephone circuits to print out messages sent from across the continent or overseas.

The new printer was developed jointly by the Signal Corps and Burroughs Corp. Research Center.

More News on Page 11

ELECTRONIC SHORTS

▸ The bigger picture screens march will start again in the TV industry when Corning Glass introduces its new 23 in. bulb. The bulb is a version of "contoured twin panel" tube announced last spring by Corning, but without the oil-filled space between tube face and panel. Now the panel is fixed directly to face of picture tube with special plastic cement. Advantages of the new tube include greater strength, flattening of tube face, and new design concepts made possible because of the sharper corners.

▸ Television will join telescopes in balloon flights 80,000 ft. above the earth, as part of a project supported jointly by the National Science Foundation and the Office of Naval Research. A 36 in. telescope, Stratoscope II, will be constructed for use in conjunction with further flights of the 12 in. Stratoscope I telescope. The latter made flights in 1957. The system, which will be equipped with a television link, control of the telescope from the ground for remote control pointing of the telescopes at celestial objects, is part of the project directed by Dr. Martin Schwarzchild of Princeton University's Dept. of Astronomy. He directed the 1957 flights, also.

▸ Missile contract awards and announcements of new projects have set a record in recent months, according to the Assoc. of Missile & Rocket Industries. New programs include the Air Force Rover rocket, being developed by the AEC, and the Falcon GAR-9 atomic missile; the Navy's Hopi rocket. Raven air-to-surface missile, and Vigilante anti-missile missile. For the Army, awarded contracts include $135-million for continued development of the Nike-Zeus and $30-million for a missile monitor defense system.

▸ Flight system simulators, or ground-test devices that investigate the flight characteristics of missiles before they are launched, have been sold by the Computer Div., Bendix Aviation Corp. to the Army Ordnance Missile Command at Huntsville, Ala., and Convair Aircraft Corp., Ft. Worth, Tex. The half-million-dollar units permit either individual components or complete controls and navigational systems of missiles to be developed and tested on the ground, eliminating costly abortive test flights. They may be used in testing air-to-air, ground-to-air and ground-to-ground missiles.

▸ The entire Pan American World Airway's jet fleet, consisting initially of Boeing 707's and Douglas DC-8's, will be equipped with Motorola Selcal Selective signaling equipment. Late this year, American Airlines will put into operation a number of ground Selcal selective signaling stations. The latter airline has ordered 21 sets of equipment.

▸ The largest steerable radio telescope in the free world—Jodrell Bank in Cheshire. England—received priceless information from the American moon rocket "Pioneer" fired from Cape Canaveral on October 11 by the USAF. Prof. Lovell, director of the radio astronomy station, reported that "for the first time we have had two full days of information about conditions in space up to 80,000 miles—regions which no man-made objects have ever penetrated before."

▸ The National Science Foundation has made a grant of $500,000 to the University of North Carolina for the purchase of a Univac 1105 computer for basic research purposes. This grant is the first in a series planned by the Foundation to assist in the establishment of basic research computer centers at about 12 widely distributed regional areas throughout the U. S.

▸ A contract for more than a million dollars has been awarded by the U. S. Army Signal Corps to the Philco Corp. to design and build two medium size, mobile electronic data processors. Philco's G&I Div. in Philadelphia received the contract. The data processors, called Logicpac and Basicpac, will be designed to meet Army field requirements for use under combat conditions.

▸ Transistor sales at the factory in September increased 20% over August. September sales totaled 5,076,443 with a dollar value of $10,811,412 compared with 4,226,616 transistors valued at $9,975,935 in August.

THE LATEST FROM EECO

Minisig SENSITIVE INDICATOR

...operates directly from low-level signals

ACTUAL SIZE

TWO TYPES

Minisig Sensitive Indicators are available in two types: neon glow tube and incandescent lamp. Both types include models for positive-going or negative-going signals. Neon Minisigs have a maximum sensitivity in the order of two volts, peak-to-peak, and bias range limits of −10 volts to +10 volts. Specifications on incandescent-type Minisigs are in design and will be released soon.

NOT JUST ANOTHER INDICATOR

The EECO Minisig Sensitive Indicator is definitely *not* "just another Indicator." It occupies no more panel space than a conventional indicator . . . BUT—

1. It incorporates a built-in *high-sensitivity* transistorized driver circuit.
2. It gives on-off indication where the signal excursion is *too small* for direct operation of neon or incandescent lamps.
3. Its operating characteristics are *adjustable*.
4. It will accommodate a *wide range* of input signal conditions.

APPLICATIONS

The principal use of Minisigs is to indicate signal levels or the state of flip-flops, switching circuits, and storage elements. Here are two typical applications of the Neon Minisig.

Note that a positive-going Minisig Neon Indicator (Model R-101) is used to display the "1" state of an EECO T-Series Flip-Flop. Because the T-Series "1" level is more positive than the "0" level, a bias voltage of −7.5 volts is used. This is conveniently derived from the 12-volt supply and is regulated by a zener diode. The other application does not require a bias supply.

The schematics in the box below show other typical applications of Minisig Neon Indicators. Though these applications are to three of the principal EECO plug-in circuit families," Minisigs can be applied with equal effectiveness to *any* system designed for small signal excursions.

For example, the signal voltage swings of these EECO circuits are as follows:

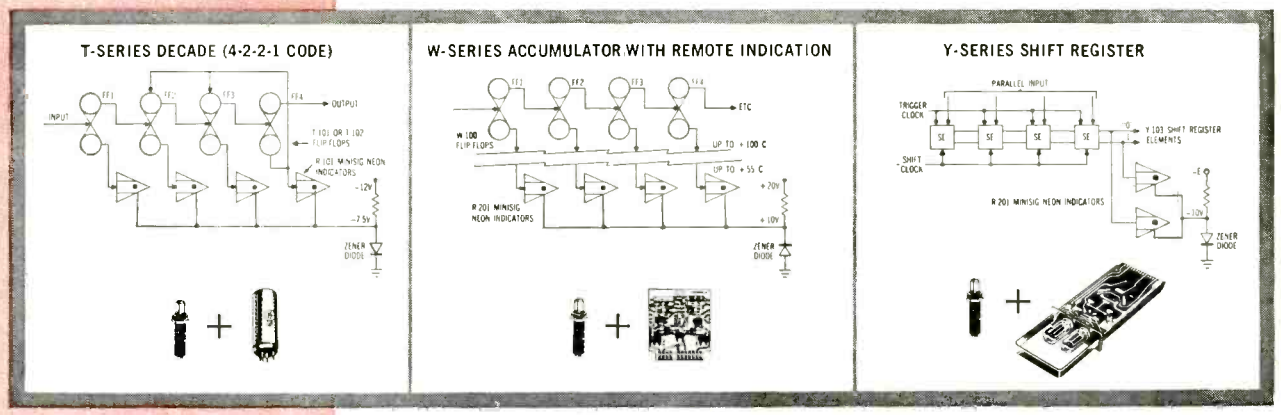
	Peak-to-peak Excursion
T-Series—Germanium transistor circuits: "0" = −3 volts; "1" = −11 volts.	8 volts
W-Series—Silicon transistor circuits: "0" = +6 volts; "1" = +16 volts.	10 volts
Y-Series—Two-tube computer circuits: "1" = −20 volts; "0" = 0 volts.	20 volts

LENSES

Minisig lenses are of high-impact polystyrene with plain, flat face. Lense configuration permits wide angle of visibility. Lenses with numerals, letters, etc., are also available on special order.

LOW PRICE

The economical price of Neon Minisigs ranges from $8.50 per unit (in sample quantities of 9 or less) to $6.55 per unit in quantities from 200 to 499. Prices for larger quantities and for Incandescent type available on request.



P.S.— See our new Relay Driver and other EECO products at the Kenneth E. Hughes Booth, **EASTERN JOINT COMPUTER CONFERENCE**, Philadelphia, Penna. December 3, 4, and 5

ENGINEERED ELECTRONICS Company

ENGINEERED ELECTRONICS COMPANY

(a subsidiary of Electronic Engineering Company of California)

506 East First Street • Santa Ana, California

EECO Ad Manager: Please find plates for your ad on Minisig (high temperature, filament type, Memory type, miniature, and subminiature types) as well as lower prices on R-101 and R-201 arrived too late. We're asking our readers to write you for the very latest information. Ed.

Coming Events

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

Nov. 28-Dec. 4: Electronic Computer Exhibition & Symp.; Olympia, London, England.

Nov. 30-Dec. 5: Annual Mtg., American Society for Mechanical Engineers; Hotels Statler & Sheraton-McAlpin, New York, N. Y.

Dec. 2-4: 3rd EIA Conf. on Reliable Electrical Connections: Statler-Hilton Hotel, Dallas, Tex.

Dec. 2-4: 7th Annual Wire and Cable Symp., U. S. Army Signal Engineering Labs. & Industry; Berkeley-Carteret Hotel, Asbury Park, N. J.

Dec. 3: Electronic Industry Show, Assoc. of Electronic Parts and Equipment Mfg.; St. Moritz Hotel, New York, N. Y.

Dec. 3-5: Eastern Joint Computer Conference, IRE, AIEE & ACM; Bellevue-Stratford Hotel, Phila., Pa.

Dec. 3-5: 2nd National Symp. on Global Communications, Desert Ranch Colonial Inn, IRE & AIEE, St. Petersburg, Fla.

Dec. 4-5: PGVC Annual Mtg., IRE; Hotel Sherman, Chicago, Ill.

Dec. 5: Annual Banquet, The Radio Club of America, Inc.; Columbia University Club, New York, N. Y.

Dec. 7-9: Instrumentation Conf., IRE-Instrumentation Group; Atlanta, Ga.

Dec. 8-10: Meeting, American Nuclear Society; Detroit, Mich.

Dec. 9-11: Mid-America Electronics Convention, IRE; Municipal Auditorium, Kansas City, Mo.

Dec. 10-11: Fourth National Construction Industry Conference, ARF; Hotel Sherman, Chicago, Ill.

Dec. 27-28: Second Technical Convention, CITE; New Delhi, India.

Dec. 29-31: Meeting, American Physical Society, Los Angeles, Calif.

Jan. 11-13: Annual Convention, National Appliance & Radio TV Dealers Assoc.; Conrad Hilton Hotel & Merchandise Mart, Chicago, Ill.

Jan. 12-14: 5th National Symp. on Reliability & Quality Control, IRE, AIEE, ASQC, & EIA; Bellevue Stratford Hotel, Phila., Pa.

Jan. 13: Meeting, Assoc. of Electronic Parts & Equipment Mfgs., Inc.; Como Inn, Chicago, Ill.

Jan. 20: Meeting, The Radio Club of America, Inc.; Benjamin Franklin Auditorium; New York, N. Y.

Jan. 21-23: Southwest Electronic Exhibit; Arizona State Fairgrounds, Phoenix, Ariz.

Jan. 23-25: Michigan State Conference, American Women in Radio & TV; Detroit, Mich.

Jan. 26-28: 12th Annual Symp. on Modern Methods of Analytical Chem., Louisiana State University; Baton Rouge, La.

Jan. 26-29: 27th Annual Meeting, Institute of Aeronautical Sciences; Hotel Astor, New York, N. Y.

Jan. 27-30: 15th Annual Technical Conf., Society of Plastic Engrs.; Hotel Commodore, New York, N. Y.

Jan. 28-29: 5th. Annual Midwest Welding Conference, ARF and American Welding Society; Campus, Ill. Inst. of Tech.

Jan. 28-31: Meeting, American Association of Physics Teachers—APS Hotel New Yorker, New York, N. Y.

Feb. 1-6: Winter General Meeting, AIEE-Technical Operations Dept.; Hotel Statler, New York, N. Y.

Feb. 2-4: 7th Regional Tech. Conf. & Trade Show, IRE, University of New Mexico, Albuquerque, N. M.

Feb. 2-7: Committee Week, ASTM; Penn-Sheraton Hotel, Pittsburgh, Pa.

Feb. 3-5: 14th SPI Reinforced Plastics Div. Conf., SPI; Edgewater Beach Hotel, Chicago, Ill.

Feb. 5-8: 1959 San Francisco High Fidelity Music Show, Institute of High Fidelity Manufacturers, Inc.; Cow Palace, San Francisco, Calif.

Feb. 12-13: Transistor & Solid State Circuits Conf., IRE, AIEE, & University of Pennsylvania; Univ. of Penna., Phila., Pa.

Feb. 15-19: Annual Meeting-Metallurgical Society Functions, AIME; St. Francis Hotel, San Francisco, Calif.

Feb. 16-23: 1959 Los Angeles High Fidelity Music Show, Institute of High Fidelity Mfg., Inc.; Biltmore Hotel, Los Angeles, Calif.

Feb. 17: Annual Education Seminar, Assoc. of Elect. Parts and Equip. Mfg. Inc.; Tam O'Shanter Country Club, Niles, Ill.

Feb. 24- 25: State Presidents Conference, National Association of Broadcasters; Washington, D. C.

Feb. 19-21: Winter Meeting, National Society of Professional Engineers; Dinkler-Tutweiler Hotel, Birmingham, Ala.

Abbreviations:

ACM: Association for Computing Machinery
AIEE: American Inst. of Electrical Engrs.
AIME: American Institute of Mining & Metallurgical Engineers
APS: American Physical Society
ARF: Armour Research Foundation-Illinois Institute of Technology
ARS: American Rocket Society
ASQC: American Society for Quality Control
ASTM: American Society for Testing Material
CITE: Council of the Institute of Telecommunication Engrs.
EIA: Electronics Industries Assoc.
IRE: Institute of Radio Engineers
SPI: Society of Plastics Industry

As We Go To Press (cont.)

Army Weather Radar Tracks Atomic Clouds

Tests made by the U. S. Army Signal Corps show that the Army's advanced weather radar systems, used to detect storms and aid in forecasts, may also warn against radio-active fallout from nuclear explosions.

Proved highly effective during high-yield nuclear tests, the Army's radar equipment measured the size and plotted the course of "hot" clouds. During the tests, the first photographs of a radar scope showing the nuclear mushroom were made with a special camera. Successive film exposures showed the formation, rise and drift of the characteristic cloud. The nuclear clouds were tracked for as long as two hours.

A special advantage of radar is that it works during darkness and other periods of low visibility, which prevent visual triangulation and aircraft techniques for measuring nuclear clouds.

Atomic Sub Logistics

The Navy's Submarine Supply Office, Phila., Pa., has installed a Burroughs 205 electronic computer to help solve the complex supply problem brought on by nuclear powered ships and submarines which will spend long periods of time at sea without logistics support.

Together with an integrated data supply system the computer will compile material lists that will best meet the considerations of space, weight and cost. The goal is to provide the maximum "built-in endurance" possible, for peacetime, mobilization or wartime operations.

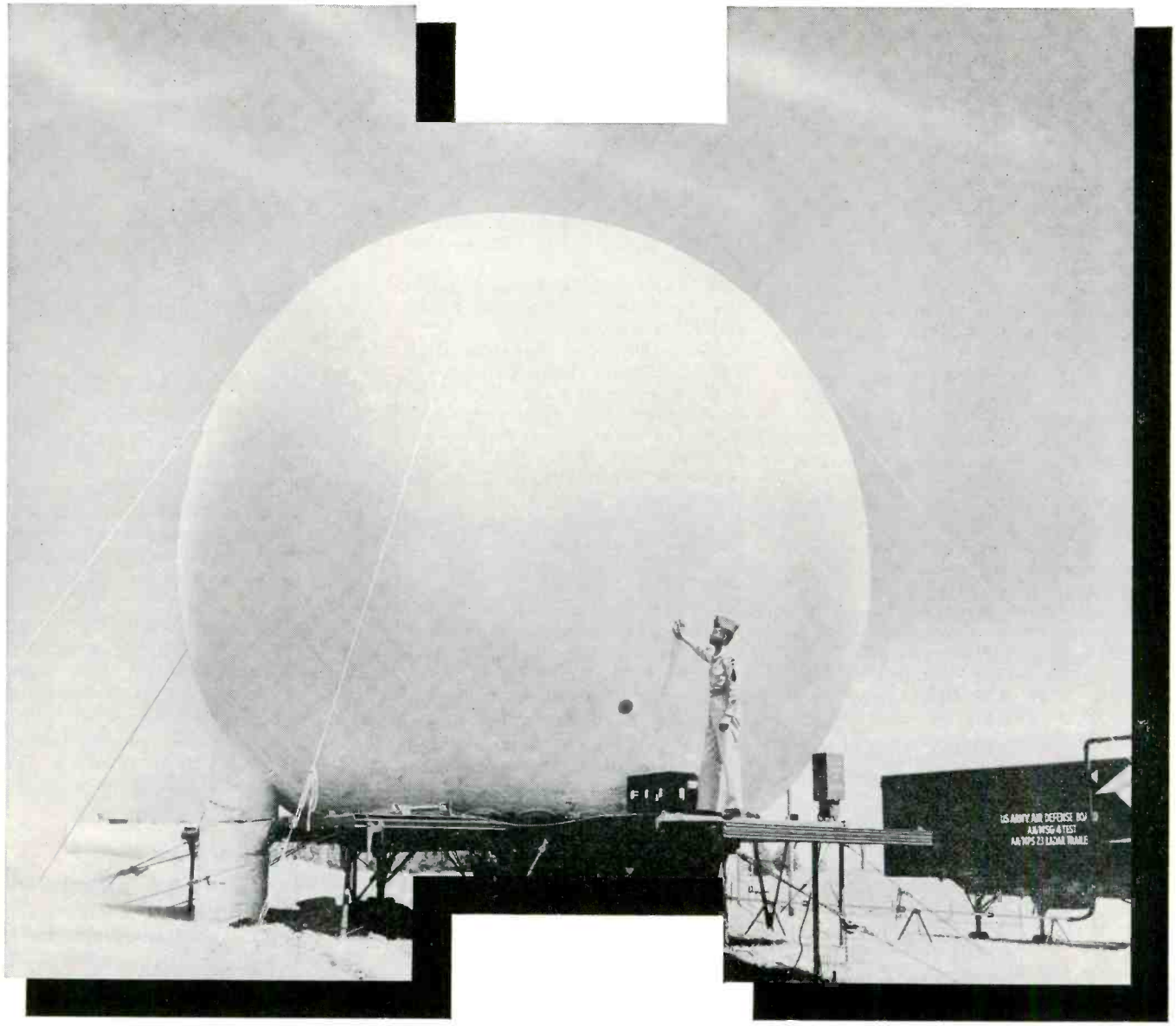
New Radar

(*Continued from page 7*)

consists of glass cloth and large mica flakes bonded with phosphate. Wire is insulated with glass fiber and impregnated with a suspension of powdered mica in a phosphate solution. After winding, the motor is potted with a slurry consisting of phosphate solution, Wollastonite, silica and other chemically reactive materials.

The motor has been operated at 950° for several thousand hours without any apparent deterioration of the insulation. Primary applications are expected to be in the missile field.

The strange shape



# of defense

This plastic balloon, resting on a mobile trailer bed like a golf ball on a tee, protects the new Hughes three-dimensional radar antenna.

Frescanar, the exclusive system combining high-speed data processors and a frequency scan radar antenna, has been developed by Hughes engineers in Fullerton, California.

Sensitive to the inadequacies of conventional radar, these Hughes Fullerton engineers have devised a radar antenna whose pointing direction is made sensitive to the frequency of the electromagnetic energy applied to the antenna. This frequency sensitivity results in the radar beam being radiated from the antenna at different angles, depending on the frequency of the energy supplied. With the supply of a succession of frequencies, the antenna beam can be moved through a succession of positions. Utilizing this advanced technique, range, bearing and altitude can be detected . . . on a single antenna.

This Hughes-developed radar system has been combined with compact, high-speed Hughes data processors to provide a completely self-sufficient, mobile radar defense system.

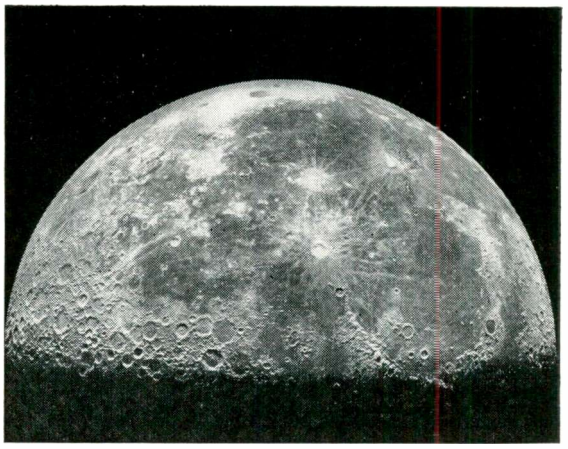
Other Hughes projects provide similarly stimulating outlets for creative engineering talents. Current areas of Research and Development include Advanced Airborne Electronics Systems, Space Vehicles, Nuclear Electronics, Subsurface Electronics, Ballistic Missiles . . . and many more. Hughes Products, the commercial activity of Hughes, has assignments for imaginative engineers for research in semiconductor materials and microwave tubes.

The diversity and advanced nature of Hughes projects provides an ideal environment for the engineer or physicist interested in advancing his professional status.

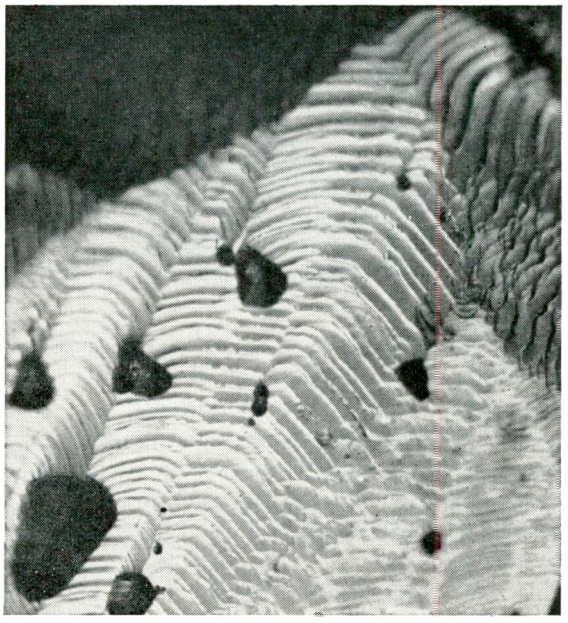
An immediate need now exists for engineers in the following areas:

Microwave & Storage Tubes	Reliability Engineering
Field Engineering	Systems Analysis
Quality Control	Circuit Design
Semiconductors	Communications
Digital Computer Engineering	Radar

Write in confidence, to Mr. Phil N. Scheid,
Hughes General Offices, Bldg. 6-F-2, Culver City, California.



The Hughes Communications Laboratories have as one objective the development of systems capable of deflecting their signals from meteors, artificial satellites and even the moon.

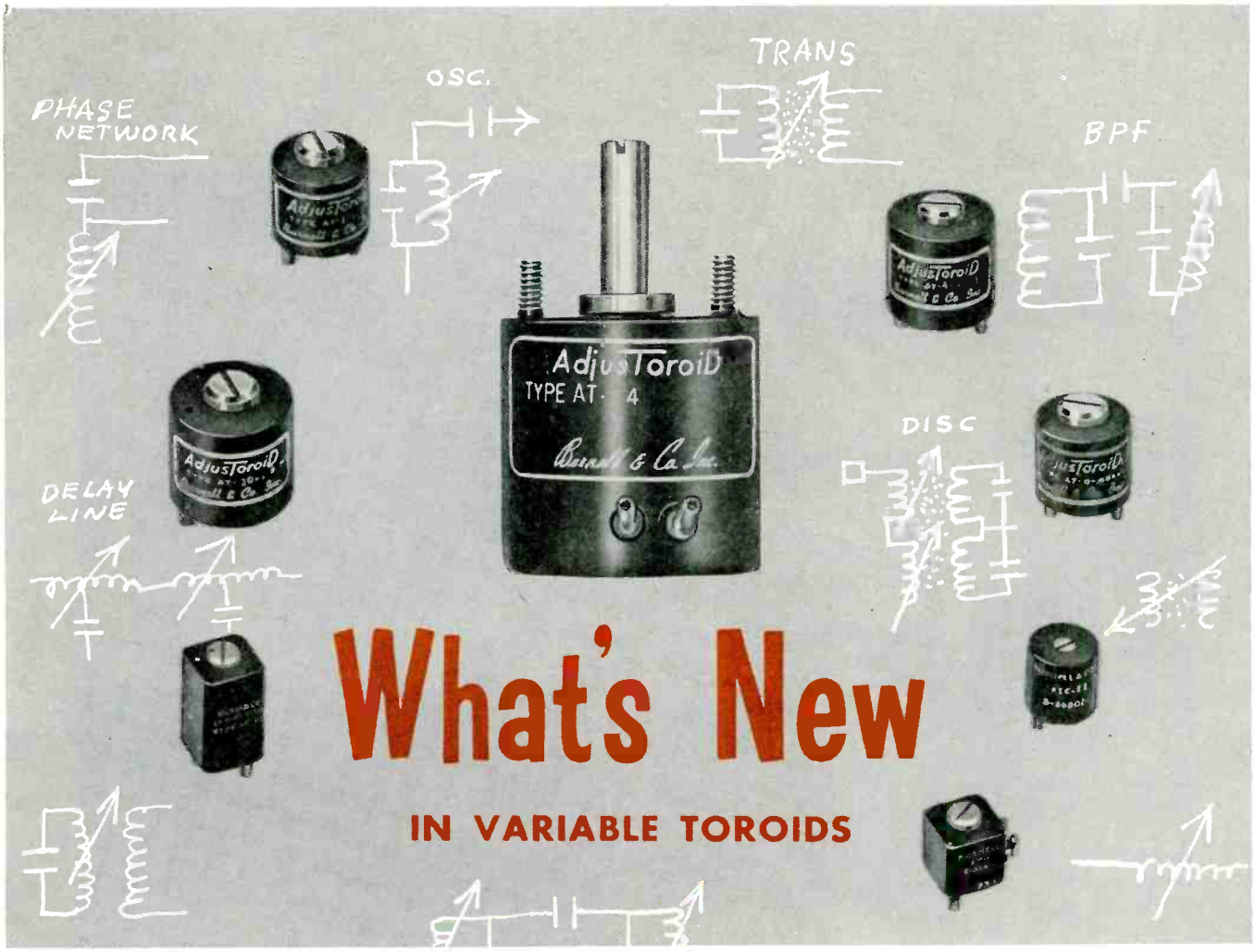


This photomicrograph of an etched silicon sphere is used in basic studies of semiconductor materials at Hughes Products, the commercial activity of Hughes.

The West's leader in advanced ELECTRONICS

HUGHES

HUGHES AIRCRAFT COMPANY
Culver City, El Segundo,
Fullerton and Los Angeles, California
Tucson, Arizona



What's New

IN VARIABLE TOROIDS

Burnell Adjustoroids® are always new because they are always being designed for newer and broader electronic and mechanical applications.

NEW Burnell's complete line of encapsulated Adjustoroids are particularly adaptable to printed circuit use.

NEW A screw mount PC type Adjustoroid for greater durability in high acceleration, shock and vibration environments.

NEW 'Pot' mounting Adjustoroids for panel mounting and knob adjustment wherever slotted controls are difficult to reach.

NEW Continuous internal improvements including adjustment range, Q, size, etc. Burnell Adjustoroid engineers are constantly seeking solutions to space, accessibility and performance problems.

Burnell Adjustoroids and sub-miniature Adjustoroids are supplied hermetically sealed to meet government specifications MIL E 15305A or encapsulated in many sizes and shapes to meet the application. If your Adjustoroid needs can't be met from our stock catalogue, we'll be glad to manufacture to your specifications. For additional information, write for Adjustoroid bulletin.

	Length/ Dia.	Width	Hgt.	Wt.	Useful Freq. Range	Max Q	Max L in hys
AT-0	1 1/16		1"	2 oz	1 kc to 20 kc	10 kc	3 hys
AT-1	1 3/4	1 3/4	1 1/4"	7.25 oz	2 kc to 10 kc	4 kc	15 hys
AT-2	2 3/4	2 3/4	2 1/4"	24 oz	Below 2.5 kc	2.5 kc	125 hys
AT-4	1 19/64		1 1/4"	4 oz	1 kc to 16 kc	6 kc	15 hys
AT-6	1 1/16		1"	2 oz	10 kc to 100 kc	30 kc	.75 hys
AT-10	1 19/64		1 1/4"	4 oz	3 kc to 50 kc	20 kc	.75 hys
*AT-11	45/64	45/64	3/4"	.83 oz	2 kc to 25 kc	15 kc	5 hys
*AT-12	45/64	45/64	3/4"	.83 oz	15 kc to 150 kc	60 kc	.5 hys
AT-15	1 31/32		1 7/8"	14 oz	Below 5 kc	4 kc	125 hys
AF-51	1 19/64		2"	5 oz	30 cps to 500 cps	120 cps	1000 hys
AF-52	1 19/64		2"	5 oz	50 cps to 1 kc	250 cps	1000 hys
*AF-87	45/64	45/64	1 1/4"	1.7 oz	90 cps to 2 kc	400 cps	80 hys
*AF-88	45/64	45/64	1 1/4"	1.7 oz	.16 kc to 4 kc	800 cps	42 hys
†ATE-11	3/4		3/4"	.83 oz	2 kc to 25 kc	15 kc	5 hys
†ATE-12	3/4		3/4"	.83 oz	15 kc to 150 kc	60 kc	.5 hys

**Special "pot" type sub-miniature Adjustoroids are not available with AT-11, AT-12, AF-87, AF-88.*

†Special screw mountings are available with the ATE-11 and ATE-12 in printed circuit applications for "plug in" types. Where vibration and shock are significant considerations, mounting screws serve as terminal connections.

®Trade Name Pat. #2,762,020

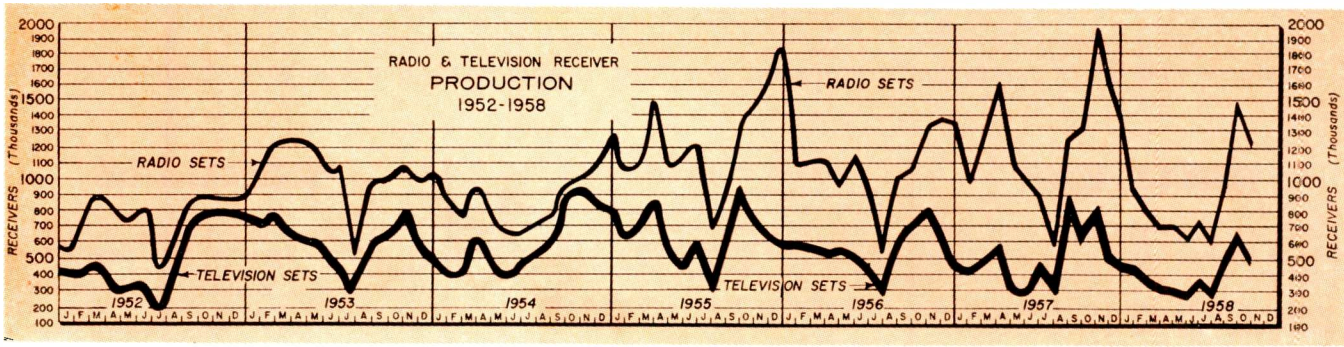
Burnell & Co., Inc.

PIONEERS IN TOROIDS, FILTERS AND RELATED NETWORKS

EASTERN DIVISION
DEPT. E112
10 PELHAM PARKWAY
PELHAM, N. Y.
PELHAM 8-5000
TELETYPE PELHAM 3633

PACIFIC DIVISION
DEPT. E112
720 MISSION ST.
SOUTH PASADENA, CALIF.
RYAN 1-2841
TELETYPE PASACAL 7578

TOTALS



GOVERNMENT ELECTRONIC CONTRACT AWARDS

This list classifies and gives the value of electronic equipment selected from contracts awarded by government agencies in October, 1958.

Amplifiers	187,287
Amplifiers, audio	160,289
Analyzers	30,460
Antennas & Accessories	262,793
Batteries, dry	645,212
Batteries, storage	217,210
Cable assemblies	198,817
Coder-Decoders	4,928,460
Computers & Accessories	162,976
Connectors	44,100
Controls	243,368
Crystal units	51,520
Delay lines	30,012
Electronic equipment	237,345
Fuses & Accessories	281,853
Gyros & Gyroscopes	485,075
Integrator, vidio signal	146,098
Kits, modification	77,392
Kits, radar installation	1,500,000
Kits, radar modification	35,300
Kits, radio modification	40,919
Meters, amp	35,518
Meters, watt	62,864
Oscillators	88,175
Potentiometers	43,114
Power supplies	80,653
Radar equipment	4,410,858
Radio equipment	426,761
Radio equipment, SSB	176,250
Radio receivers	481,545
Radio receivers-transmitters	20,973,543
Radio sets	838,878
Radio transmitters	777,431
Radiosonde equipment	99,675
Reactors	25,725
Recorders & accessories	2,085,114
Recorders-reproducers	66,474
Rectifiers	31,914
Relay components	72,255
Relays	176,871
Relays, solenoid	31,050
Research	5,304,636
Resistors	200,357
Semiconductor diodes	35,290
Switchboard equipment	370,802
Switches	219,920
Switching, assemblies	51,180
Tape, recording	220,856
Test sets, radar	420,000
Test sets, radio	129,675
Testers	1,861,910
Telemetering, radio	154,120
Telephone terminals	63,451
Television equipment	58,317
Transducers	25,200
Tubes, electron	2,788,412
Tubes, klystron	190,120
Tubes, traveling wave	41,400
Tuner	29,033
Voltage regulators	45,433

TRANSISTOR SALES

	Sales (units)	Sales (dollars)
January	2,955,247	$6,704,383
February	3,106,708	6,806,562
March	2,976,843	6,795,427
April	2,856,234	7,025,547
May	2,999,198	7,250,824
June	3,558,094	8,232,343
July	2,631,894	6,598,762
August	4,226,616	9,975,935
September	5,076,443	10,811,412
TOTAL	30,387,277	$70,230,195

TUBE SALES

	TV Units	Receiving Units
January	621,910	26,805,000
February	556,136	29,661,000
March	634,779	28,548,000
April	590,357	32,582,000
May	560,559	36,540,000
June	725,846	36,270,000
July	549,817	30,795,000
August	713,458	30,456,000
September	891,803	40,061,000
TOTAL	5,844,665	291,718,000

—Electronic Industries Association

RESEARCH COSTS BY INDUSTRIES

Costs of Basic Research and Applied Research and Development by Industries

Industry	1953	1956	1956 Applied R & D, Electronics ($000,000)	1956 Electronic Applied R & D %	% of R & D Financed by U. S. Government
Electronic-Electrical Systems, Parts	$ 743.3	$ 1,173.4	$ 669.6	57	61
Aircraft and Associated Parts	758.0	2,078.7	260.7	13	87
Machinery (including computers)	318.9	610.6	182.1	30	41
Telecommunications and Broadcasting	113.0	171.1	137.0	80	43
Professional and Scientific Instruments	171.7	272.5	64.5	24	36
Fabricated Metal Products and Ordnance	103.3	175.7	36.7	21	28
Stone, Clay, and Glass Products	38.0	65.8	4.4	7	—
Food and Kindred Products	54.2	75.9	4.0	5	—
Petroleum Products and Extraction	145.9	250.3	.8	—	2
Primary Metals	59.8	87.9	.8	1	3
Chemicals and Allied Products	361.1	511.7	.4	—	3
Paper and Allied Products	27.9	39.6	.1	—	—
All Other Industries	769.3	939.5	31.8	2	10
Total	$ 3,664.4	$ 6,452.7	$ 1,392.9	22	49

—Electronic Industries Association

Electronic Industries' News Briefs

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

EAST

GENERAL ELECTRIC CO. has formally dedicated its new television picture tube plant in Augusta, Ga.

RADIO CORPORATION OF AMERICA has established a new high-level scientific and technical organization known as Advanced Military Systems to create and develop new and advanced weapon system concepts. The new group to be located at Princeton, N. J., will be directed by Dr. Nathaniel Korman.

RAYTHEON MFG. CO. set an outstanding safety record of more than 8-million man-hours without a single day's loss of work caused by on-the-job accidents.

GENERAL TELEPHONE CORP. and SYLVANIA ELECTRIC PRODUCTS INC. are considering a merger of Sylvania into General Telephone. General Telephone Board of Directors also voted to recommend a change in the name of that company to General Telephone & Electronics Corp.

CONSOLIDATED AIRBORNE SYSTEMS, Mineola, N. Y., was awarded two contracts, valued in excess of $1.25-million by Gentile Air Force Dept. One contract calls for modernization of the Air Force's M-5 tachometer tester. The second contract calls for production of the TTU-27/E tester, which will supersede the M-5 for field testing applications.

AUDIO DEVICES, INC., is now readying an additional 20,000 sq. ft. area for magnetic tape production adjacent to its present Stamford, Conn., plant. It is the second such addition within a year.

POWER SOURCES, INC., is being provided with new and modern headquarters in the Northwest Industrial Park area of Burlington, Mass. Construction for the facilities has been started on a new wing to the existing Microwave Associates plant.

CLEVELAND CONTAINER CO. has opened a new plant at 20-21 Wagaraw Rd., Fair Lawn, N. J.

ROCHESTER DIV., CONSOLIDATED ELECTRODYNAMICS CORP., has been awarded contracts totaling $113,665 by the Army Ballistic Missile Agency. One calls for delivery of a high-altitude simulation system; the other for research and development studies in extending the application of high vacuum in the simulation of high-altitude conditions.

THE DAVEN CO., Livingston, N. J., has created a Reliability Assurance Div. It will provide the equipment required by the "mean-time-to-failure" contract provisions now in effect in a majority of weapons systems programs.

TECHNITROL ENGINEERING CO., Philadelphia manufacturer of pulse transformers, delay lines and computer equipment, has opened a new regional sales office at 456 Main St., Wakefield, Mass.

APPLIED SCIENCE CORP. OF PRINCETON (ASCOP) has received a $250,000 order from the Naval Air Training Center, Patuxent, Md., for a mobile data van containing both PWM and FM/FM data reduction equipment.

YARDLEY ELECTRIC CORP. has been awarded a Navy Bureau of Ordnance contract totaling $613,230 for the manufacture of Silvercel silver-zinc batteries to be used in torpedoes.

NUCLEAR PRODUCTS — ERCO, Div. of ACF Industries, Inc., has been awarded a U. S. Navy contract for modification of electronic flight simulators for the F4D-1 Skyraider. The $230,000 contract is for modification of four trailerized simulators.

COLUMBUS ELECTRONICS CORP., Yonkers, N. Y., has placed into operation its new Semiconductor Mfg. Div. for the production of silicon rectifiers, transistors and other semiconductor devices.

SANDERS ASSOCIATES, INC., now has a record backlog of orders for space age instruments totaling more $2-million.

FLOW MEASUREMENTS CORP. has been organized for the production of thermal and ultrasonic flow meters. The new firm is located at 10506 Wheatley St., Kensington, Md.; phone LOckwood 4-0122. The new firm recently acquired the flow meter business of Industrial Development Labs. of Jersey City, N. J.

SAGE ELECTRONICS CORP. will move its entire operation into a new plant on Commercial St. in East Rochester, N. Y., shortly after the first of the year.

EPSCO INC. has been awarded a contract totaling several hundred thousand dollars for a dual purpose, compatible ground-air data acquisition and processing system, for use at the Naval Air Test Facility, Patuxent River, Md.

BRADLEY SEMICONDUCTOR CORP. is the new name for Bradley Laboratories, which has been operating under that name since incorpation in New Haven nearly 20 years ago.

MID-WEST

MIDLAND MFG. CO., Kansas City, Kans., is expanding its present operation by establishing a Crystal Filter Div. The new division, which has already employed a large group of engineers and technicians, will be temporarily housed within the Midland premises until production in quantities is feasible.

TRANSITRON ELECTRONIC SALES CORP. of Wakefield, Mass., has opened new sales offices in Denver and Dayton. The Denver office is located in the First National Bank Bldg., 621 17th St., and is managed by Harvey Weyrick. The Dayton branch is at 379 W. First St. and will be managed by Arthur A. Powell.

INSTRUMENTS DIV., PHILIPS ELECTRONICS, INC., recently demonstrated its new Norelco low-temperature environmental test chamber and a new liquid nitrogen generator.

TEXAS INSTRUMENTS INCORPORATED has introduced an economy silicon rectifier for applications in the manufacture of high-volume industrial electronic goods.

BURROUGHS CORP. has been awarded a USAF contract for $22,817,000 for an additional 32 data processing systems in the SAGE continental air defense program.

UNIV. OF MICHIGAN and **SYSTEMS DIV., BENDIX AVIATION CORP.,** recently sponsored a three-day session with the nation's top weathermen—both government and private agencies. The symposium concerned itself on man's first effort to probe the weather on a global scale.

WEST

CONNECTOR SEALS CORP. is the name of the newly organized West Coast Div. of Hermetic Seal Corp. of Newark, N. J. The firm located in Rosemead, Calif., will manufacture the complete line of hermetically sealed connectors. Wesley Speer, formerly President of Seals, Inc., Pasadena, has been appointed to serve as head of the newly organized company.

CONSOLIDATED ELECTRODYNAMICS CORP., Systems Div., has been awarded a contract for almost $450,000 by the National Advisory Committee for Aeronautics for instrumentation to be used in a new rocket systems research facility being built for the Lewis Flight Propulsion Laboratory in Cleveland.

LING ELECTRONICS, INC., reported that it received total new business in excess of $3-million within a 30 day period.

ACOUSTICA ASSOCIATES, INC., has opened its eighth and largest plant at Inglewood, Calif. The new plant will produce airborne missile fuel control systems containing ultrasonic liquid level sensors for the ATLAS missile.

HOFFMAN ELECTRONICS CORP., Semiconductor Div., manufactured the tiny, pie-shaped silicon solar cells used in the Atlas ICBM. The cells have a high conversion efficiency under extreme temperature variations from —65°C to +175°C and higher.

PACIFIC SEMICONDUCTORS, INC., has added a fifth building to its facilities in Culver City. The new building at 1001 W. Jefferson Blvd. will house facilities for the fabrication of production equipment to be used in the new PSI plant under construction at 14520 S. Aviation Blvd.

PACKARD-BELL ELECTRONICS CORP. has received a USAF contract covering a digital-to-analog function table (DAFT) which will combine components of the Trice digital computer and Multiverter analog-to-digital conversion system.

SIERRA ELECTRONIC CORP. of Menlo Park, Calif., has been listed as a major supplier of electronics equipment for the Atlas ICBM program.

WESTERN BRANCH, PESCO PRODUCTS DIV., BORG-WARNER CORP., is already in volume production of precision generators and inverters for aircraft and missiles in its new $1-million Burbank plant, situated on a large expandable site at 3310 Vanowen St.

HUGHES AIRCRAFT CO. has been awarded a U. S. Army Signal Corps contract in excess of $30-million for production of certain elements of Missile Monitor air defense systems for use by a field army. The system is designated AN/MSQ-18.

SHOCKLEY TRANSISTOR CORP. has been formed as a subsidiary company by Beckman Instruments, Inc. The firm will expand development and manufacture of specialized semiconductor components for electronic instruments, communications equipment and control systems.

LOCKHEED MISSILES SYSTEMS DIV. has disclosed, with USAF approval, that a Lockheed X-7 ramjet missile has been flown in excess of four times the speed of sound to become the fastest air-breathing missile in the free world.

Circle 10 on Inquiry Card, page 83 ⟶

A NEW POWER FERRITE for FLYBACK TRANSFORMERS by ALLEN-BRADLEY

A-B QUALITY

HIGHER FLUX DENSITY
LOWER CORE LOSSES
HIGHER CURIE POINT

Now, with the higher flux density of Allen-Bradley's new Class W-04 ferrite, you can design smaller flyback transformers with smaller cores. This saves space . . . saves weight . . . and saves copper, too. And the new ferrite is priced so that, with this smaller size, the actual cost of the core itself is also reduced.

Specify Allen-Bradley's new W-04 ferrite for *your* flyback transformers. The table on the following page compares the superior characteristics of the new W-04 with Allen-Bradley's "premium quality" W-03 ferrite.

ALLEN-BRADLEY CO.
ELECTRONIC COMPONENTS
QUALITY

Allen-Bradley Co.
222 W. Greenfield Ave.
Milwaukee 4, Wisconsin

In Canada—
Allen-Bradley Canada Ltd.
Galt, Ontario

7-58-E

Check the superior characteristics of this NEW ALLEN-BRADLEY W-04 Power Ferrite

Class	Temp. °C	B_{max}* in Gauss at 10 Oe	Core Loss P_h in $\frac{\mu Watts}{cm^3 cps}$				μ_{max}*	μ_0 at Room Temp.	B_u**	μ at B_u †	Curie Temp. °C
			B = 1350 Gauss		B = 1800 Gauss						
			16 Kcps	60 Kcps	16 Kcps	60 Kcps					
RECOMMENDED FOR FLYBACK TRANSFORMER CORES (AND OTHER POWER APPLICATIONS)											
W-04	25	4900 ± 10%	3.8 ± 20%	5.3 ± 20%	6.4 ± 20%	9.0 ± 20%	7000 ± 30%	2000	2700 ± 15%	6000 ± 25%	225
	115	3700 ± 10%	3.8 ± 20%	5.3 ± 20%	6.4 ± 20%	9.0 ± 20%	7000 ± 30%				
W-03	25	4200 ± 10%	4.1 ± 20%	5.5 ± 20%	6.9 ± 20%	9.1 ± 20%	6000 ± 30%	2000	2100 ± 15%	5600 ± 25%	180
	115	2800 ± 10%	4.2 ± 20%	6.5 ± 20%	6.9 ± 20%	10.0 ± 20%	6000 ± 30%				
RECOMMENDED FOR TV YOKE CORES											
W-01	25	2850 ± 10%	5.8 ± 30%	9.5 ± 30%	9.2 ± 30%	16.0 ± 30%	5000 ± 20%	850	1200 ± 20%	5000 ± 25%	180
	115	2000 ± 10%	4.4 ± 30%	7.9 ± 30%	7.4 ± 30%	14.5 ± 30%	6000 ± 30%				

*B_{max} and μ_{max}, Frequency—16 Kcps.

**Usable flux density—flux density at which the 115°C permeability is equal to ½ of the 25°C permeability.

†Permeability of the core at 25°C at B_u.

The above table shows the superiority of the new W-04 ferrite—higher flux density, higher permeability, lower core loss . . . properties that permit significant improvement in your flyback transformer design.

Allen-Bradley has also developed new square-loop power ferrites (R-03), and ferrites with unique characteristics for transistorized medium frequency power inverters (W-07).

The experienced engineering staff at Allen-Bradley will be glad to assist you with your ferrite problems. Write, today!

Allen-Bradley ferrites are available in a wide range of shapes and sizes for various applications. Just a few of the basic shapes and sizes are shown above.

Allen-Bradley Co.
222 W. Greenfield Ave., Milwaukee 4, Wis.
In Canada—
Allen-Bradley Canada Ltd., Galt, Ont.

A-B QUALITY

ALLEN-BRADLEY CO.
ELECTRONIC COMPONENTS
QUALITY

7-58-E

Raytheon — World's Largest Manufacturer of Magnetrons and Klystrons

ENGINEERING STRENGTH

This towering figure represents 3,300 Raytheon people at your service, helping to develop and produce magnetrons, klystrons and special purpose tubes—the most complete line in the industry.

The heart of this Raytheon division is our famous Research and Development Laboratory with 1,065 specialists, *of whom 207 are professional engineers.*

Put this dependable source of engineering manpower to work on your problems. Call on Raytheon's Application Engineering Service. Write for complete data booklet. There is no cost or obligation.

RAYTHEON MANUFACTURING COMPANY

Microwave and Power Tube Division
Section PT-55, Waltham 54, Massachusetts

Excellence RAYTHEON *in Electronics*

Regional Sales Offices: 9501 W. Grand Avenue, Franklin Park, Illinois
5236 Santa Monica Blvd., Los Angeles 29, California

Raytheon makes: Magnetrons and Klystrons, Backward Wave Oscillators, Traveling Wave Tubes, Storage Tubes, Power Tubes, Miniature and Sub-Miniature Tubes, Semiconductor Products, Ceramics and Ceramic Assemblies

← Circle 10 on Inquiry Card, page 83 Circle 11 on Inquiry Card, page 83

for regulating...
limiting...
clipping...

MOTOROLA ZENER DIODES

10 AND 50 WATT TYPES UP TO 200 VOLTS

10MZ SERIES
10 watts
@ 55°C

50MZ SERIES
50 watts
@ 55°C

TYPICAL APPLICATIONS

- Regulation of DC voltage
- DC level changing and coupling
- Surge protection
- Regulation of vacuum tube heaters
- Arc suppression
- Wherever a constant DC voltage independent of current is desired.

- Very high power ratings... both 50 and 10 watt types available.
- Wide voltage range... up to 200 volts in both series.
- Very low Zener impedance limits.
- "Soft" or unstable Zener knees eliminated... by impedance limits at 5 mA for 50 watt types, at 1 mA for 10 watt types.
- Controlled forward characteristics... for applications requiring conduction in both directions.
- Available with either anode or cathode connected to case.
- Conservatively rated... excellent long-time stability.
- Designed for military usage.
- Operating and storage temperature range −65°C to +175°C.
- Standard packages

  10 WATT TYPES in welded, hermetically sealed, metal to glass, Jetec package.

  50 WATT TYPES in plug-in or solder-in TO-3 package with .052 inch diameter pins and series interlock construction for protection against overvoltage on load.
- Various tolerance ranges available. Inquiries invited on AC clippers and on your special requirements.

for complete technical information

concerning Motorola Zener Regulators, contact the nearest Motorola regional office listed below or . . .

MOTOROLA INC., Semiconductor Products Division
5005 East McDowell Road • Phoenix, Arizona
BRidge 5-4411 • Teletype Px80

"DEPENDABLE QUALITY—IN QUANTITY"

MOTOROLA SEMICONDUCTORS

MOTOROLA INC., 5005 E. McDOWELL, PHOENIX, ARIZONA

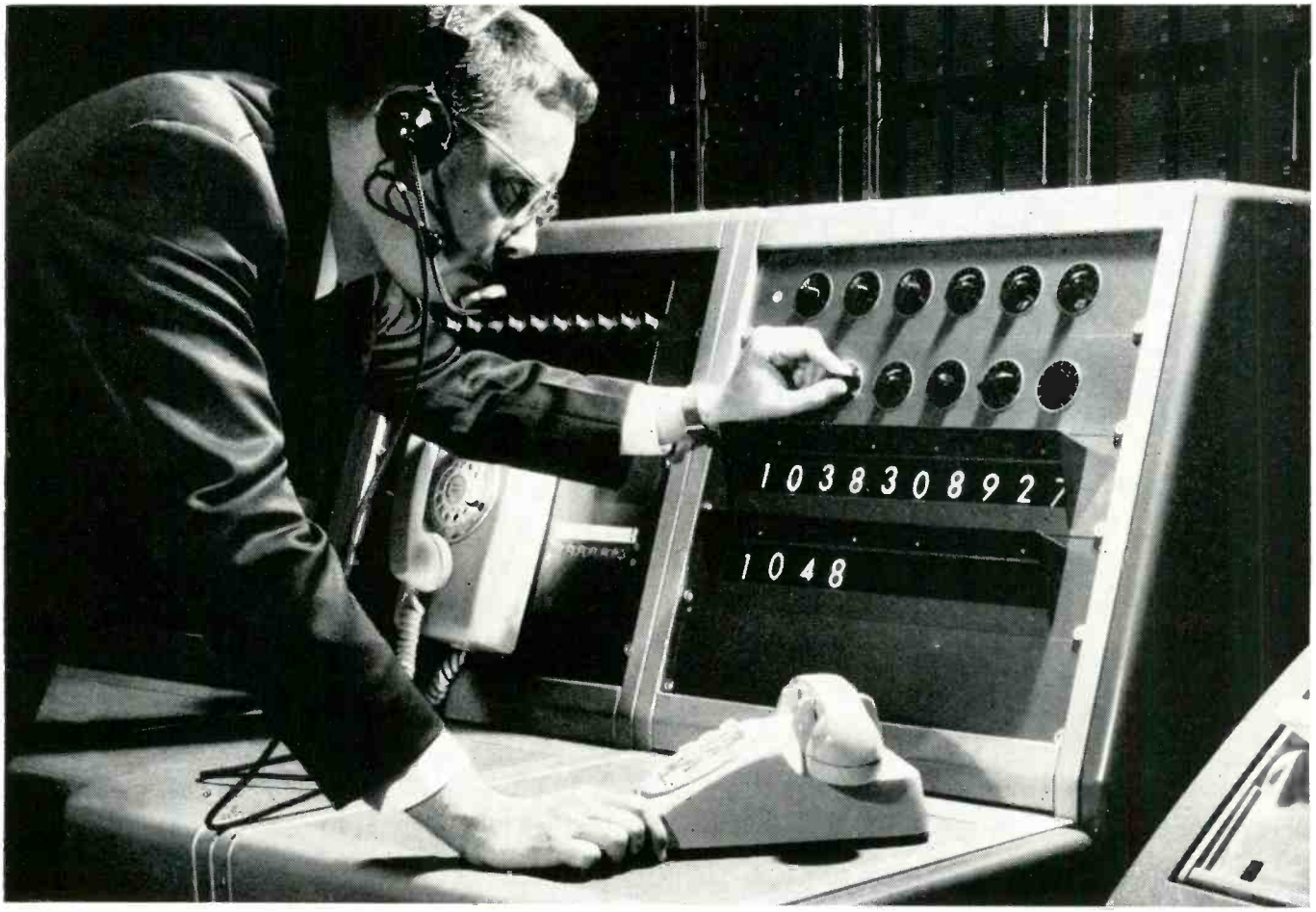
REGIONAL OFFICES

RIDGEFIELD, NEW JERSEY
540 Bergen Boulevard
WHitney 5-7500

CHICAGO 44, ILLINOIS
4900 West Flournoy Street
ESterbrook 9-5200

HOLLYWOOD 28, CALIFORNIA
6555 Sunset Boulevard
HOllywood 5-3250

MECHANIZED ORACLE EXPLORES BELL SYSTEM COMMUNICATIONS



At monitoring console, designer H. D. Irvin watches performance of "Sibyl" during test of user-reaction to experimental telephones. A computer-like machine, Sibyl simulates the functions of future communications devices and records interplay between phones and users. Sibyl is named after the women oracles of ancient Greece.

A mechanized "oracle" is helping Bell Telephone Laboratories predict the future in communications devices and systems.

The oracle is "Sibyl," a computer-like machine developed by Bell Laboratories engineers and psychologists. It can simulate the action of many kinds of communications devices. Through Sibyl, new kinds of telephone service can be evaluated without the considerable expense of building actual equipment. Observing and recording users' reactions to the simulated equipment, Sibyl provides indications of how users would react to proposed new systems features and equipment.

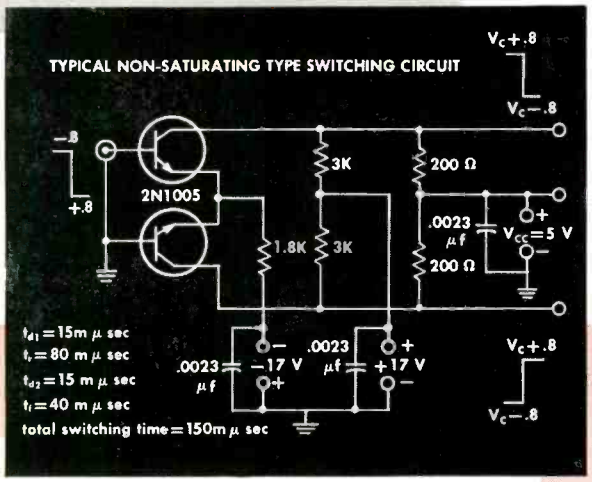
Sibyl, for example, is used to test the reaction of Bell Laboratories people to experimental push-button telephones. Each test subject has a push-button telephone in his office and he uses it in the ordinary course of his business. But the set is not connected directly to the local PBX: it is connected *through* Sibyl, which performs the special signaling functions required by such a push-button telephone. In this way, push-button telephone service is given to a group of people without modifying the PBX, or providing completely instrumented push-button telephones.

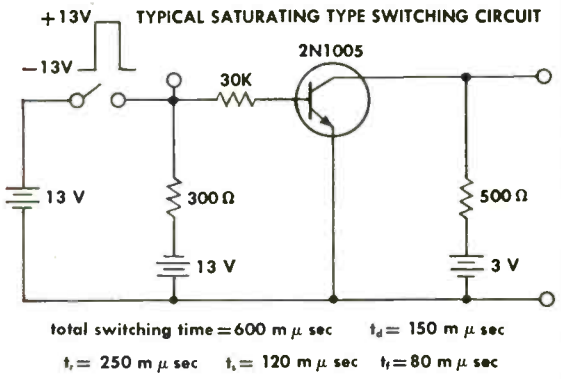
At the same time, Sibyl gathers information on how the call was placed—date, time, originator, speed of operation, errors, whether the line was busy or the call completed. Sibyl does all this without violating the privacy of telephone conversations.

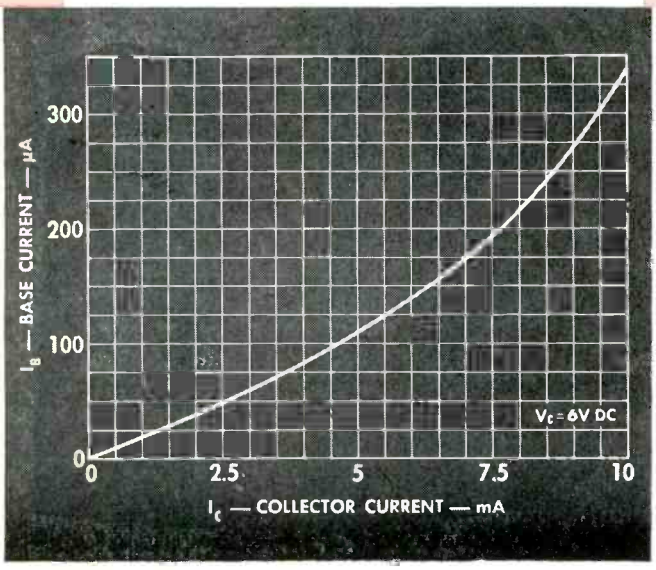
Bell engineers expect that Sibyl will provide a better understanding of the relationship between telephone equipment and the people who use it. Sibyl's rapid and economical technique for evaluating new types of telephone sets is an important contribution to the art of telephony.

NEW SILICON TRANSISTORS..

Actual Size







extremely high speed switching times as low as 150 mμsecs

NOW switching times as low as 150 mμsec with NEW production-quantity TI 2N1005 and 2N1006 N-P-N silicon transistors!

The newest additions to the nation's widest transistor line are packaged in the industry preferred JETEC TO-5 package . . . and *guarantee* DC betas of 20-to-55 and 45-to-100. For the reliability your high speed switching circuits require, both units also *guarantee* h_{fe} greater than 1 at 50 mc, collector dissipation of 125 mW at 25°C, 60 ohms saturation resistance, and 0.1 μA collector cutoff current.

For reliability . . . plus production quantities delivered on time . . . select the silicon switchers most suited to your specific applications from the table shown below:

SAME-DAY DELIVERY
FROM YOUR NEARBY TI DISTRIBUTOR
IN 1-249 QUANTITIES

Type	Dissipation at 25°C W	Small Signal Current Transfer Ratio h_{fe} min	max	Collector Current I_C mA max	DC Current Transfer Ratio hFE min	max	Collector Breakdown Voltage-V BV_{CBO} min	Saturation Resistance R_{CS} Ohms max	Alpha Cutoff Frequency $f_{\alpha b}$ mc min
2N337	0.125	19		20	20	55	45	150	10
2N338	0.125	39		20	45	150	45	150	20
* 2N1005	0.125	1 @ 50MC			20	55	15	60	75 (typ)
* 2N1006	0.125	1 @ 50MC			45	150	15	60	75 (typ)

* NEW TYPE ADDED TO PRODUCT LINE

IMMEDIATELY AVAILABLE IN PRODUCTION QUANTITIES

TEXAS

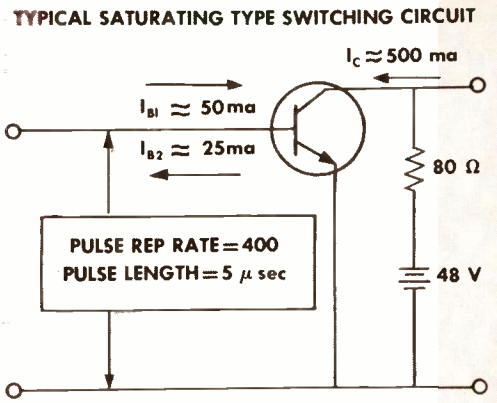
WORLD'S LARGEST SEMICONDUCTOR PLANT

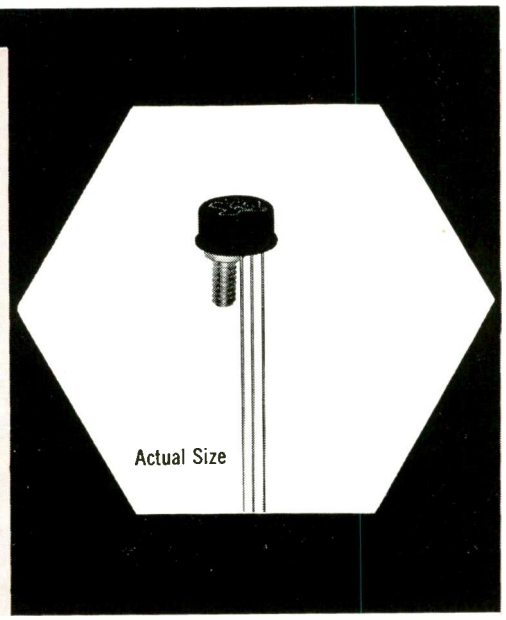
. FROM TEXAS INSTRUMENTS!

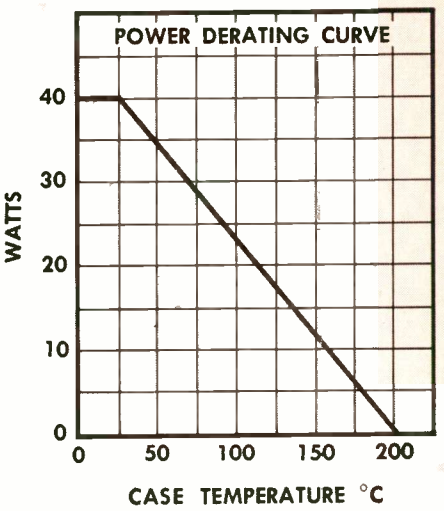
intermediate power transistors

80 and 120 BV_{CEX} 2.4 μsec switching

20 W at 100°C operation to 200°C







NEW TI silicon intermediate power transistors have bridged the gap between high and medium power devices...TI 2N1047, 2N1048, 2N1049, and 2N1050 *guarantee* 20 watts at 100°C.

Ideal for your power switching applications, these newest gaseous diffused transistors provide a typical total switching time of 2.4μsec! All four new units dissipate 40 watts at 25°C with an infinite heat sink ... the new TI design permits mounting of the semiconductor wafer directly onto the stud.

For your intermediate power and power switching applications, specify the 120-volt 2N1048 and 2N1050 or the 80-volt 2N1047 and 2N1049 with design flexibility and tight beta spreads of 12-to-36 or 30-to-90 that are *guaranteed!*

TI Silicon—Medium Power—Intermediate Power—Power—Transistors

	Type	Dissipation at 25°C W	$f_{\alpha e}$ Typical	I_C mA max	h_{FE} min	h_{FE} max	BV_{CBO} min	R_{CS} Ohms max
medium power	2N497	4	9 @ 2MC	200	12	36	60	25
	2N498	4	9 @ 2MC	200	12	36	100	25
	2N656	4	6 @ 2MC	200	30	90	60	25
	2N657	4	6 @ 2MC	200	30	90	100	25
intermediate power	2N122	8 75		140	3		120	200
	* 2N1047	40	10 @ 1MC	500	12	36	80	15
	* 2N1048	40	10 @ 1MC	500	12	36	120	15
	* 2N1049	40	9 @ 1MC	500	30	90	80	15
	* 2N1050	40	9 @ 1MC	500	30	90	120	15
power	2N389	85 at 25°C 45 at 100°C	3.5 @ 1MC	2A	12	60	60	5
	2N424	85 at 25°C 45 at 100°C	6 @ 1MC	2A	12	60	80	10

* NEW TYPE ADDED TO PRODUCT LINE

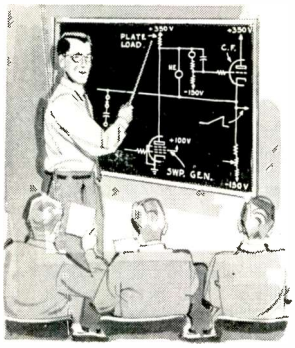
INSTRUMENTS
INCORPORATED
SEMICONDUCTOR – COMPONENTS DIVISION
13500 N. CENTRAL EXPRESSWAY
POST OFFICE BOX 312 • DALLAS, TEXAS

TEXAS INSTRUMENTS SALES OFFICES
DALLAS • NEW YORK • CHICAGO • LOS ANGELES
DAYTON • DENVER • DETROIT
OTTAWA • PHILADELPHIA • SAN DIEGO • SAN FRANCISCO
SYRACUSE • WALTHAM • WASHINGTON, D. C.

Circle 12 on Inquiry Card, page 83

The Manufacturer's Responsibility to the User

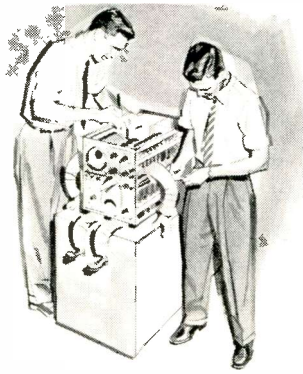
YOUR REQUIREMENTS for increasingly higher performance in oscilloscopes inevitably lead to instruments of greater complexity, and therefore to an enlarged responsibility on the part of the instrument manufacturer to provide needed assistance in the field. As a user of Tektronix Instruments you have easy access to a large well-trained field organization, anxious to help with any problems that arise due to unfamiliarity with new circuits or other factors. All services described below are readily available through twenty-four Tektronix Field Offices in North America. Most of these services are also provided by more than twenty Tektronix Engineering Representatives in pertinent overseas locations.



Maintenance—Tektronix willingly assumes much of the responsibility for continued efficient operation of the instruments it manufactures. If you should experience a stubborn maintenance problem, your Field Engineer will gladly help you isolate the cause. Often a telephone discussion with him will help you get your instrument back into operation with minimum delay. If yours is a large laboratory, your Field Engineer can be of service to your maintenance engineers by conducting informal classes on test and calibration procedures, trouble-shooting techniques, and general maintenance.

If you are responsible for the maintenance of a large quanity of Tektronix Instruments, ask your Field Engineer about the free factory training course in maintenance and calibration.

Operation—Your Tektronix Oscilloscope can be most useful to you when you are familiar with all control functions. Your Field Engineer will be glad to demonstrate the use of your instrument in various applications to help you become more familiar with its operation. If your instrument is to be used by several engineers, your Field Engineer will be happy to conduct informal classes on its operation in your laboratory.



Instrument Reconditioning—An older Tektronix Oscilloscope, properly reconditioned, can give you many additional years of service. Your Field Engineer will gladly explain the advantages and limitations of factory reconditioning, and make the necessary arrangements if you decide in favor of it.

Many major repair and recalibration jobs can be performed at a nearby Field Repair Station. Ask your Field Engineer about this at-cost service to Tektronix customers.

Applications—Perhaps the answers you need in a specific application can be obtained faster and easier through use of your Tektronix Oscilloscope. Your Field Engineer can help you find out, and if use of your oscilloscope is indicated, help you with procedures. He may also be able to suggest many time-saving uses for your oscilloscope in routine checks and measurements.

Ordering—There are many types of oscilloscopes, each designed for a specific application area. Your Field Engineer can help you select the one best suited to your present and future needs, and he will be happy to arrange a demonstration of the instrument . . . in your application if you so desire.

If you are a Purchasing Agent or Buyer, your Field Engineer or his secretary can help you with information on prices, terms, shipping estimates, and best method of transportation on instruments, accessories, and replacement parts.

Communications—Your Field Engineer is a valuable communication link between you and the factory. He knows the exact person to contact in each circumstance, and he can reach that person fast and easily. Let him help speed your communications with the factory on any problem related to your Tektronix Instruments.

Tektronix, Inc.

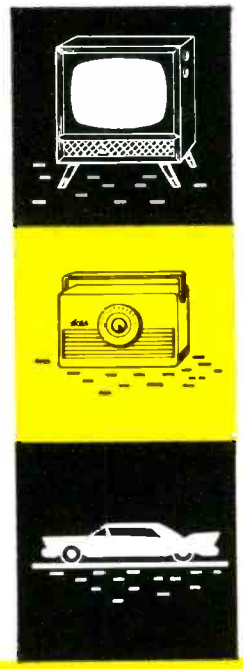
P. O. Box 831 • Portland 7, Oregon

Phone CYpress 2-2611 • TWX-PD 311 • Cable: TEKTRONIX

TEKTRONIX FIELD OFFICES: Albertson, L. I., N.Y. • Albuquerque • Bronxville, N.Y. • Buffalo Cleveland • Dallas • Dayton • Elmwood Park, Ill. • Endwell, N.Y. • Houston • Lathrup Village, Mich. • East Los Angeles • West Los Angeles • Minneapolis • Mission, Kansas • Newtonville, Mass. • Polo Alto, Calif. • Philadelphia • Phoenix • San Diego • Syracuse • Towson, Md. Union, N. J. • Willowdale, Ont.

TEKTRONIX ENGINEERING REPRESENTATIVES: Arthur Lynch & Assoc., Ft. Myers, Fla., Gainesville, Fla.; Bivins & Caldwell, Atlanta, Ga., High Point, N.C.; Hawthorne Electronics, Portland, Ore., Seattle, Wash.; Hytronic Meosurements, Denver, Colo., Salt Lake City, Utah.

Tektronix is represented in 20 overseas countries by qualified engineering organizations.



The ferrites MOST electronic manufacturers DEPEND UPON

Coldite 70+® fixed composition resistors
Snap and Slide Switches • Fixed composition capacitors • Ceramagnet® ceramic magnets
Iron Cores • Variable composition resistors
Brushes for all rotating electrical equipment
Electrical contacts • hundreds of related carbon & graphite products for electrical, mechanical, chemical and refractory applications.

...FOR UNIFORMITY
of electrical and mechanical characteristics from one unit to another, and from one order to the next.

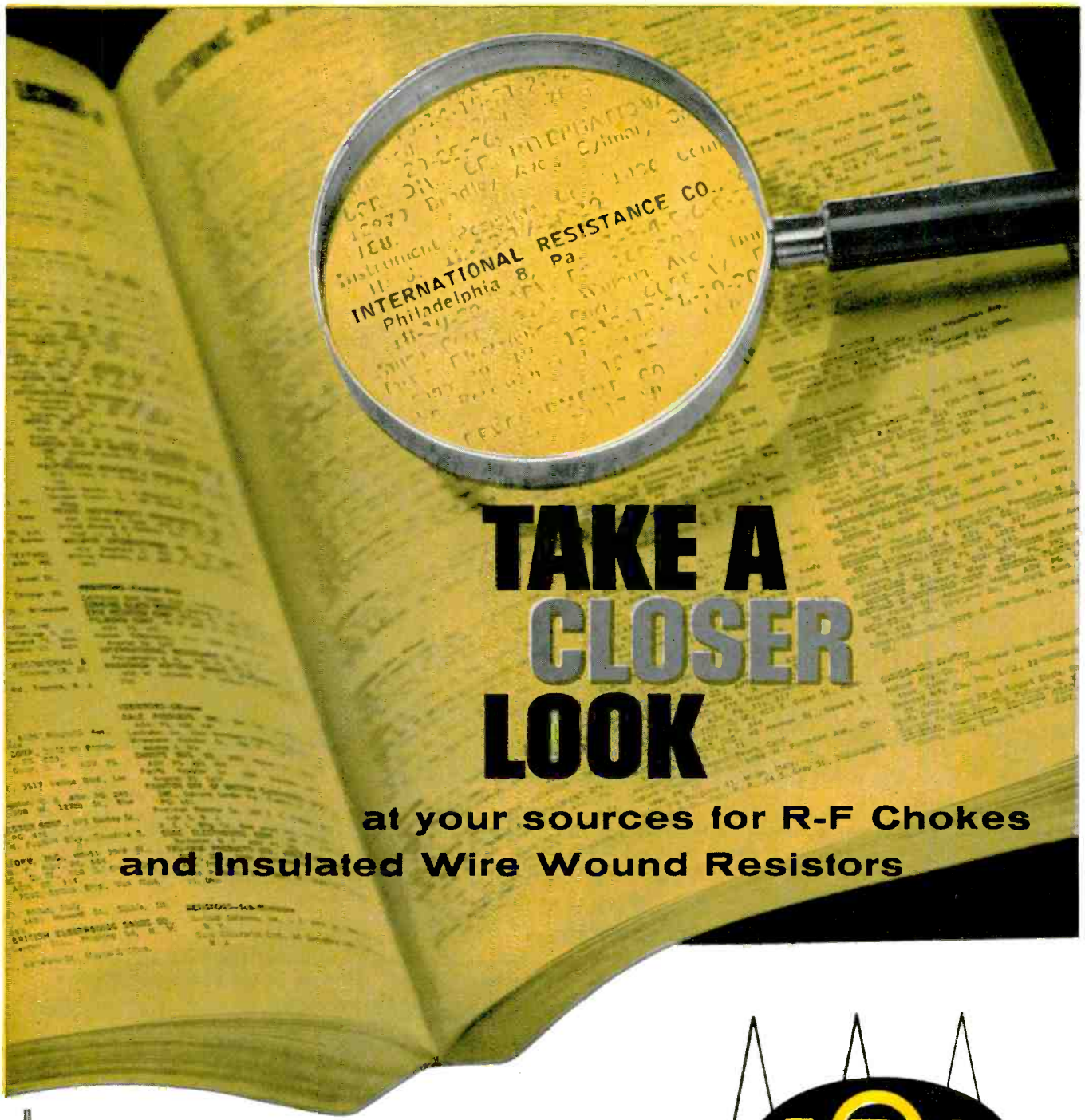
...FOR PERFORMANCE
that matches special physical and electrical requirements "on the nose".

...FOR "ON TIME" DELIVERIES
to meet Production deadlines.

Electronic Components Division
STACKPOLE CARBON COMPANY, St. Marys, Pa.

STACKPOLE Ceramag®
FERROMAGNETIC CORES

Circle 14 on Inquiry Card, page 83



TAKE A CLOSER LOOK

at your sources for R-F Chokes and Insulated Wire Wound Resistors

Have you rechecked your sources of supply for these two products recently? Take a look at R-F Chokes. Are you satisfied with quality? Are you getting all the product and assembly advantages your money can buy?

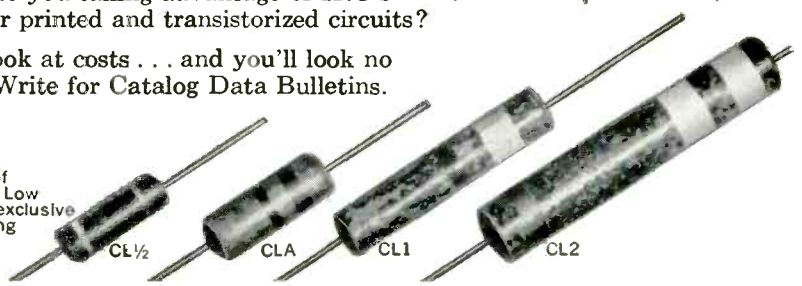
Take a look at Insulated Wire Wound Resistors. Are you happy with their reliability for your applications? Are you saddled with "yesterday" components or are you taking advantage of IRC's specialized wire wounds for printed and transistorized circuits?

Finally, take a *closer* look at costs . . . and you'll look no further than IRC. Write for Catalog Data Bulletins.

IRC®

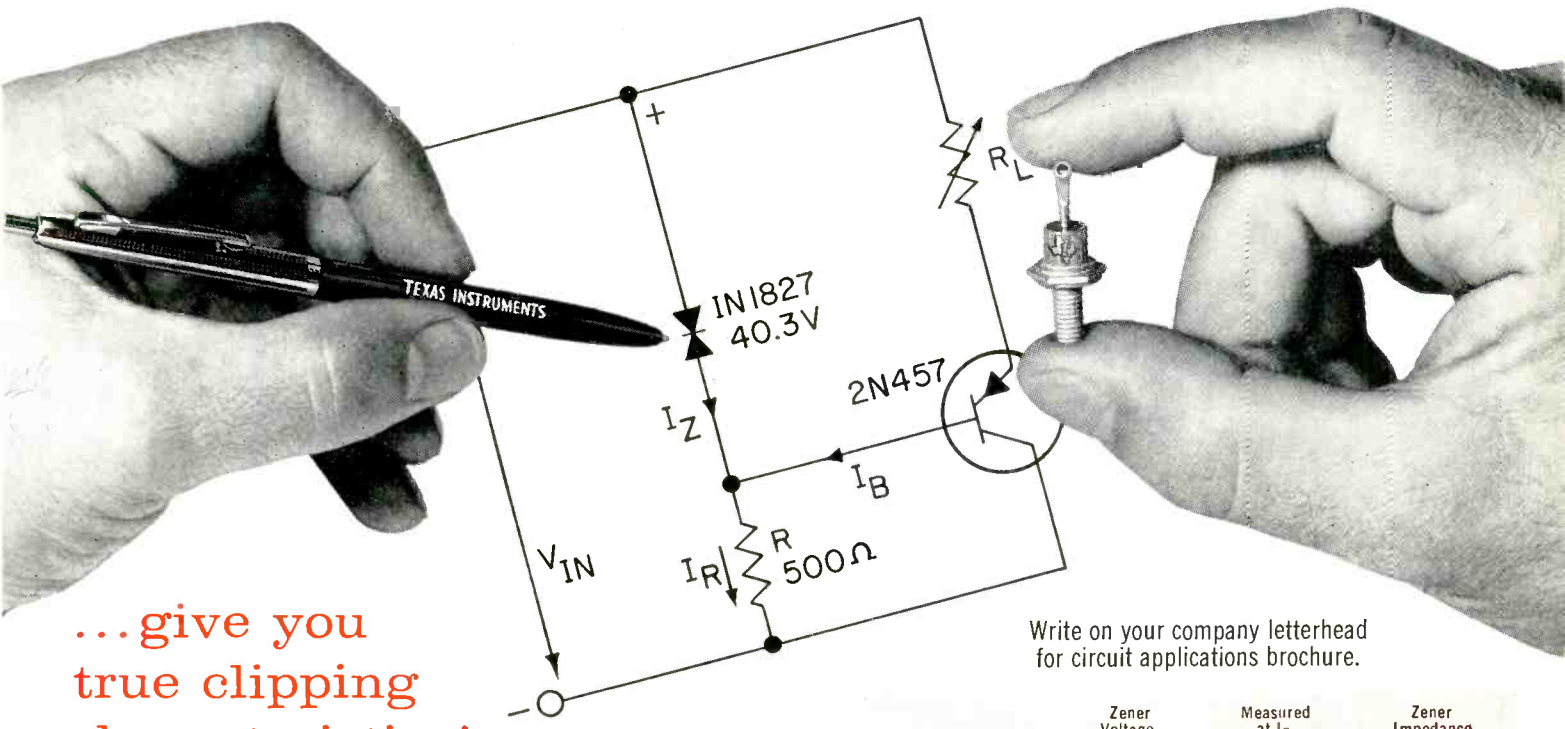
3 SIZES OF INSULATED WIRE WOUND RESISTORS
Small, low range, low resistance—excellent for transistor circuits.

4 SIZES OF R-F CHOKES
Wide range of inductances. Low cost, due to exclusive manufacturing methods.



INTERNATIONAL RESISTANCE COMPANY • Dept. 355, 401 N. Broad St., Phila. 8, Pa. • *In Canada:* International Resistance Co., Ltd., Toronto, Licensee

NEW 10W VOLTAGE REGULATORS FROM TEXAS INSTRUMENTS



...give you true clipping characteristics!

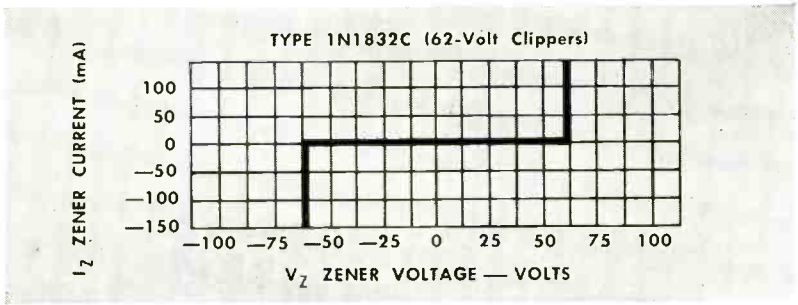
You get true clipping action with TI 1N1816-series double anode voltage regulators. A full line of regulators with dissipation ratings to 10 watts is available in 5 or 10% tolerances over a 13 to 91-volt range.

These stud-mounted silicon voltage regulators give you guaranteed zener impedance, –65 to 150°C operation, and are designed to meet or exceed strict military (MIL-T-19500A) requirements.

This new 1N1816-series provides greater design flexibility for your shunt regulator, surge protection, operating bias, and arc suppression applications. Select from 105 types . . . 16 voltage ratings . . . 5 or 10% tolerances . . . cathode-to-stud or anode-to-stud polarity.

Write on your company letterhead for circuit applications brochure.

Type	Zener Voltage V_Z Volts	Measured at I_Z I_Z mA	Zener Impedance at I_Z Z_Z (max) ohms
1N1816	13	500	2
1N1817	15	500	2
1N1818	16	500	3
1N1819	18	500	3
1N1820	20	250	3
1N1821	22	250	3
1N1822	24	250	3
1N1823	27	250	3
1N1824	30	250	4
1N1825	33	150	4
1N1826	36	150	5
1N1827	39	150	5
1N1828	43	150	6
1N1829	47	150	7
1N1830	51	150	8
1N1831	56	150	9
1N1832	62	50	12
1N1833	68	50	14
1N1834	75	50	20
1N1835	82	50	22
1N1836	91	50	35



1N1816C — 1N1836C CLIPPER

Types 1N1816C — 1N1836C are specifically designed to clip, and exhibit true double anode characteristics. Each zener is held within 10% tolerance of the specified voltage. See "Typical Clipper Characteristics" curve at left.

WORLD'S LARGEST SEMICONDUCTOR PLANT

TEXAS INSTRUMENTS
INCORPORATED
SEMICONDUCTOR-COMPONENTS DIVISION
POST OFFICE BOX 312 • 13500 N. CENTRAL EXPRESSWAY
DALLAS, TEXAS

Circle 16 on Inquiry Card, page 83

Tele-Tips

AT NEW RESEARCH LABS of CBS-Inc. in Stamford, Conn., a 100-year time-capsule is buried in the ground, containing some 50 modern day musical records. We can't help wondering what posterity will think of "The Purple People Eater."

THE DECIBEL, as defined by W6JAT in "QST": The amount a youngster turns down the TV set after being told it is too loud!

NO MORE PIG-STICKING, thanks to ultrasonics. In the past about the only way that butchers could gauge the amount of fat on a pig was literally to stick a sharp pin through to the lean meat. It was not only painful to the hogs, it was also difficult to hold them still while the operation was performed. Now ultrasonics does it painlessly. The time it takes for the sound waves to bounce back from the fat-meat interface is an accurate measure of the fat's depth.

RADAR SPEED CHECK on the New York Thruway found that 1 of every 4 cars was exceeding the speed limit.

THIS YEAR'S "WHO'S WHO" lists 58 electronics executives, 209 electrical engineers, 211 communications executives and 441 physicists among the 50,645 listees. The group collectively accounts for 1.8% of the total.

WHAT HAPPENED! Most of the news that comes across our desk is pretty cut-and-dried but every so often comes a provocative little item that leaves us chewing our nails. Here's the latest, with obvious name changes: "Recently we sent you a news release announcing the establishment of a Marketing Research Dept. at the XYZ Blown Glass Gasket Co. and the appointment of Phil A. Ment as director. Now, due to the sudden resignation of Mr. Ment, we would appreciate your killing this story. (Sounds like they forgot to tell Phil!)

Tele-Tips

SUPERVISORS who think they have a good deal of influence within their organization are usually regarded favorably by their workers, according to Univ. of Michigan research. This "surprisingly strong" correlation was explained this way: supervisors who are influential and who understand their workers needs may be in a better position to do something about these needs than supervisors who lack influence within their organization.

PAINLESS DENTISTRY for army GI's is provided by a new anesthesia jet injector that shoots liquid into the gum tissues at a speed of about 700 ft./sec. The new method eliminates the hazards of needle fracture during injection and reduces the danger of transmitting infectious hepatitis.

THE JETLINERS will open the door to all sorts of crazy experiences. For instance, Boeing is pointing out that with their new 707 the sports fan could watch the Orange Bowl game in Florida and reach Los Angeles in time for the second half of the Rose Bowl game the same afternoon. Or the inveterate nightclubber could catch an early show in Paris and arrive in New York for a later performance—he would lose only an hour in crossing the Atlantic. And crossing the International Date Line will cut one day in half, but make the next 40 hours long!

BULB BURN-OUTS, why they occur, and what can be done to prevent them, is the problem being attacked by the Computer Division of Bendix Aviation Corp. A Bendix G-15 computer is being adapted to help solve radiation problems involving temperature changes in wire filaments and filament vibration. Bendix spokesman said the problem involves "the previously insurmountable maze of mathematical problems."

FOR UNVARYING PERFORMANCE

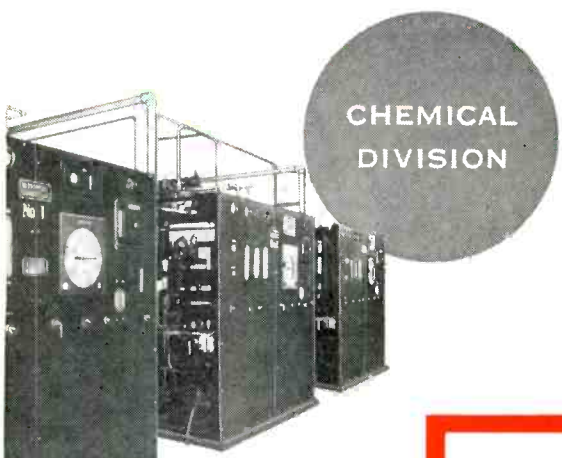
PRECIOUS METAL CONTACTS . . . for long operating life and unvarying performance. Available in pure or alloyed forms of Silver, Platinum, Palladium, and Gold. These contacts provide extremely high resistance to atmospheric corrosion, deformation, arc erosion, sticking and metal transfer. They are supplied as wire, rod, sheet, and as fabricated forms.
Baker Contact Division, 207 Grant Avenue, East Newark, Harrison P. O., N. J.

Circle 19 on Inquiry Card, page 83

FOR CORROSION-RESISTANT SURFACES

RHODIUM PLATING . . . an economical, hard, white, corrosion-resistant surface. Extremely well-suited for many electrical and electronic applications. Resistant to corrosive atmospheres, oxidation, arc erosion. Reduces wear on moving surfaces, assures low noise level for moving contacts, no oxide rectification, low and stable contact resistance. Ideal when a low-resistance, long wearing, oxide-free contact is required.
Chemical Division, 113 Astor Street, Newark 2, N. J.

Circle 20 on Inquiry Card, page 83



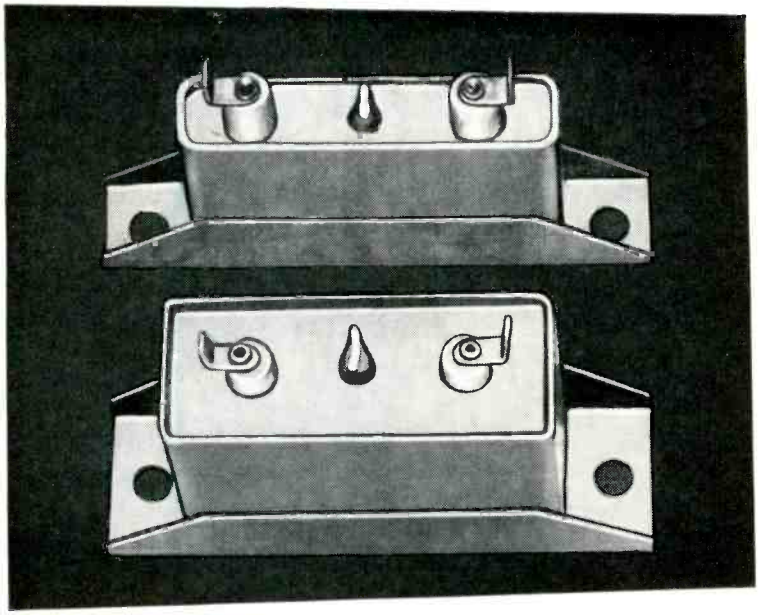
FOR PRODUCING NITROGEN

NITRONEAL® GAS GENERATOR . . . With a controllable hydrogen content—produces oxygen-free gas consisting of nitrogen, hydrogen and water vapor. Hydrogen content can be varied and maintained as desired between 0.5% and 25%. Economy is a major factor in this equipment. The cost of the nitrogen produced is found to be many times cheaper than an equal amount of cylinder nitrogen. Furthermore, the catalyst lasts indefinitely—maintenance costs are practically nil.
Chemical Division, 113 Astor Street, Newark 2, N. J.

Circle 21 on Inquiry Card, page 83

ENGELHARD INDUSTRIES, INC.

113 ASTOR STREET
NEWARK 2, NEW JERSEY



HIGH TEMPERATURE CAPACITORS BY BENDIX

Now Available
in Production Quantity

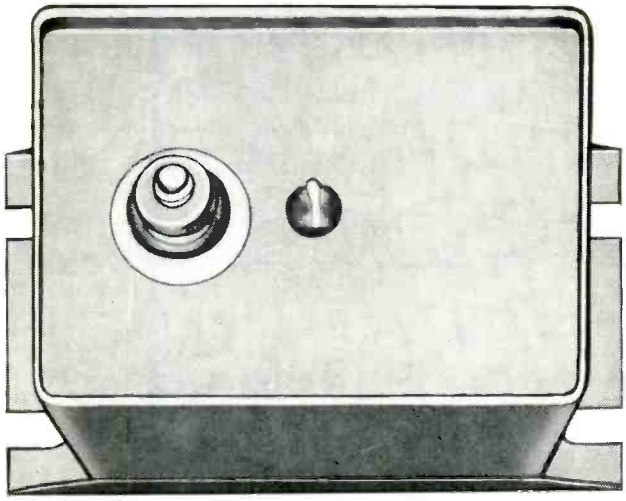
E-315

Scintilla Division of Bendix developed and has in production the *E*-315 family of *E*-nvironmental resistant capacitors to aid in satisfying the fast growing requirement for high temperature components in the high speed aircraft and missile fields.

The *E*-315 capacitor offers proven stability of operation over the temperature range of —55° to +315° Centigrade* with no voltage derating and low capacitance variation. Of rugged hermetically sealed construction and nonstrategic materials, this capacitor is built for high altitude and severe environmental operation.

This nonpolarized capacitor is available in a variety of sizes in a capacity range of from 0.05 to 4.0 microfarads at 600 VDC. It is also available in higher voltage ratings. Performance data and operating characteristics are given in Technical Bulletin SL-61 which is supplied upon request.

*Confirmed by qualification test of 1000 hours at 100% rated voltage over ambient temperature range of —55° to +315° C.



DESIGN FEATURES

Temperature Range . . . —55° to +315°C. Capacitance . . . 0.05 to 4.0 uf at 600 VDC. Voltage Range . . . 600 V to 3000 V per section. No Voltage Derating, Low Capacitance and Power Factor Variation, Environmental Resistant, Hermetically Sealed, Rugged Construction, Nonstrategic Materials, Minimum Size and Weight, High Altitude Operation.

Scintilla Division
Sidney, New York

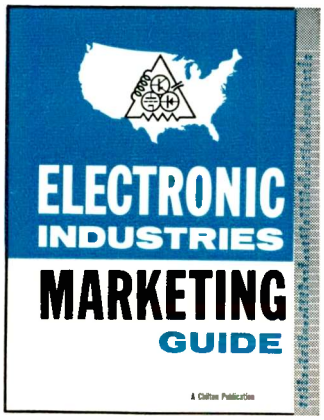
Bendix
AVIATION CORPORATION

Circle 22 on Inquiry Card, page 83

A MAJOR BREAK-THROUGH

TWO POWERFUL NEW TOOLS YOU CAN USE—NOW—TO:

a. Define your market
b. Determine sales potentials
c. Measure sales performance
d. Pinpoint your prospects
e. Plot sales territories
f. Find new product markets
g. Perform market research



A new "EI Marketing Guide" book which supplies a state-by-state, county-by-county, product-by-product breakdown of electronic manufacturers product data. (Book in excess of 376 pages.)

Up-to-the-minute product data from 4,694 companies in the electronic industries available in 35,000 IBM punched cards.

The old era of dependence on government census classifications and data not suited to our industry has come to an end. ELECTRONIC INDUSTRIES' development of these two marketing tools opens up a new era for electronic market research.

These two new market research tools will enable you to spotlight the potential users of your products with a precision never before possible in the electronic industries and assist you in the marketing of your products.

Electronic products in this "EI Marketing Guide" and in the deck of IBM cards are classified under 101 major product numbers. They are further subdivided into an *average* of 20 sub product classifications under each major classification by the IBM punched cards (approximately 2,300 products).

Electronic manufacturers may acquire the "EI Marketing Guide" through a lease agreement with ELECTRONIC INDUSTRIES. A "deck" of the 35,000 IBM cards may be purchased for use on your own IBM facilities or on your local IBM Service Bureau Corp. facilities. (83 Bureaus in U. S.)

For full explanation of the content and uses of the "EI Marketing Guide" book and "EI" census data in punched form, contact any of the ELECTRONIC INDUSTRIES' Regional Managers listed below.

Chicago 1
George Felt
360 N. Michigan Ave.
RAndolph 6-2166

Cleveland 15
Shelby A. McMillion
930 Keith Bldg.
SUperior 1-2860

New York 17
Gerald Pelissier
100 E. 42nd St.
OXford 7-3400

Philadelphia 39
Joseph Drucker
56th & Chestnut Sts.
SHerwood 8-2000

New England
Menard Doswell
100 E. 42nd St.
New York 17, N. Y.
OXford 7-3400

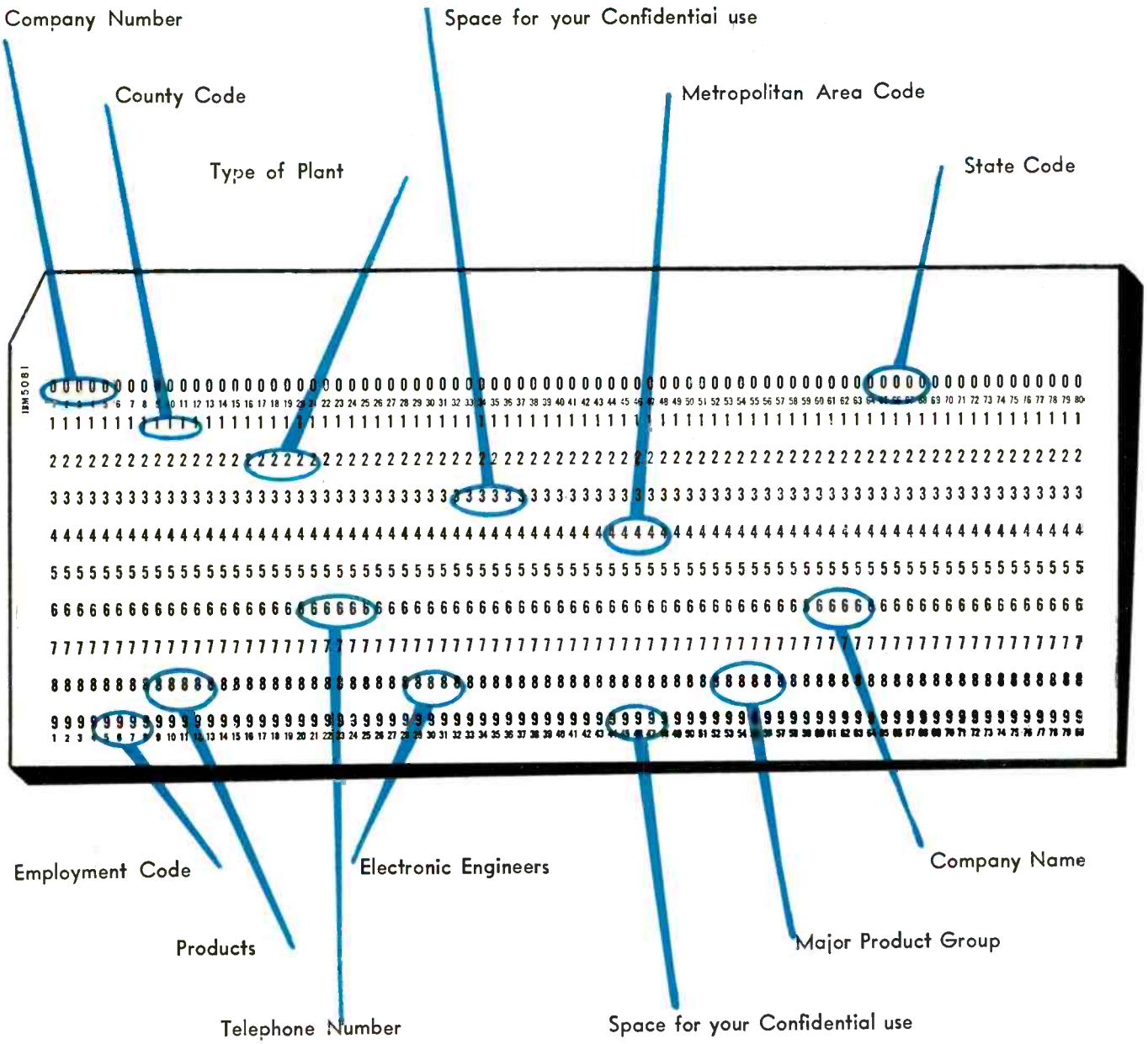
San Francisco 3
Don May
1355 Market St.
UNderhill 1-9737

Los Angeles 57
B. Wesley Olson
198 S. Alvarado St.
DUnkirk 7-4337

Dallas 1
Hal Mott
Meadows Building
Expressway at Milton
EMerson 8-4751

Atlanta 9
John Sangston
1371 Peachtree St. NE.
TRinity 6-4110

IN ELECTRONIC MARKETING!



ELECTRONIC INDUSTRIES

Chilton Company Executive Offices:
56th & Chestnut Sts., Philc. 39, Pa.
SHerwood 8-2000

Circle 23 on Inquiry Card, page 83

Letters

to the Editor

"Ultra-Linear Output"

Editor, ELECTRONIC INDUSTRIES:

I would like to correct some omissions I made in my article "An Inexpensive Ultra Linear Output Stage" on Page 89 of the October, 1958 issue of ELECTRONIC INDUSTRIES.

The 12AX7 tube which acts as the phase splitter has both a 220K plate and a cathode resistor. This value for the cathode resistor was inadvertently omitted. The two output tubes are 6AQ5's, not the apparently non-existent 6GAQ5 and the common cathode resistor value, again omitted, is 470 ohms.

Some fellow audio enthusiasts have tried this modification using 5687 triodes with 6L6/5881 and even more powerful output stage tubes and have reported good results once the other feedback loops have been adjusted. In fact the circuit has taken on one of the aspects of Frankenstein's monster, it is being referred to as the "Barditch Output Stage."

I might also add that the circuit is covered by a Westinghouse Patent Application.

I. F. Barditch
Engineering Dept., 454
Air Arm Division
Westinghouse Electric Corp.
Baltimore, Md.

"All-Reference Directory"

Editor, ELECTRONIC INDUSTRIES:

I would appreciate it very much, if you would send me a copy of "Electronic Industries Directory."

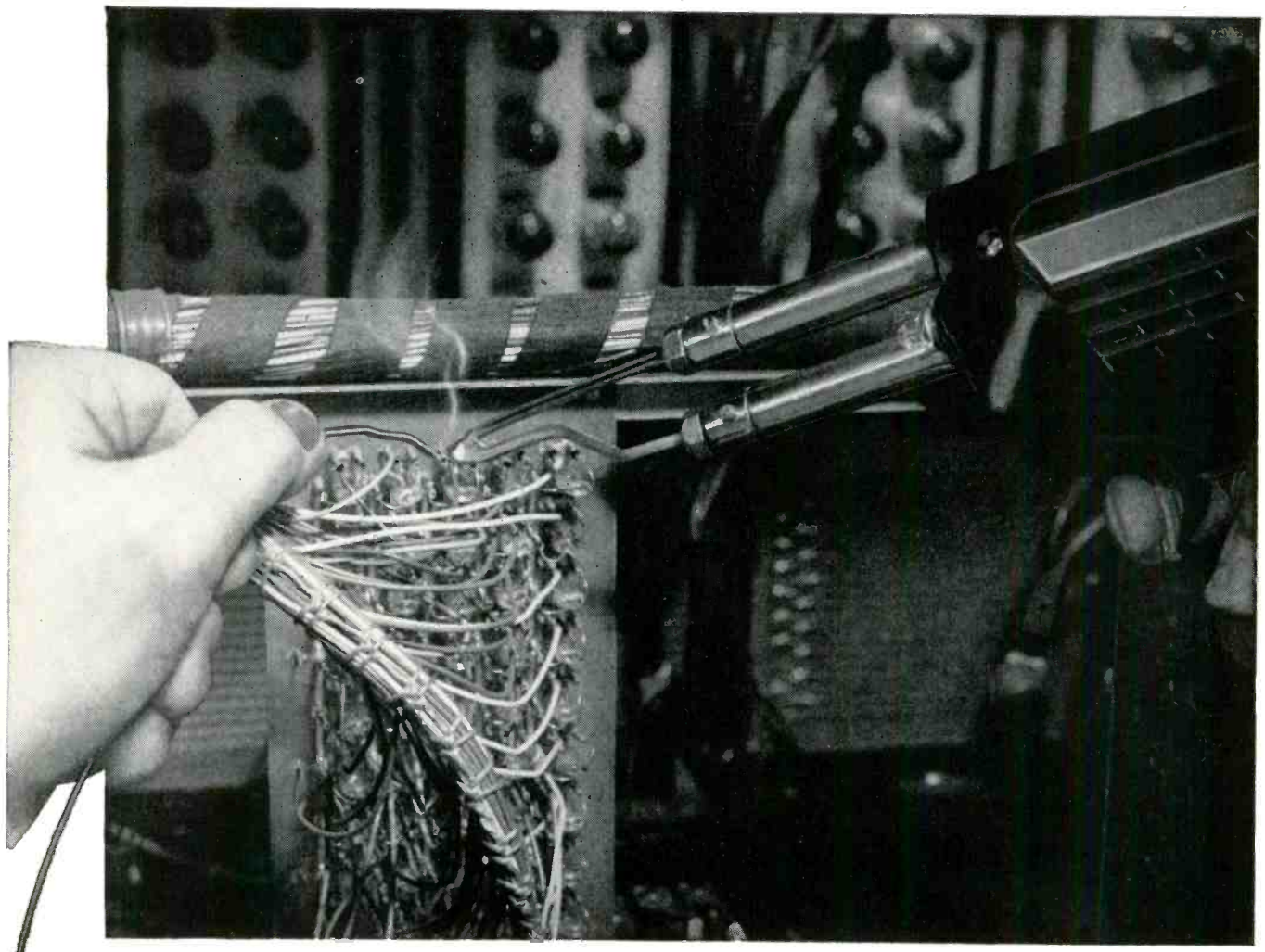
I find this directory very useful in my work as a designer, and in my opinion, it is the best book of its kind. The factor most liked by myself and the people that I have talked to, is the listings of the physical sizes of electronic components.

Thank you very much for your attention and cooperation in this matter.

Donald V. Russo
3608 Centinela Ave.
Los Angeles, 66, California

Plan for Space Age

Dr. Lloyd V. Berkner, president of Associated Universities, has been named chairman of a newly formed 15-man Space Science Board. Dr. Detlev W. Bronk, president of the National Academy of Sciences-National Research Council, announced the appointment. Purpose of the board is to "Survey in concert the scientific problems, opportunities, and implications of men's advance into space."



"Dutch Boy" Solder specialists help keep electronic brains sane

...develop solder-flux combinations that give practically perfect performance

Who wants a psychopathic computer?

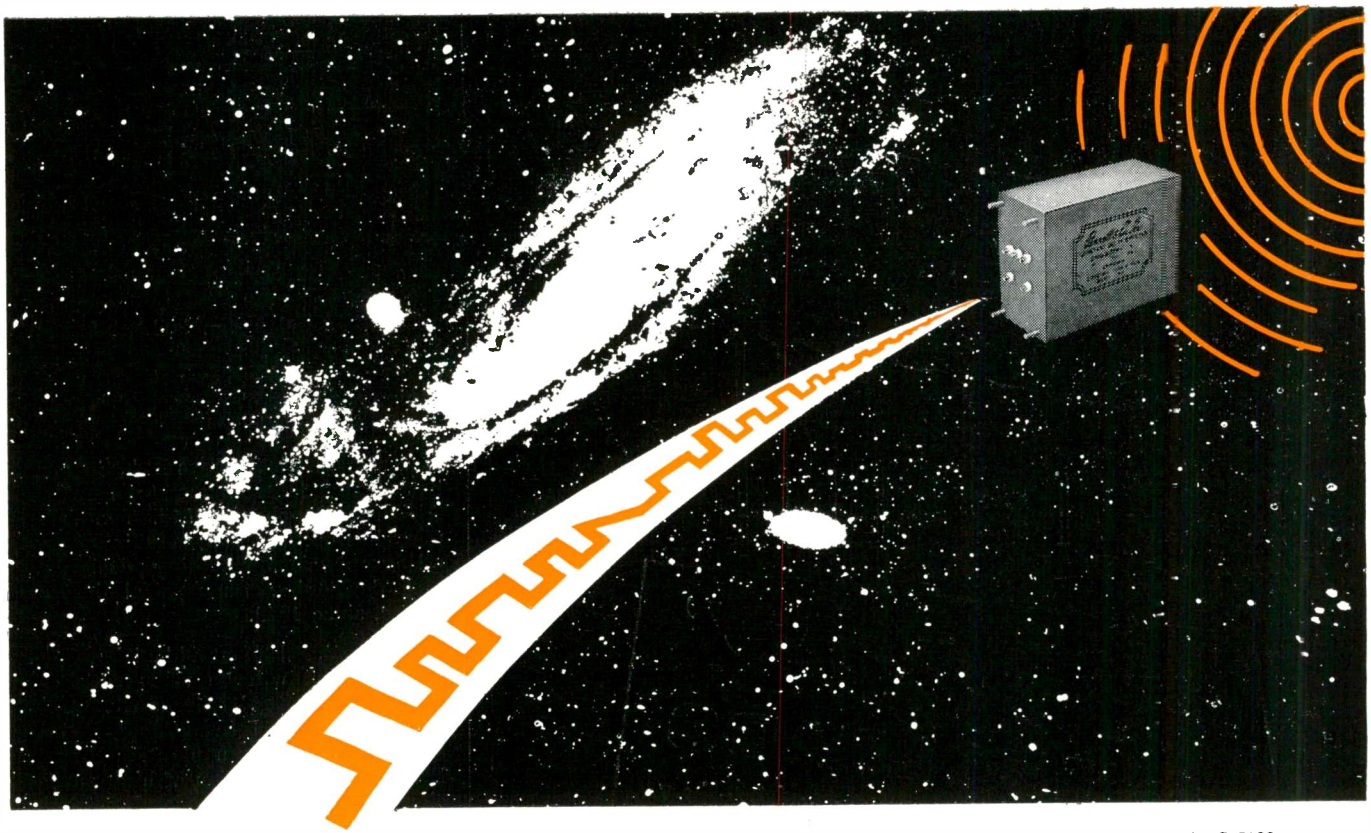
Not the electronic-brain makers... or their customers. That's why they demand... and get... practically never-miss reliability in soldering the thousands of joints and connections in even a small computer. A single open could put the circuitry out of commission.

"Dutch Boy" Solder specialists have done much to improve reliability of metal joining . . . helping to improve soldering methods, advising on (and sometimes devising) new equipment, and, most of all, developing improved solders and fluxes.

As new electronic devices are developed, as new service requirements unfold, National Lead solder specialists meet the challenge — a new test to insure flux continuity and integrity in cored solders . . . new formulations for ultra-cold service . . . fluxes that are truly non-conductive and non-corrosive — these are a few of the things National Lead people have done to solve customers' solder problems . . . produce solders worthy of the "Dutch Boy" name.

Maybe your "Dutch Boy" Solder specialist can help *you* improve your production soldering. It's easy to find out. Just write National Lead Company,
111 Broadway, New York 6, N. Y.
Offices in Principal Cities.

Dutch Boy® Solders and Fluxes



MAXIMUM TELEMETERED RESPONSE THROUGH FLAT AMPLITUDE AND CONSTANT DELAY

In keeping with its reputation as a pioneer in the field of toroids, filters and related networks, Burnell & Co. now offers a complete line of low pass and band pass constant delay filters for standard RDB telemetering channels. These Burnell constant delay filters combine accurate amplitude and phase to effectively limit intelligence distortion and false transients to a minimum. Telemetered signals from off course missiles or those in distant or terminal flight are no longer blocked by attenuation and noise.

Amplitude and Phase Necessary

For maximum performance of telemetering systems, it is recognized that filtering of sampled data requires *both* linear phase and flat amplitude in the pass band. However, until recently a combination of the two in one unit had not been available.

Combination Achieved

Existing sub carrier discriminators afford no better than a choice of flat amplitude pass band with *non-linear* phase in one filter or a constant time delay filter with *distorted amplitude.* In contrast, Burnell constant delay filters combine both—are flat within 3 db over the pass band—1½ db for the low pass filters—and possess a time delay constant within 5%.

Write for Bulletin CD 051

TECHNICAL DATA

FOR ± 7½% PASS BAND
1 Flat within 3 db over pass band
2 21 db at ± 15% of center freq.
3 40 db at ± 22% of center freq.
4 Time delay over the pass band, constant to ± 5%

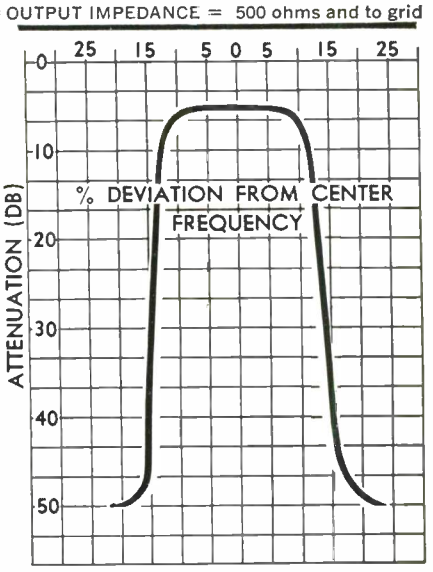
FOR ± 15% PASS BAND
1 Flat to 3 db over pass band
2 23 db at ± 30% of center freq.
3 40 db at ± 44% of center freq.
4 Time delay over pass band constant to ± 7%

Input impedance — 500 ohms
*Output impedance — 500 ohms and high impedance for operation to a grid
*optional impedance available on special order.

CONSTANT DELAY BAND PASS

Channel	Frequency	Part #	Delay in ms.	.B/W
1	.4 KC	S-60051	34.00	15%
2	.56 KC	S-60052	24.30	15%
3	.73 KC	S-60053	18.60	15%
4	.96 KC	S-60054	14.20	15%
5	1.3 KC	S-60055	10.50	15%
6	1.7 KC	S-60056	8.00	15%
7	2.3 KC	S-60057	5.93	15%
8	3.0 KC	S-60058	4.40	15%
9	3.9 KC	S-60059	3.38	15%
10	5.4 KC	S-60060	2.44	15%
11	7.35 KC	S-60061	1.80	15%
12	10.5 KC	S-60062	1.26	15%
13	14.5 KC	S-60063	0.91	15%
14	22. KC	S-60064	0.60	15%
15	30. KC	S-60065	0.44	15%
16	40. KC	S-60066	0.33	15%
17	52.5 KC	S-60067	0.252	15%
18	70. KC	S-60068	0.189	15%
A	22. KC	S-60069	.305	30%
B	30. KC	S-60070	.224	30%
C	40. KC	S-60071	.168	30%
D	52.5 KC	S-60072	.128	30%
E	70. KC	S-60073	.096	30%

CASE SIZE—2″ x 3½″ x 4 13/16″
* INPUT IMPEDANCE = 500 ohms
* OUTPUT IMPEDANCE = 500 ohms and to grid



Burnell & Co., Inc.
PIONEERS IN TOROIDS, FILTERS AND RELATED NETWORKS

EASTERN DIVISION
10 PELHAM PARKWAY
PELHAM, NEW YORK
PELHAM 8-5000
TWX PELHAM 3633

Dept. EI-12

PACIFIC DIVISION
720 MISSION ST.
SOUTH PASADENA, CALIFORNIA
RYAN 1-2841
TWX PASCAL 7578

Circle 27 on Inquiry Card, page 83

ELECTRONIC INDUSTRIES

International

Sweden is ordering the Bristol Ferranti Bloodhound guided missile, Britain's first air defense system. Bloodhound is a long range semi-active surface-to-air supersonic homing missile. Actual range is kept secret. It is a complete weapon system, including target-illuminating radar equipment, control posts, and launchers for the missiles.

Aeromagnetic Surveys Ltd., Canada, has changed its name to Hunting Airborne Geophysics Ltd. The company has been in airborne mining and oil geophysics, including designing and developing geophysical instruments, since 1949.

International Metalloids, Inc., Puerto Rico, will be represented in the United States by Grace Electronic Chemicals, Inc. International Metalloids is completing a plant in Puerto Rico for the production of high purity elemental silicon. Grace Electronic Chemicals is a subsidiary of W. R. Grace & Co.

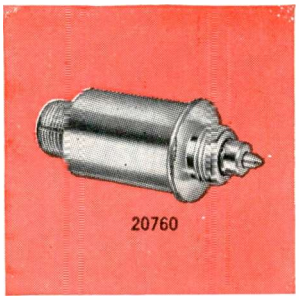
Testing in England of the Percival System of compatible, single channel stereo FM radio indicates the possibility of obtaining true stereo reproduction by separating the directional information from the audio information and transmitting the former on a subcarrier. The power and bandwidth for the directional signal are small and only minor modifications are necessary to the transmitter and receiver.

Volker Koch-Weser, Manager in Sao Paulo for George Fry & Associates, Limited.

The general manager in Brazil of George Fry & Associates, Ltd. is now Volker Koch-Weser. The firm is planning to establish additional offices in Mexico City and Caracas.

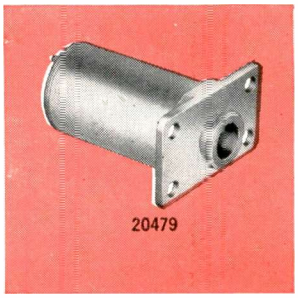
Vibrachoc, G.M.B.H. will manufacture Robinson Aviation Inc. products in West Germany under a recently established licensing agreement.

(*Continued on page* 42)



true hermetically sealed solenoids

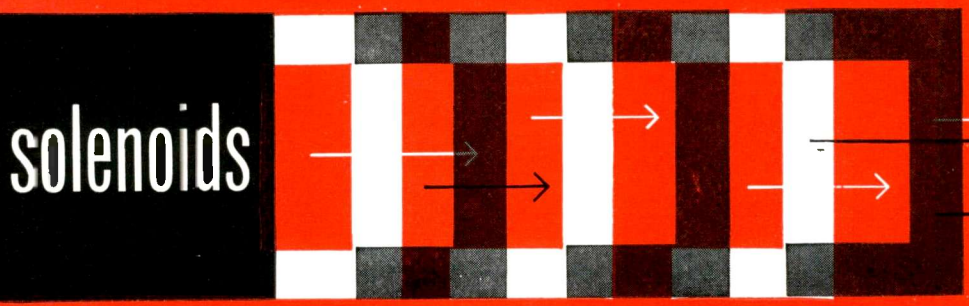
Just like a sealed vacuum tube! True hermetic sealing around a solenoid . . . glass seal terminals, lugs, and connectors. All welded and brazed construction. Completely plated after assembly. Exceed most requirements of military specification MIL-S-4040 (USAF). Priced at approximately the same level as conventional types.

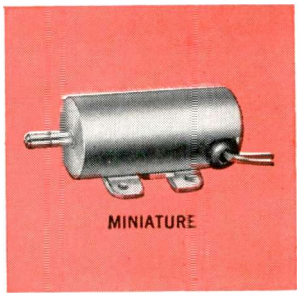


high-temperature solenoids

These modern new solenoids give you a reasonable life expectancy at temperatures as high as 350° C. A by-product of hermetic sealing. Class H insulation combined with inert gas filling add those necessary extra few degrees needed in your temperature limits . . . make these solenoids exceptional high-quality, high-temperature units.

D.C. solenoids





. . . and those unusual specialties you look for!

Having trouble finding solenoid specialties? Here at Cannon, we'd like to help you. Standard production now includes multiple-strip solenoids for keyboard operation, locking types requiring no holding current, and miniatures and sub-miniatures ½" diameter. In addition, our expanded solenoid engineering department is ready to serve you at any time.

CANNON PLUGS

CANNON ELECTRIC CO., 3208 Humboldt St., Los Angeles 31, Calif.
Please refer to Dept. 201
Factories in Los Angeles, Salem, Mass., Toronto, London, Melbourne. Manufacturing licensees in Paris and Tokyo. Representatives and distributors in all principal cities. See your Telephone Yellow Book.

Please ask for latest SR-S releases and/or Solenoid Bulletin.

ELECTRONIC INDUSTRIES

International

(*Continued from page 40*)

Jugoimport, the Yugoslavian import agency has concluded an agreement with Marconi Wireless Telegraph Ltd. for the manufacture, in Yugoslavia, of sub-miniature automatic direction finders. Marconi will supply technical assistance and parts for assembling the ADF's.

Italian production of TV receivers reached 380,000 units—over 90% of the country's requirements—in 1957 compared with 90,000 in 1955. The output of radio sets remained relatively stable. Imports of TV sets from the dollar area, subject to licensing, are small; the import quota for 1958 is 3,500 units.

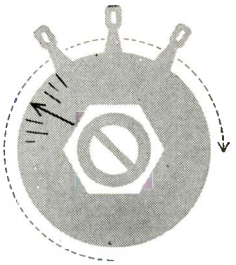
RCA Victor Co., **Montreal, Canada**, is now the sales and service agent in Canada of Keleket X-Ray Corp. Key members of the RCA organization have taken a training course at the company's plant in Waltham, Massachusetts.

Eric Sullivan has been named General Manager of Consolidated Diesel Electric Corporation of **Canada**, Ltd. He was formerly with the instrument division of Pye Canada, Ltd.

A 1000 ft TV mast will be built at Mendlesham, Suffolk, **England** by E. M. I. Electronics Ltd. for the Independent Television Authority. It will be the tallest TV mast in the commonwealth.

"TRANSLATORS" FOR TV

The BBC is using "translator" stations to relay television programs to outlaying towns in England. Pictured below is the receiving and transmitting aerial mast on Creteway Down. The television translator units can be seen near the base of the mast.



SETTINGS MADE WITH BOURNS POTENTIOMETERS REMAIN STABLE ...VIRTUALLY IMMUNE TO SHOCK, VIBRATION, ACCELERATION!

Even in the most severe dynamic environments, settings made with Bourns TRIMPOT® potentiometers remain stable. Unlike the conventional single-turn rotary potentiometer shown at the right, the Bourns potentiometer is unaffected by shock, vibration and acceleration. The open view at the left shows the basic design. The short, low-mass wiper has a translatory rather than a rotary motion, and is affixed to a plastic block. A slotted, stainless steel lead-screw drives the plastic block smoothly and positively between end points. No lock-nuts to set. No readjustments. Electrical settings stay put.

Available with printed circuit pins, solder lugs, or insulated stranded leads.

Write for TRIMPOT Model Summary Brochure.

ACTUAL SIZE

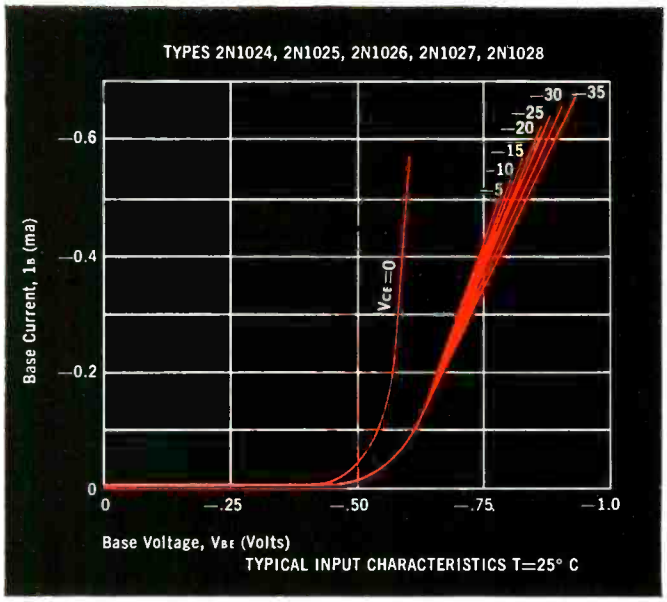
BOURNS
Laboratories, Inc.

P. O. Box 2112-E, Riverside, California
In Canada: Douglas Randall (Canada), Ltd., licensee

ORIGINATORS OF TRIMPOT® AND TRIMIT®
PIONEERS IN POTENTIOMETER TRANSDUCERS FOR POSITION, PRESSURE AND ACCELERATION

NEW FROM SPERRY

SILICON PNP TRANSISTORS FOR AIRBORNE AND MISSILE APPLICATIONS



SPECIFICATIONS

TYPE	COLLECTOR VOLTAGE	BETA (h_{fe})	$f_{\alpha b}$	APPLICATIONS
2N1024 2N1025 2N1026	15v 35v 35v	9 min. 9-18 18-54	1mc min. 1mc min. 2mc min.	D.C. and audio amplifiers, voltage regulation. Modulator and demodulator and switching circuits.
2N1027	15v	18 min.	4mc min.	Medium frequency—amplifier, oscillator and switching circuits.
2N1028	10v	9 min.	4mc Beta 1.8 min.	High speed computer switching.

Five new Sperry silicon transistors, made by the alloy junction process, offer important advantages for general-purpose and switching circuits in missile and airborne applications.

- **Low saturation resistance**
- **High-temperature operation**
- **Uniform input impedance**
- **High conduction**
- **150 Milliwatts power dissipation**
- **Light, ruggedized design**
- **JETEC 30 (TO-5) package for automatic assembly**

For complete electrical characteristics of these new Sperry PNP transistors, write for data sheets.

SPERRY SEMICONDUCTOR DIVISION
SPERRY RAND CORPORATION
South Norwalk, Connecticut

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Books

Transistor Technology, Volume III.

Edited by F. J. Biondi. Published 1958 by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. 416 pages. Price $12.50.

This final volume in a 3 part series brings together information from many competent workers in the field over the past 5 years covering the preparation of junction structures, fabrication technology, measurements and characterizations, and transistor reliability. The material is divided equally between that of a general nature and that which is specific to germanium and silicon. Wherever time necessitated the omission of important new material, it is especially noted in chapter introductions.

Switching Circuits with Computer Applications

By Watts Humphrey, Jr. Published 1958 by McGraw-Hill Book Co., 330 W. 42nd St., New York 36. 264 pages. Price $8.50.

The theoretical basis for this work, commonly referred to as switching theory, is concerned with the mathematical techniques for the design of networks and systems of networks composed of elements like switches.

The book covers the most important single application of switching circuits . . . digital systems. The methods described greatly simplify the design of modern high speed digital computers and their hundreds and in some cases thousands of individual switching circuit networks. The sound and thorough treatment of switching circuit techniques allows the designer to complete the detailed organization of very large systems without drawing a single circuit diagram. The resulting equations can then be converted directly to logical, or simplified schematic form.

Coil Winding

By William Querfurth. Published 1958 by George Stevens Mfg. Co., Inc., Pulaski Rd. at Pederson, Chicago 46, Ill. 192 pages. Price $5.00.

This work describes coil winding procedures, winding machine, and associated equipment. Twenty-seven hundred gear ratios alone are a valuable time saver for anyone winding universal type coils. Two chapters, filling 102 pages, are devoted to universal types of windings. Other chapters discuss single-layer windings, multi-layer windings, toroidal windings and deflection yoke and armature windings. Detailed instructions are given on how to set up and align winding machines of various types, how to lay out a bench to best advantage for coil winding, how to make an arbor, chuck and collet, how to design cams, how to align wire guides and how to select and adjust various wire tension devices.

Books

Television Factbook, 27th Semi-Annual Edition.

Published by Television Digest, Wyatt Bldg., Washington 5, D. C. 496 pages. Price $5.00.

Facts and compilations are among the 70 odd departments in the Factbook, providing important reference material on such subjects as TV, radio and phonograph manufacturers; new station applications pending and channel allocation; national sales representatives of stations; TV program producers and news services; network rates and data; community antenna systems; attorneys and engineers specializing in TV-radio; Federal Communication organization and personnel; TV-radio time billings and set & tube sales by years; trade associations, publications, research firms, unions, etc.

Process Dynamics, Dynamic Behavior of the Production Process

By Donald P. Campbell. Published 1958 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16. 316 pages. Price $10.50.

Emphasizing a general approach to process dynamics, this book examines the characteristics of processes under unsteady-state conditions or in response to periodic disturbances. The author views process design as an integrated problem in process systems.

The author also considers the use of linear network theory as a means of predicting the dynamic performance of a plant before it is built.

The Junction Transistor and its Applications.

Edited by E. Wolfendale. Published 1958 by the MacMillan Co., 60 Fifth Ave., New York 11. 394 pages. Price $7.50.

This volume aims to give the engineer, the physicist, and the student a comprehensive introduction to the junction transistor, its equivalent circuit and its applications.

Introduction to the Design of Servomechanisms

By John L. Bower and Peter M. Schultheiss. Published 1958 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16. 510 pages. Price $13.00.

This book emphasizes a basic understanding of stability and feedback system design, both single and multiple loop. The authors provide a systematic approach to the design, dealing with the principal performance requirements, such as harmonic response, time response, error coefficients and noise response, and giving attention to the common aspects of non-linear operation. An attempt is made to treat the synthesis problem on a basis that permits the specification of performance, given components, and noise to be handled at the same time.

Personals

L. Delalio, former Chief Research and Development Engineer at Filtors Inc., has been promoted to Chief Engineer. Prior to his association with Filtors, he was a project engineer for Sperry Gyroscope Co.

August Nuut is now Principal Engineer-Transistor Circuitry at DataTape Div., Consolidated Electrodynamics Corp. He was formerly Senior Project Engineer at Hycon Manufacturing Co.

The Director of Engineering for the Missile Section of Bendix Aviation Corp. is now **J. M. Miller.** He will direct engineering design and development for the "Talos" missile.

James K. Chapman has been named Engineering Manager for the electronics control system being designed for the Air Force by General Electric Co.'s Heavy Military Electronics dept.

Dr. J. H. Buck has been appointed Vice President-Engineering at BJ Electronics, Borg-Warner Corp. He was formerly Vice President at Well Surveys, Inc.

J. A. Buck

C. A. Wetherill

C. A. Wetherill is now Chief Engineer of Stromberg - Carlson, San Diego. He was formerly with the Convair-San Diego Electronic Development Group.

J. R. Isken is now Chief-Reliability and Quality Engineering at International Resistance Co. He was formerly Quality Control Supervisor at RCA.

Charles E. Bowland is now East Coast Field Engineer for Gulton Industries, Inc. He will handle the Products of the Engineered Magnetics Div.

Six nuclear energy specialists have joined Hughes Aircraft Co. They are: **Dr. S. S. Friedland, G. H. Syrovy, V. E. Thompson, Dr. Valerie C. Burkig, A. Frisole, and R. G. Downing.**

H. W. Paige is the new head of the missile and space vehicle activities at General Electric Co. He was formerly Manager of the nose cone section of the department.

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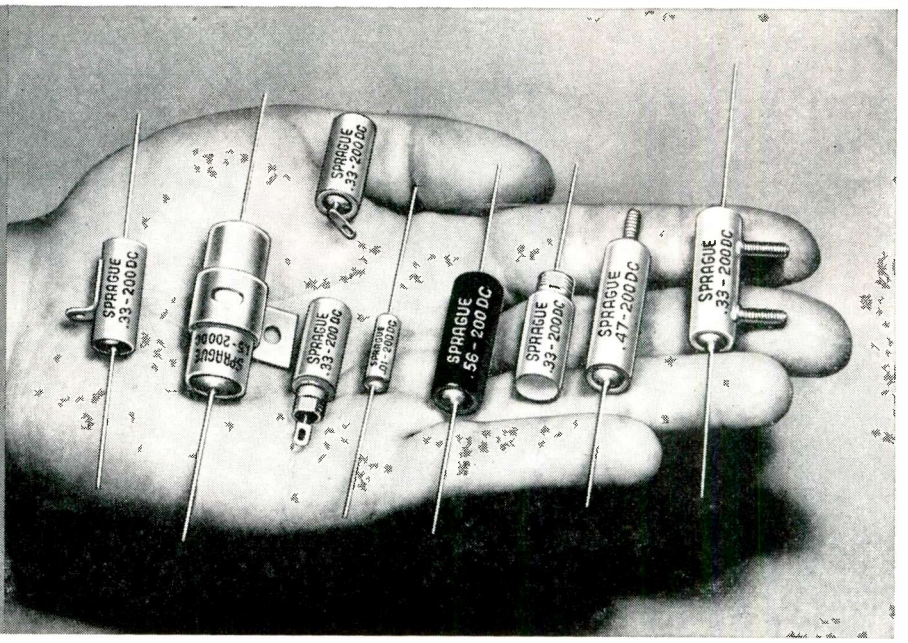

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This new type of connector is "sexless"—there are no male or female members; both are exactly alike at their mating faces. Provisions have been made to maintain correct polarity, hot lead protection, sealing and coupling. Interconnecting cables may be run without worry about having the correct connector on the right end. They can also be very easily mated in total darkness.

New Connector Design . . .

Hermaphroditic Connectors

By H. E. RUEHLEMANN
Vice President, Engineering
Elco Corp.,
"M" St. below Erie Ave.,
Philadelphia 24, Pa.

RECENTLY, a major breakthrough in the connector field has been accomplished with the development of hermaphroditic connectors. Their design principles deviate completely from the conventional methods known.

Connectors having pin and socket type contacts with male and female features to establish the mating of a pair have existed since the inception of the electronic industry. Innumerable design variations of this principle have been developed in the past to provide for correct polarity, for protection of hot leads, sealing, simple coupling and many other specifications. Common to all these designs is the pronounced difference between male and female members of the connector.

In the hermaphroditic design this distinguishing feature is omitted; the connector is sexless; there is no male and female; both mating members are exactly alike at their mating face. Provisions have been made in the design of these connectors to maintain correct polarity, to have protection for hot leads where required, and to incorporate all other features of sealing, coupling, etc., whatever may be specified for their usage.

Because male and female members of a hermaphro-

Fig. 1: Hermaphroditic connectors make use of the Varicon design shown.

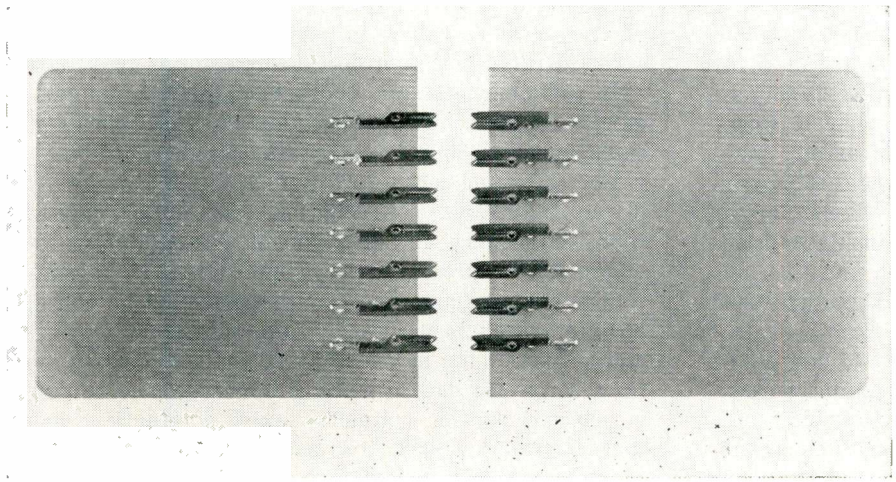
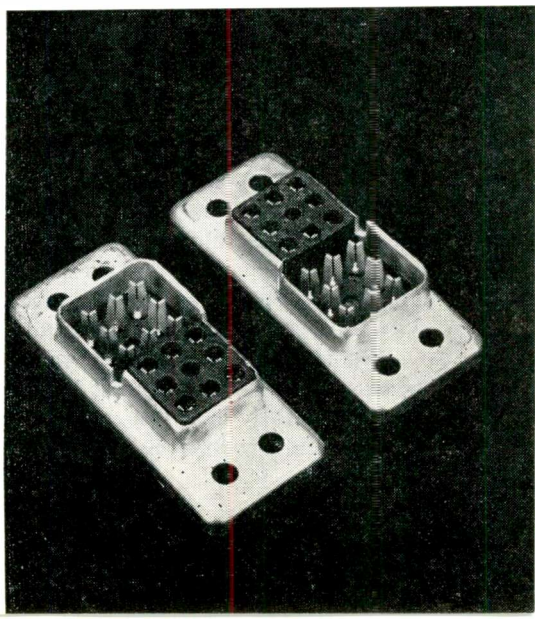


Fig. 2: Panel connectors with new design.



ditic connector are alike, a lower variety of connectors is required for stock, the inventory is practically cut in half.

Design Principles

1. To allow two identical connectors to mate, as required in a hermaphroditic design, any portion which extends at one side of the symmetry axis above the mating plane must have a counter part which, at the opposite side of the symmetry axis, stays below the mating plane as shown in Fig. 3. On the other hand, portions which stay below the mating plane need no counter part at the opposite side of the symmetry axis. This makes it possible to provide the necessary clearance for mating.

2. Due to the hermaphroditic nature of the forklike Varicon contact, no high and low portions of the insulator would be required. The mating area of all contacts could be 50% concealed in the casting and 50% of the mating portion could protrude. For maximum protection it is advisable to completely conceal 50% of the total number of contacts in a high portion of the insulator and have 50% of the total number of contacts extend their mating member above the low portion of the insulator.

3. The insulator could be divided into two parts; a high and low section, acting as an orientation feature. (Fig. 4a.) The hardware surrounding the casting can not be divided in two portions if threads are used for securing the mating connectors, because a thread extending only over 180° or less would not allow a proper functioning of the mating nut. Such an arrangement is feasible if other means for coupling the mating connectors are used, such as clamps or the like. A better arrangement is shown in Fig. 4b. The insulator is divided into 4 equal parts, two being high and two low. The hardware has a similar pattern. Highs are used where the insulator has lows and vice-versa.

To polarize such a pattern which has two degrees of freedom, the hardware must have keys or one portion must be slightly more, the other slightly less than 90°, symmetrical around the symmetry axis. Such an arrangement is suitable for coupling the mating connectors with clamps or threads. Instead of 4 sections of approximately 90°, six sections of 60° or eight sections of 45° and so on could be used. This is not advisable for the hardware, since each portion becomes too weak.

4. The pattern of the insulator may be independent of the pattern for the hardware, provided the patterns are symmetrical with respect to the common symmetry axis. Figure 4c shows a square pattern with 3 highs and 3 lows for the insulator, but the hardware is divided in 4 portions of close to 90°, both patterns being symmetrical with respect to the common symmetry axis.

5. There are two major requirements for which hermaphroditic connectors will be used. The first one is to feed power from a source to a load. This is a straight series connection, established with one cable or any number of cables in series. In this case the number of contacts of the connector is equal to the number of conductors of the cable. All connectors are alike and the panel connectors at source and load are wired so that the load becomes the mirror image of the source, and vice versa. The wiring of a cable is such that one end becomes the mirror image of the other. (Fig. 5.) In this way power can be sent in either direction, depending only on the wiring.

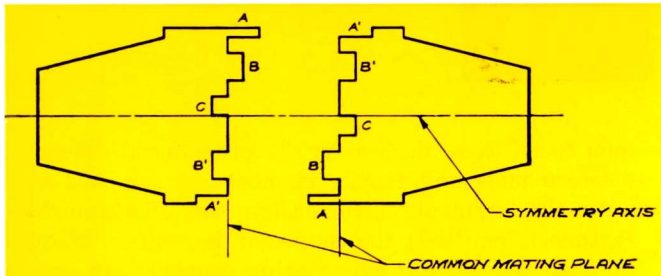


Fig. 3: Portions above mating plane have a counterpart below opposite symmetry axis; portions below mating plane do not.

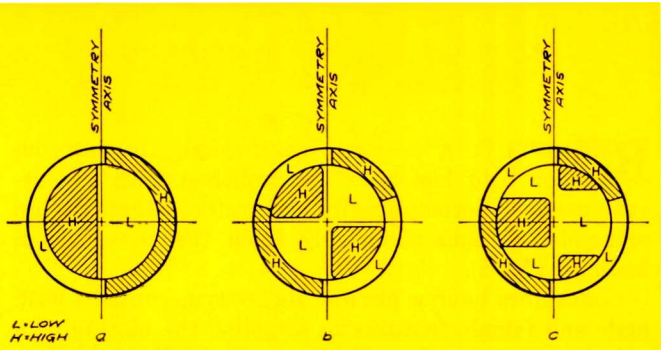


Fig. 4: Molding and hardware are symmetrical about s.a.

6. The second and general requirement for a hermaphroditic connector is to establish a network. This network may consist of any number of terminal boards which have to be connected in parallel with the help of one or more cables in series. For this purpose a series-parallel hermaphroditic connector is required.

In this connector any contact outside the symmetry axis must have an opposite contact symmetrically located and both must be inter-connected. (Fig. 6.)

For the panel connector, duplication of contacts can be omitted as shown in Fig. 6g; each contact must be represented once and the side of the symmetry axis where it is represented is unimportant. If hermaphroditic contacts are used, such as the Varicon contact, no duplication is necessary for contacts at the symmetry axis. This means that if all contacts required for a connector can be placed in one row and this row is selected as the symmetry axis, no duplication of contacts would be required as shown in Fig. 7.

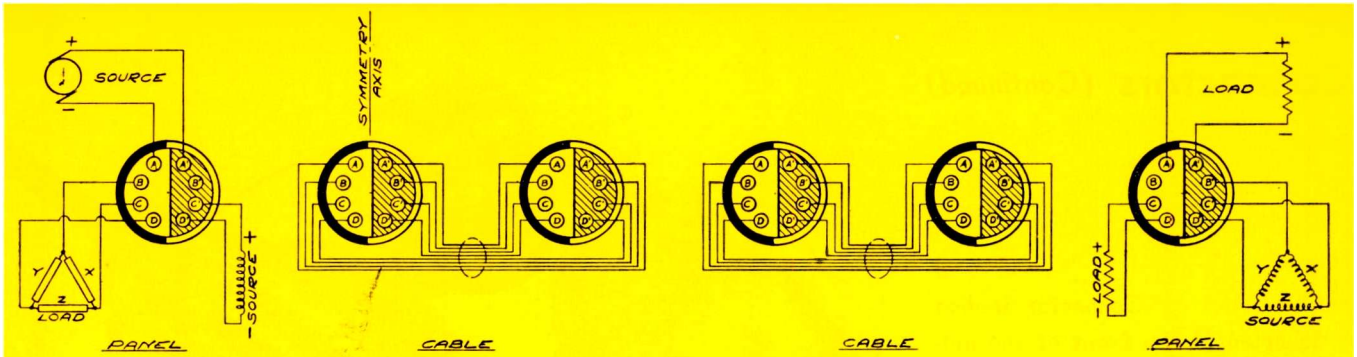


Fig. 5: Hermaphroditic series connection—power can be sent in either direction, load is an image of source.

Series Parallel Connection

This connector has 92 contacts. Twelve of them are located at the symmetry axis of the connector and therefore are not duplicated. Forty contacts located to the left of the symmetry axis are connected by beryllium copper bridges to the corresponding 40 contacts symmetrically positioned at the right side of the symmetry axis. The contact pattern is arranged in ten rows in a square pattern with a single contact on top and at the bottom at the symmetry axis. There are 4 rows of 11 contacts, 4 rows of 9 contacts and two of 5 contacts. The spacing between contacts and between rows is 0.156 in.

Each row of contacts is assembled in a plastic wafer as shown in Fig. 9, which is an exploded view of the connector. This wafer is provided with grooves and holes to securely locate the metal contact bridges. Four such bridges are required for the 11 contact wafer, 4 for the 9 contact wafer and two for the 5 contact wafer. At the bottom of these wafers, oval shaped grooves are provided to perfectly orient the contacts by their ears which are produced by a metal squeezing process.

The contact is made of 0.090 in. phosphor bronze and silver plated. The Varicon nose is produced by milling, closely controlled to the correct insertion and withdrawal pressure.

Of the 92 contacts, only 52 are made with a solder cup tail end for termination of wires. The remaining 40 contacts are short, terminating below the rear surface of the back insulator. The 52 contacts with solder cups are assembled alternately in rows to the left and to the right side of the symmetry axis to obtain maximum accessibility for soldering the wires to the contact tails.

The rear insulator has 92 through holes with oval shaped elongations. The axis of this oval is perpendicular to that in the wafers and therefore perpendicular to the oval shoulder of the contacts. In this way the rear insulator applies pressure against the wafers and secures the contacts in the oval grooves of the wafers at the correct orientation allowing the necessary slight float for the contacts along their axis.

This arrangement permits easy exchange of a single contact if required. If the rear insulator is backed off approximately 1/16 in., the contact which should be replaced can be pushed back by this amount. In this position, the contact shoulder is out of the oval shaped groove of the wafer and the contact now can be turned 90° allowing it to slide through the oval shaped hole of the rear insulator. Thus, single contacts can be removed from the back of the connector uninfluenced by any solder which may have accumulated at the circumference of the contact tail due to soldering and unsoldering the cable lead.

In front of the contact wafers is a center insulator with 92 through-holes to perfectly locate the contacts and to provide pressure to a silicone rubber seal. This rubber wafer has bumps surrounding each contact which mate in recesses at the rear of the front insulator to provide a seal for each contact individually after the wafer is placed under pressure.

The front insulator has two high and two low portions which conceal 40 contact noses and expose 52 of them. The entire contact-insulator assembly is inserted in an aluminum housing, secured by a stainless steel ring which applies the pressure to the contact seal, and to an "O" ring at the front casting, thereby completely sealing the front from the rear.

(*Continued on following page*)

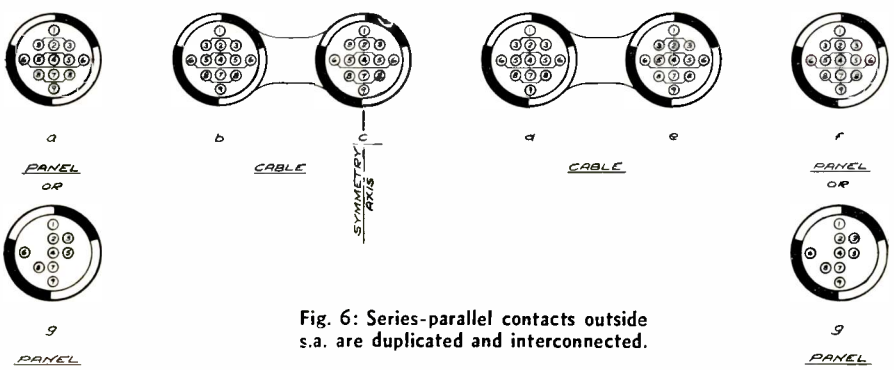


Fig. 6: Series-parallel contacts outside s.a. are duplicated and interconnected.

Connectors *(Continued)*

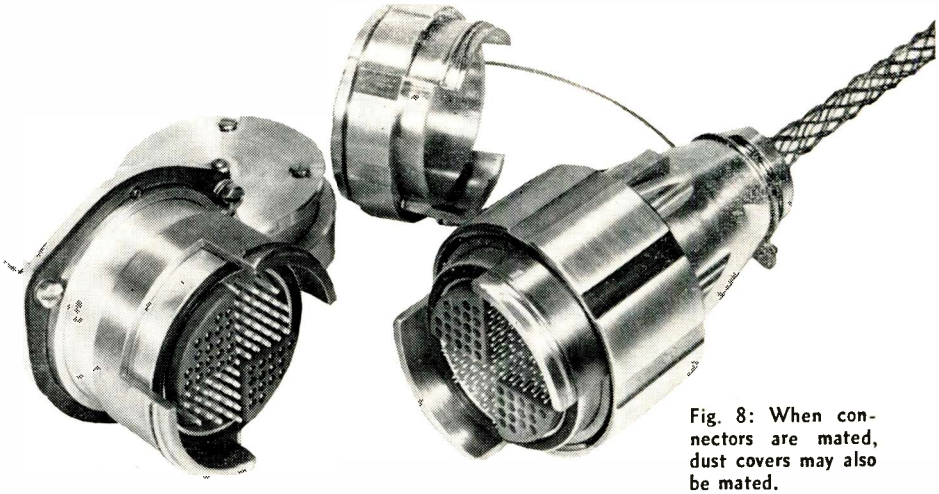


Fig. 8: When connectors are mated, dust covers may also be mated.

Connector Sealing

Inserted at the front of the aluminum housing a rubber sealing ring located at the mating plane of two mating connectors, provides a seal when two connectors are mated. A stainless steel sleeve is fastened to the aluminum housing which has two high and two low sides of 82° and 98° respectively to provide positive keying of mated connectors. This stainless steel sleeve is hardened and has on the front of its high portions the thread for coupling two connectors together.

The unit described so far is common for the cable or panel connector. However, the cable connector has a cable housing which is screwed to this unit with a rubber seal in between. This cable housing in turn has, at its rear, a rubber grommet with a pressure nut and a cable strain relief. The panel connector has a flange which is screwed to this common unit with a seal in between. The flange in turn has an orientation key to correctly locate the connector at the panel. Mounting of the panel connector onto a panel is accomplished by 3 screws with a rubber flange seal in between the connector and panel.

A coupling nut is required for the cable connector which is assembled over the connector housing before the cable housing is screwed to it. This nut has a mating thread portion to mate with the thread of the stainless steel sleeve. The coupling nut has its threaded portion behind the mating plane. The male thread at the stainless steel sleeve is in front of the mating plane. The thread of the nut will never reach the thread of the stainless steel sleeve of its own connector. The nut with its thread behind the mating plane will only mate with the thread of the stainless steel sleeve of the mating connector because this thread is in front of the mating plane and therefore reaches into the nut of the mating connector.

The coupling nut is limited in its forward movement by a shoulder which never allows the front of the nut to extend beyond the mating plane of the connector. However, the nut can slide backwards sufficiently to clear the thread of the mating connector. This is a necessity for foolproof coupling. Each of the mating connectors has a nut which, with its thread, screws onto the thread of the mating connector thereby advancing both connectors against each other. If both nuts would be at a definite position at the connector, they would have to be turned at the same time for the same angle to create an equal amount of advancement between both connectors. If the nut can escape to the rear, one nut can be screwed on to the mating thread after the other is engaged and vice versa.

Lead-in Thread

The thread used for coupling is an interrupted one, 82° being threaded at one side and 98° at opposite side. This may cause trouble in engaging the nut, if the two mating connectors are not aligned correctly, resulting in cross-threading. Provision is made in the design of this connector to avoid this, using a thread with a coarse lead-in as shown in Figure 10.

If two mating connectors are misaligned with respect to their common axis, the thread of the nut will enter the wide opening between the first two threads of the screw. In turning the nut, the connectors are forced to align themselves, this alignment taking place at a position where both connectors are only partially mated, when a low contact insertion pressure still exists, allowing easy alignment. If the nut continues to turn, after 36° of travel, the thread of the nut enters the standard thread of the screw. From there on high forces are created to provide complete mating, and finally sufficient pressure to properly create a seal of the rubber gaskets at the mating plane. As an added feature, the

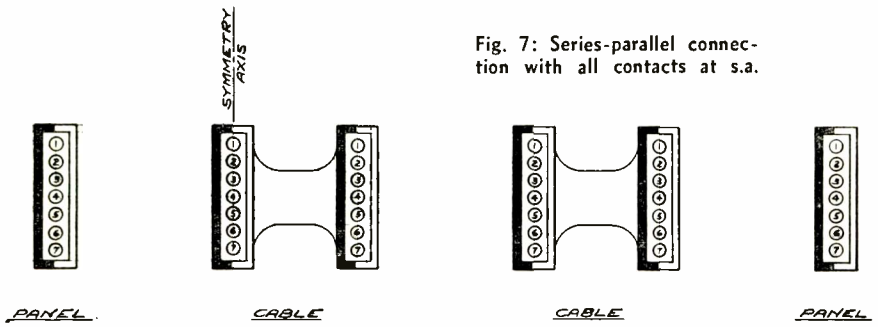


Fig. 7: Series-parallel connection with all contacts at s.a.

cable connector has a projection on its cable housing, which is easy to feel, allowing blind alignment of two connectors.

Power Connector

With all the knowledge in hermaphroditic connector design, the Elco Corp. has gone one step further and developed a hermaphroditic power connector. In a signal connector no dangerous voltages are used. Power connectors have hot contacts and they must not be exposed. In addition to the danger of touching hot contacts, a short between two exposed hot contacts may cause an arc with permanent damage. Therefore, the principle employed in the 92 hermaphroditic connector, having 52 contacts exposed and 40 contacts concealed, is not applicable for a power connector.

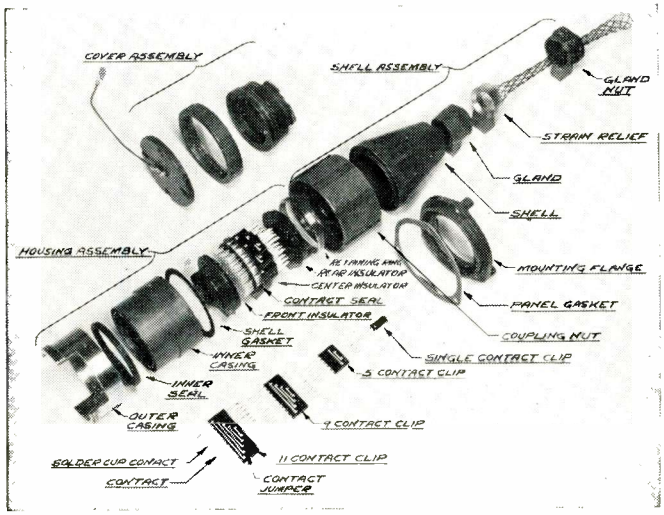
The power connector is designed so that half the contact area of each contact is exposed and half recessed. However, this dividing line is not made perpendicular to the contact axis, but rather along the center of the contacts. Each contact area, along its longitudinal axis, is half enclosed in high portions of the insulator, and half exposed by low portions of the insulator. With narrow areas and contacts sufficiently recessed below the surface of the high insulator areas, it is impossible to touch the "hot" contacts.

Figure 11 shows the hermaphroditic power connector for 3 conductors, 30 amp, 115 v ac. The insulator pattern consists of 6 high and 6 low portions symmetrically located with respect to the symmetry axis, thus permitting the mating of two identical connectors.

Only 3 contacts are used, which are located at the symmetry axis of the connector, thereby avoiding duplication of contacts. In addition, the 3 conductor, 30 amp power cable, which is used for this application, is of a flat design. Therefore, cable and conductors are in the same plane, making wiring easy.

With only 3 contacts of the hermaphroditic Varicon principle and a hermaphroditic insulator pattern, a 3 pole fully hermaphroditic power connector for series-parallel connection, with hot contacts completely recessed below the top surface of the connector insulator has been created.

Fig. 9: Exploded view shows all of the connector parts.



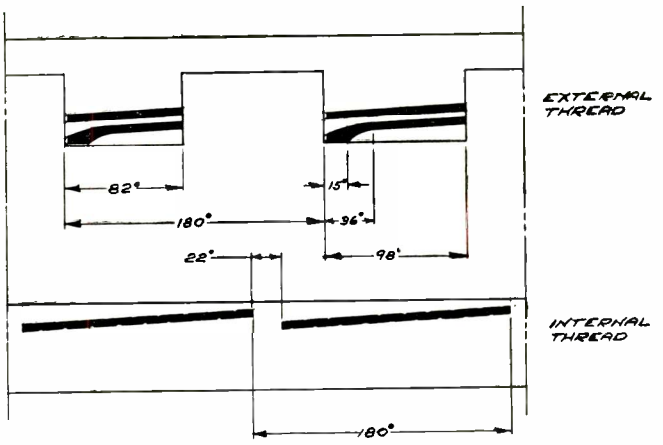


Fig. 10: Connector double thread with coarse lead-in is shown.

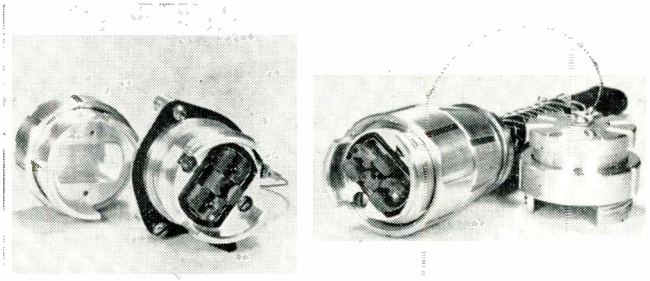
The design of the connector hardware is basically similar to the 92 pin signal connector described. It is of the sealed type. The housing, made of aluminum, has two high sides with double lead threads having special "lead-in," and two low sides, one being 82° and the other 98°. Each connector is equipped with a coupling nut which makes it possible to screw two mating connectors tightly together, or to secure a dust cover. A flange can be mounted on the connector assembly to obtain a panel connector, or a shell with cable strain relief and seal may be assembled to provide a cable connector.

Basic R & D of this connector was completed prior to submission to the U. S. Signal Corps by the Elco Corp. and Specialty Engineering Co. In cooperation with U. S. Army R & D Labs., certain refinements were made to the original connector to meet pending military requirements. Work is in progress to draft and finalize military specifications to cover this new type of connector.

With the two connectors described in this paper, a new approach in connector design for various purposes has been illustrated. Several patents for their various new features and principles have been applied and were granted to the Elco Corp. and Specialty Engineering Co.

Special acknowledgment must be given to Mr. Jack Eggert and Mr. Rocco M. Iamello of the U. S. Army R & D Labs., Mr. B. Fox and Mr. John Alley of the Elco Corp. and Mr. M. Camer and Mr. Joseph Ross of Specialty Engineering Co.

Fig. 11: Hermaphroditic connector designed for power use.



What's New . . .

Extradop

"SWITCHOVER to Extradop at T plus 175 seconds" is a new phrase heard on the countdown net at Cape Canaveral during the launch of some ballistic missiles. Extradop (Extended Range Dovap) is a new system for extending the usable range of doppler trajectory data. The new countdown announcement confirms it is to be used on the missile test in progress.

Through analysis of the actual trajectory data produced during the flight of a "big bird," on the Atlantic Missile Range, RCA personnel are evaluating the results obtained with this new system.

Early results indicate that Extradop provides precision trajectory data from the extended baseline. Receiving sites for the basic system have been installed at the Cape, at Jupiter Lighthouse and at Basset Cove, GBI. Since it uses the subcable synchronization signal as a reference, this system can be installed as far as Puerto Rico —thus increasing the length of the baseline between receiving sites for greater accuracy in the geometric solution of the trajectory.

Extended Range Dovap has been sought after for more than three years. A Dovap engineer working in CW Radar Engineering of RCA Range Instrumentation conceived the idea that greater position and velocity accuracy could be obtained by locking the present Up-Range and Down-Range Dovap complexes into one composite data gathering system. He proposed using the synchronization signal which is always present on the submarine cable for this purpose.

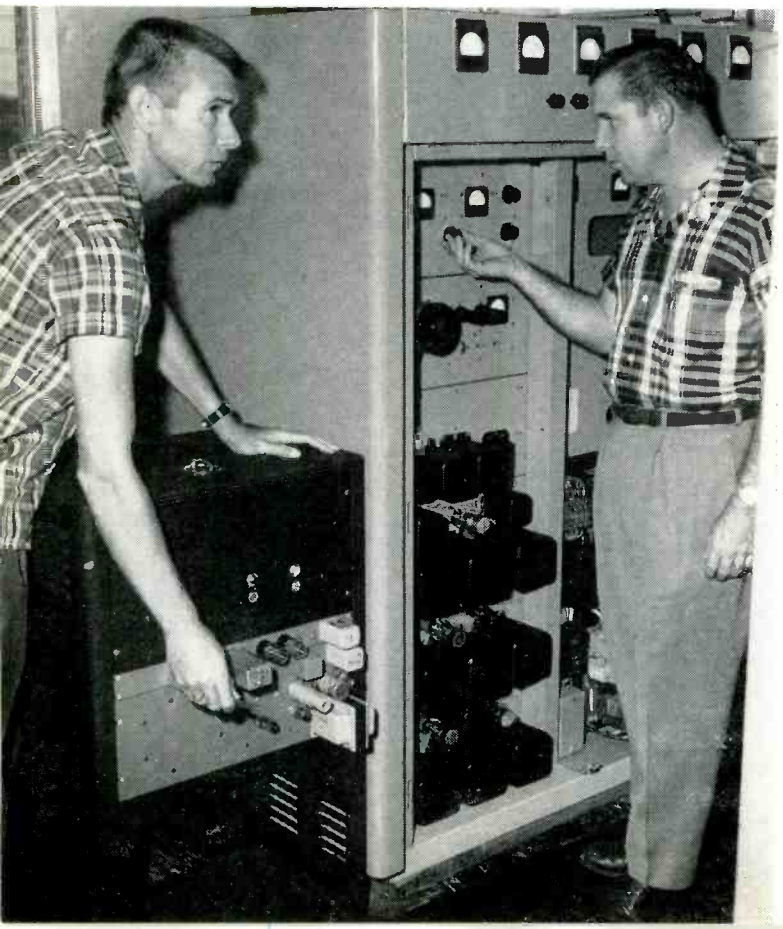
Previously both systems worked independently of each other, using separate reference transmitters. Receiving stations were clustered within approx. 2/mi. of each transmitter to assure that satisfactory reference signals could be received. Data produced from the two systems (one located about the Cape Canaveral area and the other at the GBI complex) were not satisfactory because transmitter switchover caused loss of reference from one complex to the other. Optical support systems were required to provide a tie point for continuation of missile trajectory from the Cape area to the GBI area. Extremely small errors in the tie point result in relatively large errors in the data.

In the new technique, CW Radar Engineers consolidated the two systems by using the common reference derived from a 32 KC synchronization signal. This signal is sent down the submarine cable from Cape Canaveral to down-range stations, and was therefore readily available.

The 32 KC signal is multiplied 128 times by electronic multipliers, while maintaining proper phase relationship at all receiver and transmitter sites. In the Cape transmitter, this output signal replaces the crystal oscillator in the transmitter. The transmitter output is compatible with the standard Up-Range Dovap system, in that it provides a reference for the ground stations and simultaneously interrogates the missile transponder. The resulting "beat" note represents the normal total doppler shift which is produced by the radial velocity of the missile relative to the transmitter and to each receiver station.

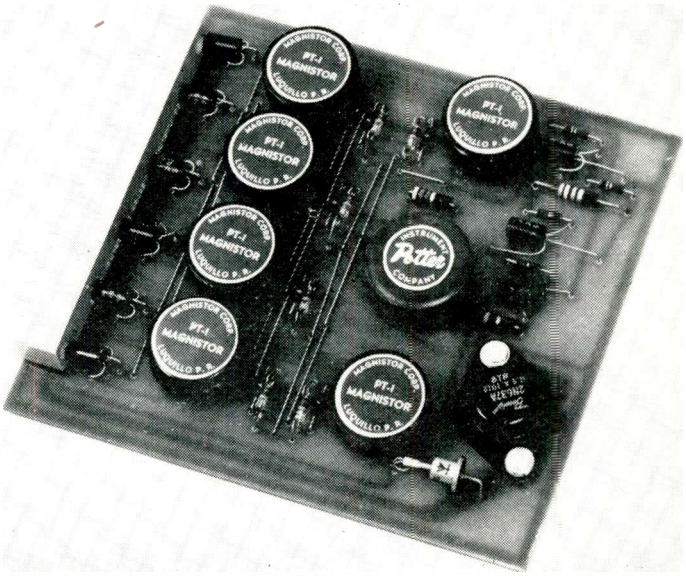
At down-range stations, the 32

(*Continued on page* 98)



The Dovap transmitter at Cape Canaveral. Chief Electronics Technician C. E. Hagler (left) adjusts the Extradop unit as Electronics Technician J. E. Crotteau aligns the transmitter.

Magnistor

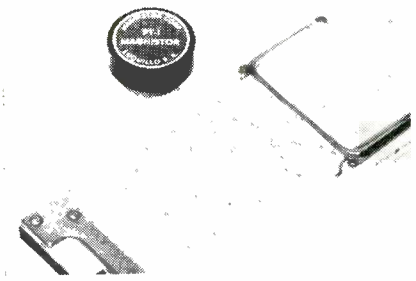


Alpha-mumeric character module for storage, comparison, coincidence detection and solenoid drive.

DEVELOPMENT of a new type dime-size magnetic component promises to cut the cost of many "space-age" electronic computers by one-third.

Sealed in tough epoxy plastic, the new component—called a transient permanent magnistor—will also make possible high speed printer systems two-thirds smaller than those now in use by the Armed Forces in space experiments and by private industry to store, analyze and compare data. The magnistor is manufactured by Magnistor Corp., a subsidiary of Potter Instrument Company, Inc., Plainview, N. Y.

The MPT-1 Magnistor, has a 9-pin noval base and is only one inch in diameter.



Magnistors are so durable that they can be incorporated directly into data processing computer equipment circuits without provision for replacement. They have an indefinite shelf life, will operate over a wide frequency range, and have near "absolute reliability."

Wide scale applications forecast for the tiny magnetic component include automation control equipment, business data handling systems, magnetic tape systems, high speed printer systems, automatic volume control systems, and magnetic proximity detection and automatic on-off switching systems for thyratron actuated sign board.

The MPT-1 Magnistor is a solid state magnetic component composed of inert materials in a highly reliable and versatile arrangement. High retentive ferrite combined with a high permeability low retentive ferrite is employed in a novel configuration to achieve characteristics heretofore not obtainable in a single component. Originally developed for data processing applications, the Magnistor has already found applications in other fields.

The MPT-1 is an eight terminal device. Set input terminals provide access to the high retentive ferrite for data storage as with conventional magnetic ferrite cores. The associated Reset winding when actuated dissipates the stored magnetism. The alternate states of magnetism resulting is evidenced by a two state change of inductance of an R.F. signal winding.

The Int. (interrogate) winding with the high permeability ferrite and effects an identical change of the R.F. signal winding inductance; however, with the lack of magnetic retentivity the response is proportional to the applications of current to the Int. winding. When both magnetic circuits are considered in combination the effects of each with respect to the other is of a complementary nature. This result reveals an identity to the half adder (less carry) that is employed in digital computors.

PROBLEM CLINIC

For a Special Purpose Thickness Tester

A large Midwest gas company is seeking an easy method of measuring corrosion in their tanks. Here are the details:

Problem: To measure the thickness of steel in the wall of large tanks when only one side is accessible.

Purpose: To detect loss of thickness from oxidation or corrosion on the inaccessible side of the tank wall.

Conditions: Walls are cylindrical with radius of curvature ranging from 53 in. to 62 in.

Thickness of steel plate in the range of .75 in. to 1.25 in.

Some tanks would be checked from outside while in service, under pressure, filled with propane.

Others are buried and would be tested from inside after emptying and purging.

Manhole opening is 18 in. in diameter.

Manufacturers producing equipment that may handle this problem are urged to contact "The Problem Clinic," ELECTRONIC INDUSTRIES, 56th and Chestnut Sts., Phila. 39, Pa.

Rapid, reliable, high quality communications ●
Long distance, high resolution detection and identification ●
Long distance, ultra-precise navigation ●
These are the objectives of the USAF Ground Electronic Program

The Air Force Explores

The Future with Solid State

Part One of Two Parts

PROGRESS toward our goals is marked by the extent to which we have reduced our problems, not solved them completely. Each significant improvement is eagerly applied, almost without regard to immediate economics, to narrow the gap between what we are doing and what is theoretically possible. Among other things, our degree of success will depend upon:

1. Better utilization of the electromagnetic frequency spectrum,
2. Greatly increased capability and utilization of computers,
3. Radically improved detection sensitivity at all frequencies, and
4. Significant advances in quality of post-detection signal handling techniques.

Fig. 1: Transistorized version of the computer shown in Fig. 2.

Space Travel

The interest of today is space travel, and the engineer and scientist are called upon to solve the problem of making possible such adventurous and promising geocyclic or planetary ventures. Electronics falls heir to no small role in the solutions to these problems. It is easy to understand the need for exceeding compact, lightweight, and reliable electronic gear in the space vehicle. The effect these needs may have on associated ground equipment is not as readily recognized.

Due to the high ratio of vehicle weight to payload weight, all functions which can be performed on the ground must be eliminated from the space vehicle. This leads to the need for considerably more complex ground installations. New emphasis is placed on the demands for ultra-high speed, complex computers, oscillators with previously unheard of stability, supersensitive receivers, elaborate telemetry equipment, and precise time standards. Techniques for extrapolation of the range of all appropriate electronic systems, from the modest distances with which we deal today to literally astronomical ranges, are also emphasized.

We must also consider that the ground stations of today may be planetary stations in the near future. Initially, at least, such stations will require electronic equipment which is weighed by the kilogram rather than by the ton.

We have already learned to depend on a variety of solid state materials and phenomena which have been introduced in the last decade as gyrators, switching

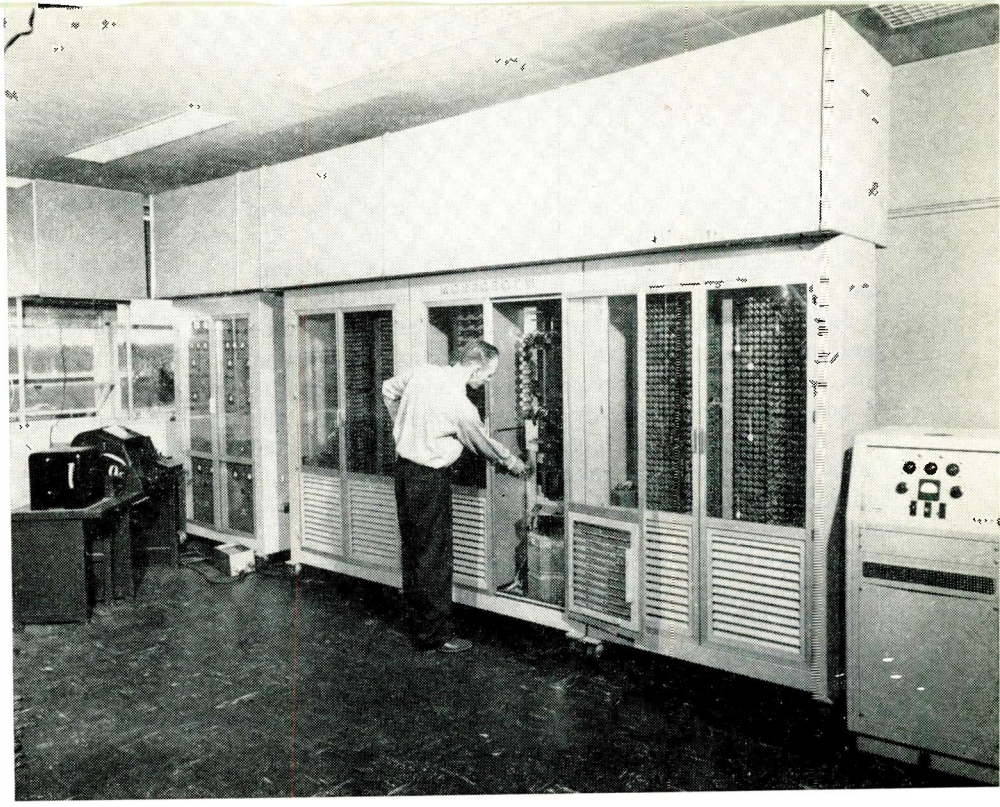


Fig. 2: This tube type computer consumes 18 kw and requires a heat sink. Its transistorized version is shown in

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Devices

devices, memory elements, amplifiers, and thermoelectric devices.

In the near future we hope to consider as standard devices or circuits those dependent on phenomena not widely used by circuit and equipment designers. Included in this category might be:

Superconductivity
Atomic and Molecular Resonance Phenomena
Magnetic Effects in Semiconductors
Non-Linear Capacitance
Electro-optic Effects

Solid State Advantages

It might be in order to ask ourselves the question: "Why solid state?" We have not reached the limit in vacuum tube technology as evidenced by the many new developments each year in this field. For this reason, there has not been, nor will there be in the foreseeable future, any abandonment of research efforts on vacuum tubes, ion and electron ballistics, plasma dynamics, or basic emission phenomena.

At the same time, however, there are certain properties of materials in the solid state which warrant quite a heavy concentration of research and development effort. A few which might be mentioned are:

1. The large number of charge carriers or active electrical particles which can be maintained in a given device volume with little or no external containment field or force,
2. The greater relative stability of the solid state for a given material, and
3. The ability to build almost any desired particle structure (lattice), near perfect or with controlled imperfection, homogeneous or with controlled inhomogeneity.

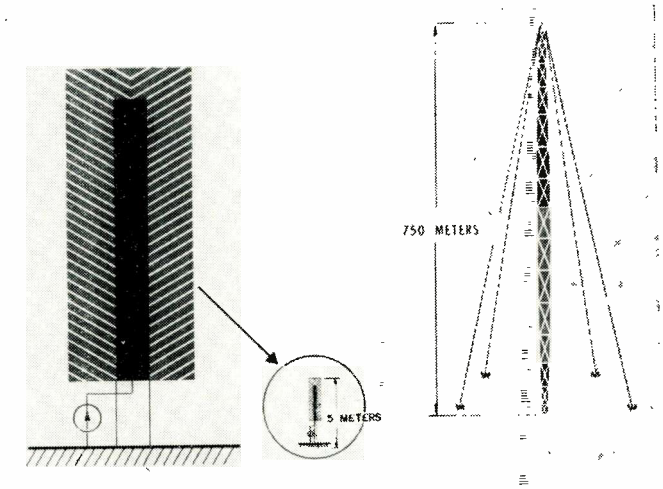
These properties of solid state materials when incorporated into electronic devices have proven, in many past applications, to provide the advantages of:

1. Higher reliability,
2. Greater simplicity (in both devices and circuitry),
3. Size and weight reduction,
4. Better operating efficiency,
5. Lower cost of complex equipment,
6. More suitable operating frequency, and
7. Performance not previously attainable.

Transistorized Computer

A fairly complete example of these advantages is given by the case history of one of our computers. The computer shown in Fig 2 is a tube version. Note the size of the unit and the air ducts required. In Fig. 1 is what we might call its "solid state" replacement. This was the first known computer of this complexity which was completely transistorized including the 90 volt neon power supply. It is 10 times as fast, has 20

Fig. 3: For 100 KC, the ferromagnetic vs conventional type antenna.



times the memory and has a larger command structure than the original unit.

The "solid state" computer contains 1500 transistors and 6000 diodes and has already logged over 1600 hrs of operation without a single failure whereas the tube version has almost never been in operation without tube failures. The tube version consumes 18 kilowatts of power and requires an air heat sink whereas the new computer draws only 600 watts, of which 300 watts is consumed in integral refrigeration. The old computer is also 21 times the size (cubage) of the new one.

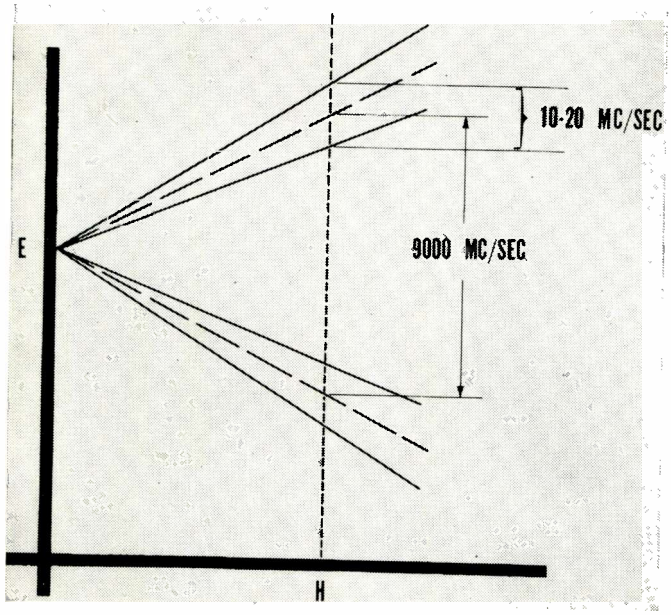
The extrapolation of electronics techniques very many years into the future is complicated by a great many factors only part of which depend on achievements in solid state devices. The question as to whether future solid state devices will determine or be dependent upon the selection of operating frequencies, power levels and other major systems parameters is rather like the old "chicken or the egg" proposition.

Without attempting to answer this riddle, let us look at some of the solid state materials and devices which may prove useful within the next few years or decades.

Radiating Systems

Where we have a requirement for lower operating frequencies more favorable for earthbased or geocyclic ventures, the problem of large radiating components arises. Consider a low-loss, high permeability ferrite-like material in which the phase velocity is an exact function of frequency over a very wide frequency band. A conductor embedded in this material, Fig. 3, would resonate at any given frequency when its wavelength is ¼-wavelength long in the material. Thus, the VLF or LF antenna of the future could be a broadband radiator embedded in this material with the thicknes selected to match the composite impedance to free space.

Fig. 4: Internal energy structures for intermediate frequency Maser.



Size reductions of two to three orders of magnitude (down to something on the order of 5 meters) would be possible with such a "slow-wave" antenna.[1,2] High-power transistors and phased array techniques for this frequency range would contribute to a very efficient radiating complex. We are already within sight of power transistors with 500 watts output at 1000 MC.

Considering the antenna problem as an application for superconductivity, even more significant possibilities arise. Assuming the theoretical possibility of ideal transformers for impedance level changing, it is practical to consider supercooled 100MC antennas a few centimeters in length.

Microwave Devices

With the major strides that have been taken in microwave devices and technology, there has been increasing interest in the performance of data handling functions at the incoming signal frequency rather than at the video or intermediate frequencies which have been standard for so long. The retention of maximum intelligence in the signal, reduction of circuit noise in initial stages of detection and amplification and other advantages are apparent. Just a few of the currently successful envisioned devices might be mentioned.

Such devices as the resonance amplifiers and oscillators, hold promise for extremely high sensitivity and low noise figures for microwave reception. For radar purposes where the beam is oriented not to look at the ground, potentially an order of magnitude improvement in sensitivity is possible. For radio astronomy several orders of magnitude better performance is possible due to noise reduction. Oscillators based on this principle are capable of greater precision and less line width and noise.

To date the greatest successes have been realized with the so-called three-level Maser. Noise figures obtained in actual devices have been so low as to defy measurement except as being below that of the available measuring equipment. However, because of vibrational and other energy coupling to the spin system, the relaxation times of the three-level system may never be reasonable much above liquid He temperatures. This possibility has led to considerable emphasis on two-level Masers where sufficiently long relaxation times may be realized even at liquid air temperatures. This factor may become important in the consideration of practical devices where a closed-cycle liquid He cryostat is not desirable.

Masers, in general, offer us a wide variety of potential applications to long range detection systems, passive-detection techniques, radioastronomy and complex systems for signal integration.

The concept of applying Maser principles in periodic or slow wave structures to achieve greater bandwidth promises to eliminate the major limitation on these resonance devices.

In another interesting extrapolation of current Maser theory, a multi-level device can be envisioned which detects at microwave frequencies, and, due to a judicious selection of internal energy structures as illustrated in Fig. 4, produces an amplified output at an intermediate frequency.

Millimeter Waves and Optical Frequencies

Consider the requirement for higher frequencies which may prove vital to electronic functions performed in space away from the attenuation of planetary atmospheres. The frequency range, all the way from millimeter waves to X-rays and gamma rays, is quite available for application to electronic requirements. There is, however, a distinct lack of practical devices, solid state or otherwise, for the performance of many required electronic functions at these frequencies. Even for earthbased electronic functions, certain optical frequencies are of interest.

Ultraviolet radiation, although confined to line-of-sight transmission because of the lack of atmospheric ducts, has a great deal of promise due to low background signals. Consider only presently available photo-emissive cathodes, (e.g., thorium) photocells with minimum detectable signal levels of 0.03 microwatts and optics providing an aperture on the order of 1.5 meters. Based on these assumptions we could today achieve ultraviolet transmission ranges in excess of 150 kilometers, a magnitude competitive with microwaves.[3]

Innumerable possibilities exist for solid state devices which will act as amplifiers, transducers and bistable elements in the upper frequency spectrum. Many types of light-amplifiers, image intensifiers and image converters have been built using cascaded emission surfaces, and combinations of electroluminescent and ferroelectric or photoconductive materials.

The potentials of some materials for these optical frequency or electro-optical devices are fairly apparent. In solid state materials we have both primary and secondary emitters for the frequencies concerned. Intermetallic semiconductors (e.g., *InSb* and *InAs*) can be properly doped to adjust the fundamental absorption region, which depends on energy band separation. For frequencies above the absorption edge, these materials can be used as optical windows, lenses and prisms. For frequencies below this edge, the same materials act as absorbers, creating free carriers or photoconductivity, and can be used as detectors to measure the intensity of radiation. Other variations can provide optical filters.

With various combinations of the electro-optical materials, a multitude of corrollaries to current electronic devices and circuits can be envisioned. We can build detectors, amplifiers, memory matrices, shift registors, and so on. The greatest promise, however, may be in the combination of electro-optical and electronic materials into functional complexes which will operate over the entire radiant spectrum from dc to gamma rays.

Energy Conversion

An electronic area which has received increased attention in our space age thinking is that of energy conversion. We have had for some time many means for conversion of thermal and radiant energy to electrical output, but because of the low overall efficiencies, such converters have achieved greatest application only in the "gadget" market. Some very important work has been done, however, in both solid state and thermionic emission devices which promise efficiencies competitive with rotating machinery. Figs. 5 and 6 illustrate the two techniques.

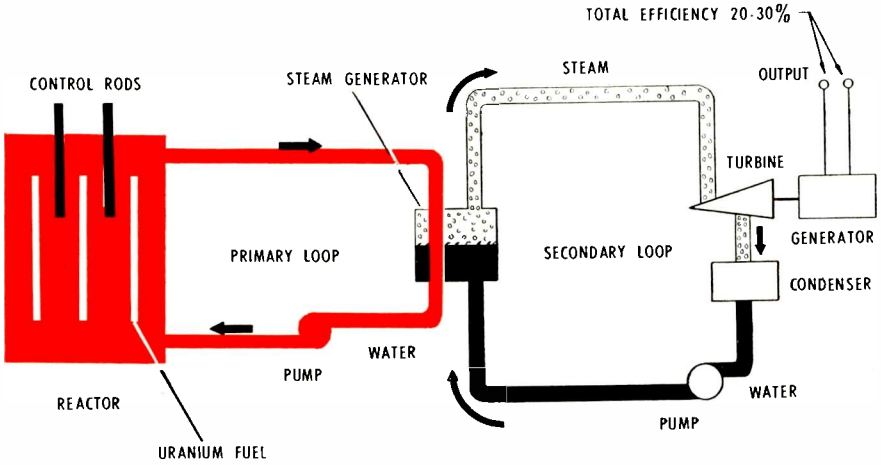


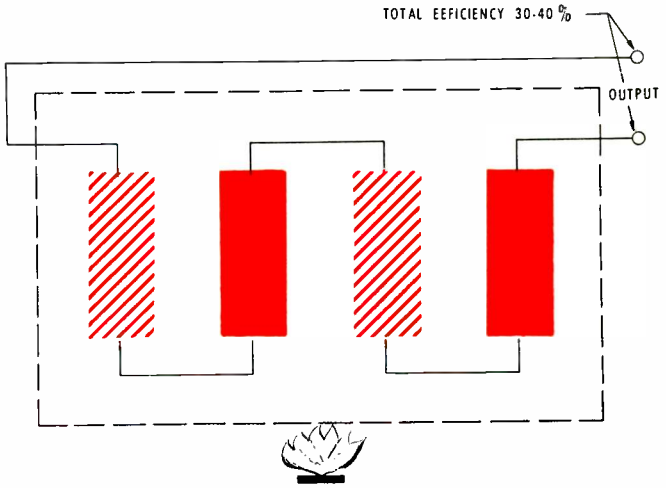
Fig. 5: Simplified diagram of a pressurized water system illustrates energy conversion.

The alloying of semiconductors to form cells with a graded band gap in a single junction and broaden the effective frequency spectrum of solar converters has made 15% efficiencies possible using *Si* and *Ge*.

New oxidic thermoelectric materials which will allow operation at extreme temperatures (1000-1500°C), and above, permit us to consider thermal to electrical conversion efficiencies near theoretical limits.

(To be continued next month)

Fig. 6: Thermoelectric conversion generator shows new technique.



A simple circuit for tubes or transistors divides a wide band of input frequencies by two. Self-starting, and not critically dependent on tube characteristics, it gives no output when input voltage is of the wrong frequency or amplitude.

Dividing Wide Frequency Bands

By E. L. LAINE
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Univ. of California
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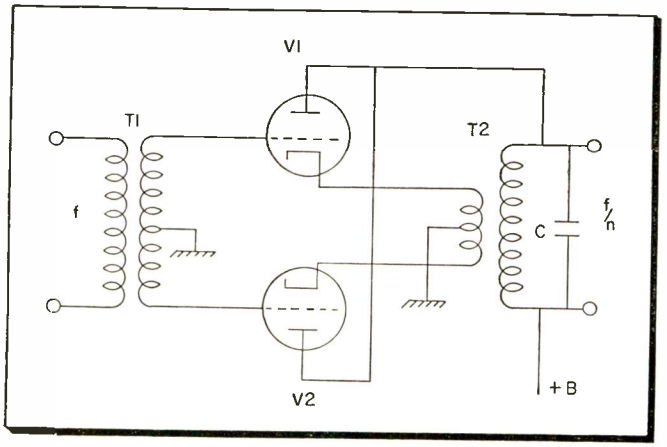
A NEW frequency divider will divide a wide band of frequencies by two without any tuning. In addition, it is self-starting, synchronized to the input frequency, and gives no output when input voltage is of the wrong frequency or amplitude.

Divider Categories

Frequency dividers generally fall into three categories: Astable multi-vibrators, dividers using regeneration and modulation, and locked oscillators. The astable multi-vibrator as a frequency divider will not divide correctly if the tube characteristics drift excessively. The multi-vibrator will also continue to give an output signal, obviously incorrect, if the input signal should fail.

Fig. 1: Modulation, regeneration, and harmonic generation are accomplished in this simple circuit. Consequently, analysis is difficult.



Dividers using regeneration and modulation overcome many of these difficulties but are necessarily complex. They are not always self-starting and may require some auxiliary circuit to insure starting. In addition, they are narrow-band devices.

The locked oscillator, being simpler, compares favorably with dividers using regeneration and modulation. It suffers, however, from the disadvantage that it continues to yield an output even in the absence of an input signal.

Advantages Combined

The divider to be described combines the advantages both of regeneration and modulation and of the locked oscillator; that is, it yields an output only in the presence of an input signal, it is simple, and tube characteristics have little effect on its behavior.

The initial circuit, Fig. 1, consists of an input transformer T1 to provide balanced voltages 180° out of phase to the input grids of triodes V1 and V2. The anodes of V1 and V2 are tied in parallel to the output transformer T2. T2 and the capacitor C resonate broadly at the midpoint of the output-frequency band. This transformer has a balanced secondary winding consisting of a few turns close-

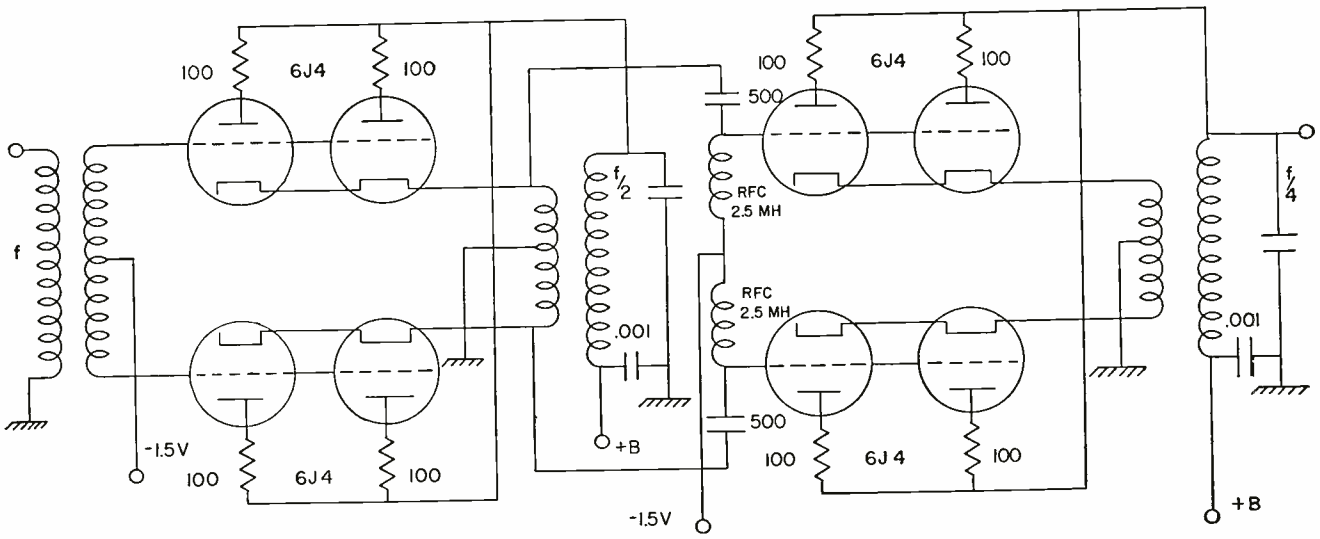


Fig. 2: This model is presently used to divide by four. Note that the output transformer of the first section is input for the second.

coupled to the primary to provide a feedback voltage to the cathodes. Because the transformer T2 is tuned to half the input frequency, the cathodes receive half the frequency that is present on the grids.

It can be seen that this arrangement is quite similar to regeneration and modulation, where the input is injected to the grids and the modulation is injected into the cathodes. The plate-to-cathode loop is made to be regenerative with the proper applied bias and amplitude of the grid signal. A careful analysis of the mechanism by which this divider locks to a synchronized signal is difficult. This difficulty does not arise because any basically new principle is involved. The circuit is similar to that of dividers using regeneration and modulation, but the complication arises because all the functions of modulation, regeneration, and harmonic generation are accomplished in a simple circuit of two tubes. The tube non-linearity is essential to these functions. Since a non-linear characteristic is difficult to handle analytically, the design was carried out experimentally.

Completed Model

Fig. 2 illustrates a completed model that is in use at present to divide by four. Any sinusoidal frequency from 5 MC to 10 MC and 10 to 12 volts can be applied to the input transformer; the divider will yield a sinusoidal frequency one quarter the input frequency at about 30 volts. At present this model is sensitive to the amplitude of the input voltage; if the input voltage varies, it is necessary to precede the divider with a limiter amplifier. It can be seen from Fig. 2 that the output transformer of the first section is the input transformer of the second section, so many sections could be cascaded by adding only one transformer per section.

It seemed desirable to transistorize the circuit using the same transformers. Two circuits were found to work quite well.

In Fig. 3, the circuit would divide by two between 6.2 MC and 7.2 MC. No attempts were made to pursue this circuit.

The circuit of Fig. 4 proved to be the most interesting. As shown, it will divide by two between 5.6 MC and 9.0 MC—a bandwidth of 3.4 MC. The output voltage was a few volts. This circuit could also be made to divide an input of 30 MC by six and yield an output of 5 MC.

The circuits of Fig. 1 through 4 can be made to multiply as well as divide by two. This is done by applying to the input transformer a frequency in the range that is one-half the output-frequency range (one-quarter the normal input range.)

* * *

Fig. 3: This circuit divides by two between 6.2 MC and 7.2 MC.

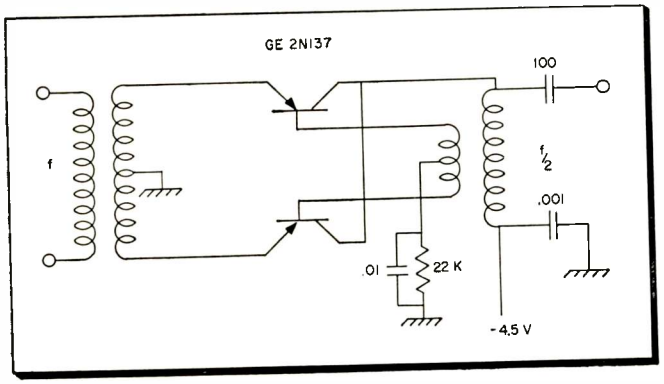
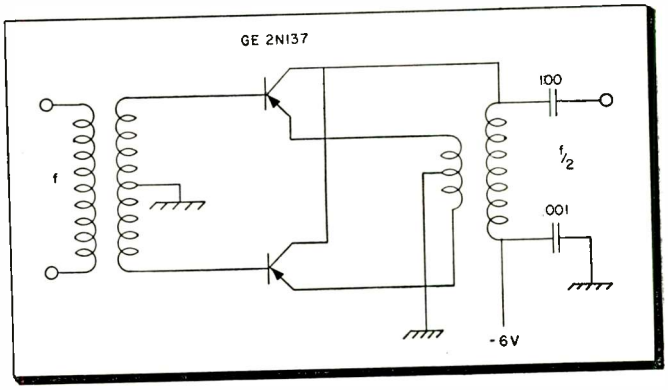


Fig. 4: A band width of 3.4 MC—5.6 to 9.0 MC—is divided by two.



Zener Diodes

Stabilize Tube Heater Voltages

Zener diodes are now being used to regulate tube heater voltages. With regulated heater voltages, the tube plate voltage remains quite stable with large input voltage changes. Heater regulation also greatly increases tube life. Typical applications of the regulators are given.

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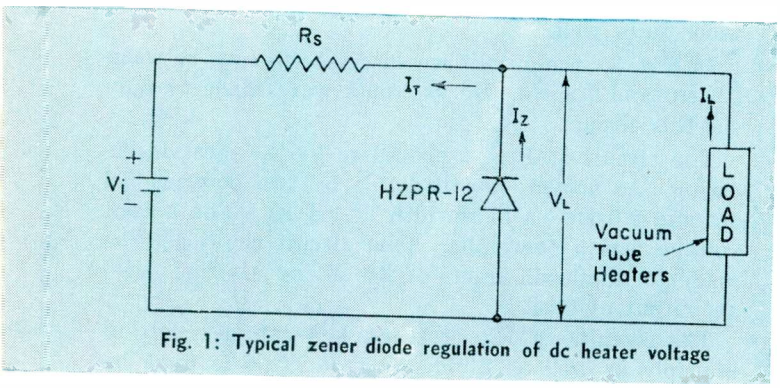


Fig. 1: Typical zener diode regulation of dc heater voltage

THE development of zener voltage regulators permits the extension of the control and stability of the "zener diode" to applications requiring the regulation of several watts of power.

Mobile, generator-battery power sources as found on airborne, marine, and land vehicles provide a variable output voltage, the stability of which depends upon the effectiveness of the regulating system to correct for the condition of the batteries, the number of accessories in use, the speed of the engine, the ambient temperature, etc. The heaters of vacuum tubes associated with communication, navigation, fire control, or other electronic equipment, are usually

Table 1

Typical Parameters of HZPR-12 Zener Regulation of DC Heater Voltage

Unregulated Input Voltage (V_i)	Zener Current (I_z) ma.	Series Resistor (R_s) ohms	Load Current (I_L) ma.	Load Voltage (V_i)	Total Circuit Current (I_T)	Input Change	Output Change
23.0	165	36.3	150	11.40	315		
26.5	250	36.3	150	11.60	400	±13%	±1.7%
30.0	340	36.3	150	11.80	490		
23.0	140	26.4	300	11.40	440		
26.5	250	26.4	300	11.65	550	±13%	±1.7%
30.0	380	26.4	300	11.80	680		
23.0	130	20.7	450	11.20	580		
26.5	250	20.7	450	11.55	700	±13%	±2.6%
30.0	420	20.7	450	11.80	870		
23.0	110	17.1	600	11.40	710		
26.5	250	17.1	600	11.70	850	±13%	±2.6%
30.0	450	17.1	600	12.00	1050		

supplied from this variable dc voltage source. The use of the zener voltage regulators appreciably reduces the voltage variation applied to the vacuum tube heaters resulting in more stable and reliable operation and less maintenance due to longer tube life.

Line voltage variations associated with ac power sources also provide a variable heater voltage to vacuum tube circuits. In cases of high gain dc amplifiers, regulated dc plate supplies alone are not sufficient to insure a stable output. Zener voltage regulators used to regulate the ac heater voltage provide emission stabilization and appreciable reduction in the drift of the dc output.

Regulation of DC Heater Voltages

Figure 1, contains a schematic circuit diagram showing the Incorporation of the zener voltage regulator as a dc heater voltage regulator. The dc voltage source (V_i) was assumed to vary between 23 and 30 volts and R_s was selected to permit 250 milli amps to flow through the zener regulator for the mean input voltage of 26.5 volts. Figure 2 contains the typical characteristics curves of the heater load voltage as a function of the applied input voltage for four conditions of load current. The non-regulated heater voltage curves are also included on this figure to provide a direct comparison of the effectiveness of the zener regulator. Load currents up to 600 ma were handled quite effectively using a single zener regulator. This 600 ma load is equivalent to four 12.6 volt 150 ma heaters in parallel or four 6.3 volt 300 ma heaters connected in series-parallel.

Table 1, contains the experimental parameters associated with the circuit shown in Fig. 1. Typical values of the input line voltage, the heater voltage, the value of the series resistor R_s, and the zener regulator current are given for the four load current conditions. The table also indicates that for heater load current up to 300 ma the heater voltage changes ±1.7% for a ±13% change in the unregulated input voltage, an improvement of almost 8 to 1. For heater load currents of 450 ma to 600 ma, the heater voltage changes ±2.6% for a ±13% change in the input, an improvement of 5 to 1.

Regulation of AC Heater Voltages

A. Secondary Side Regulation: Figures 3 & 4, contain schematic circuit diagrams showing the use of zener regulators as ac heater voltage stabilizers on the secondary (load) side of the filament transformer. The regulating circuit requires two zener regulators connected in series cathode to cathode and placed across the heater load as shown. The filament transformer chosen had a secondary rated at 25.2 volts RMS. The series resistor R_s, was required to limit the current to the zener regulator-heater combination. Since the heater voltage waveform is non-sinusoidal, due to the clipping action of the zener regulators, true RMS values are rather difficult to measure. Therefore, tube performance in single stage dc amplifiers was used as a measure of stability. Figures 3 & 4, includes the schematic diagrams of the dc amplifiers used and shows the dc plate voltages as a function of the unregulated line voltage, both with and with-

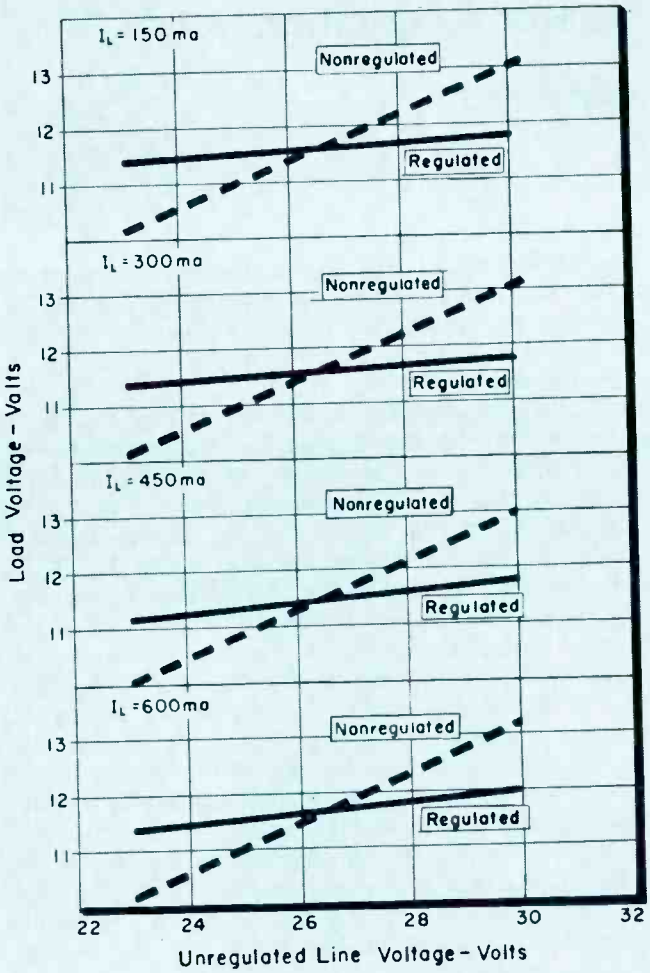
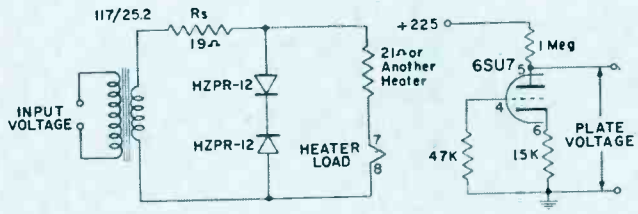
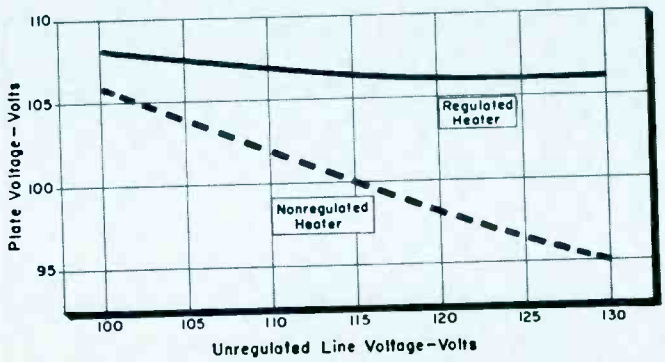


Fig. 2: Load-input voltage of dc regulated heater voltage

Fig. 3: Load side zener regulation of ac heater voltage for the 6SU7 dc amplifier which is shown in the circuit below





Heater Regulation

(Concluded)

out zener regulator stabilization. For the 6SU7 dc amplifier a total plate voltage change of only 2 v. was measured for a line voltage change of 30 v. using zener regulation, while a total plate voltage change of 11 volts was measured for the same line voltage change without zener regulation. This indicates an improvement in stability of better than 5 to 1. For the 12AX7 dc amplifier a total plate voltage change of only 1 v. was measured for a line voltage change of 30. v. using zener regulation, while a total plate voltage change of 7.5 v. was measured for the same line voltage change without zener regulation. This indicates a stability improvement of 7.5 to 1.

B. Primary Side Regulation: In addition to regulating heater voltages in ac circuits by the application of zener regulators directly across the heater load, regulation can be accomplished by the proper application of zener regulators in the primary side of a filament transformer. Figure 5, contains a schematic circuit diagram showing the use of two zener regulators in the primary side of a filament transformer. The transformer secondary voltage was originally specified as 12.6 v. RMS for a primary voltage of 117 v. RMS. The use of the zener regulators and the series resistor R_s ahead of the primary reduced the secondary output to approximately 6.3 v. RMS. Again, due to the clipping action of the zener regulators, tube performance is taken as the critera of operation.

Figure 5, shows typical dc amplifier plate voltages as a function of applied line voltage for two different tubes. Both the regulated curves and the non-regulated curves are shown to facilitate direct comparison of the effectiveness of the zener regulators. For the 6SU7 dc amplifier the plate voltage changes 2 v. for a 30 v. change in the line voltage when using zener regulation. Without the zener regulation, the plate voltage changes 10 v. under the same conditions, showing an improvement of 5 to 1 in stability. For the 12AX7 dc amplifier, the corresponding figures are 1.5 v. shift when zener regulated, compared to a 9 v. shift without regulation, yielding a 6 to 1 improvement in stability.

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The Editor
ELECTRONIC INDUSTRIES, Chestnut & 56th Sts., Phila. 39, Pa.

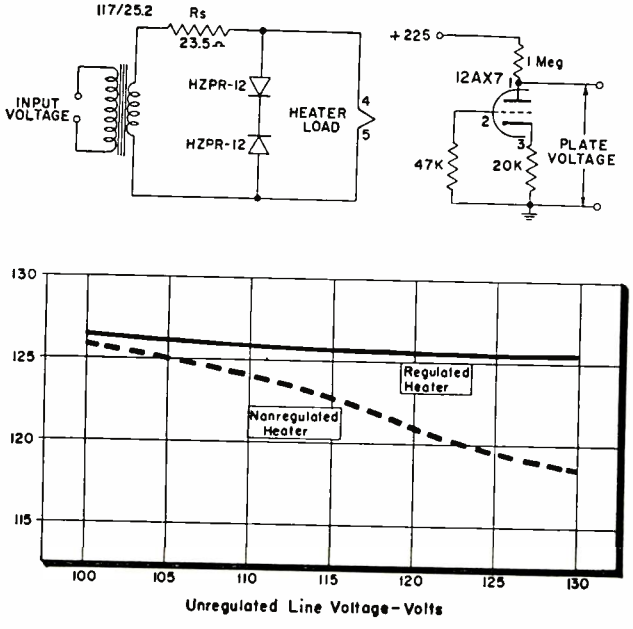
Summary

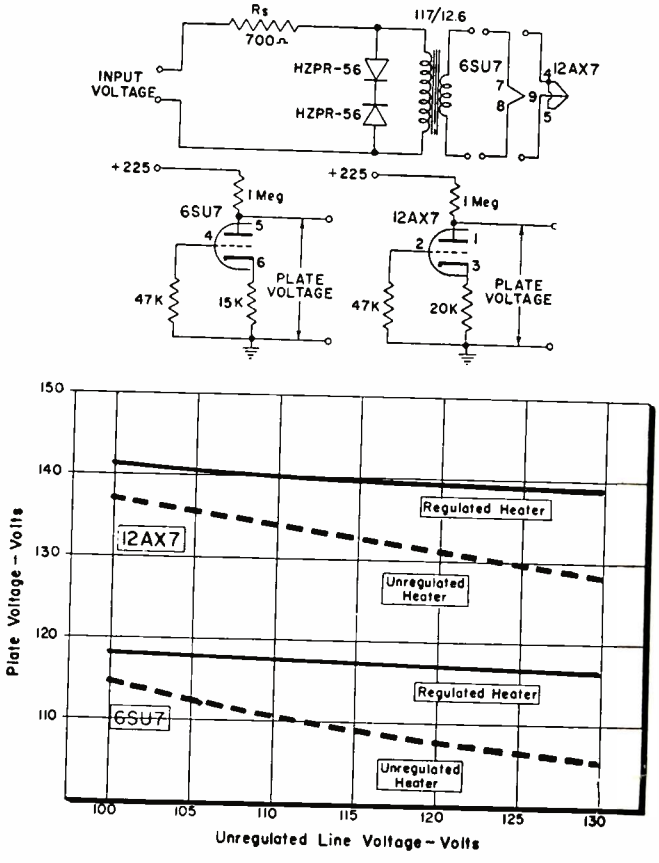
The development of zener power voltage regulators and their ability to control and regulate several watts of power make them well suited to regulate vacuum tube heater voltages. Marked improvements in stability of cathode emission, consistency of operation, and tube life due to nearly constant heater power can be achieved by incorporation of the zener power diodes in both dc and ac filament circuits. Zener power diodes with their relatively small size and light weight provide a method of heater regulation offering many advantages over the use of constant voltage transformers, carbon pipe regulators, or complex regulating circuits.

* * *

Fig. 4 (below): AC heater regulation for 12AX7 dc amplifier

Fig. 5 (right): Primary side heater regulation of ac heaters





Page from an Engineer's Notebook

#46-Information Density of Magnetic Drums

A nomograph and tables are given to determine the information density on the recording surface of magnetic drum memories.

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VERY often it is necessary to determine the frequency and resolution limitations of the magnetic recording heads in a magnetic memory. This is usually done by observing the effect upon the output of the magnetic recording head by varying the drum speed or the recording frequency, or both.

The information on the drum is defined by one of two systems of recording — Ferranti and N.R.Z. (Non Return to Zero). Actually the Ferranti system is a modified N.R.Z. system. A Ferranti bit or unit of information consists of two magnetic dipoles; whereas an N.R.Z. bit contains only one magnetic dipole. Hence, the information density is expressed by the following formulas.

1. $\text{Information Density (Ferranti bits/inch)} = \frac{\text{Frequency of recording (cycles/sec)}}{\text{Surface speed of drum (inches/sec)}}$

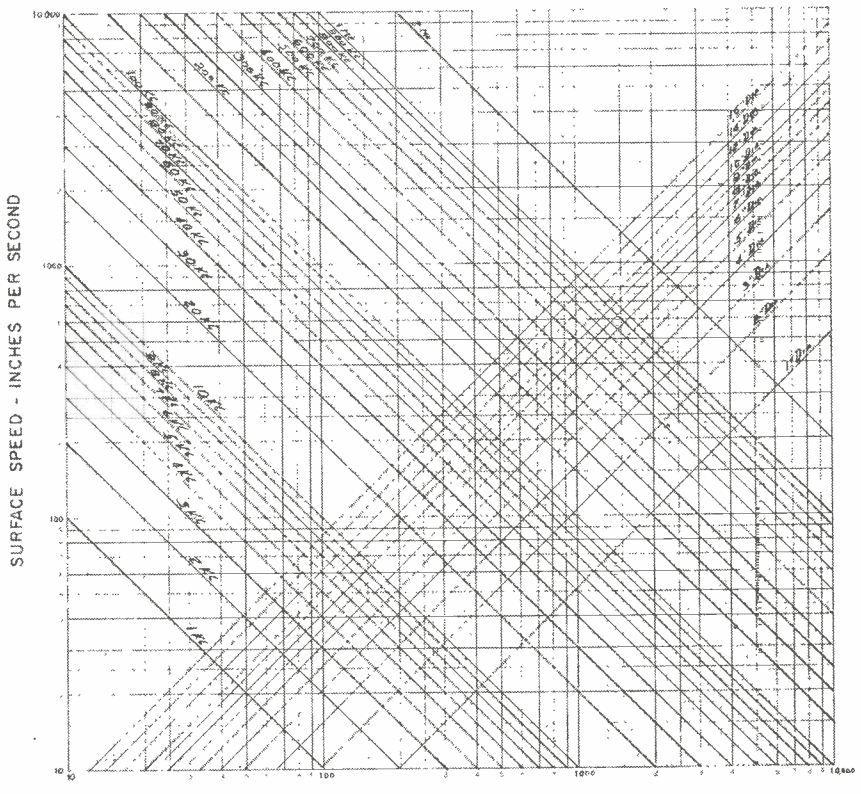
2. $\text{Information Density (N.R.Z. bits/inch)} = \frac{2 \text{ Frequency of recording (cycles/sec)}}{\text{Surface speed of drum (inches/sec)}}$

The nomograph has surface speed in inches per second as the ordinate. The abscissa has two quantities—drum speed in revolutions per minute and information density in Ferranti bits per inch, each using the same numerical scale. Two other parameters — drum diameter and recording frequency—are plotted on the nomograph. The diameters are given in inches and with a range from 1 to 16.

Usually the diameter of the drum and the drum speed are established for a given design. To use the nomograph, select the line representing the diameter of the par-

(*Continued on following page*)

A NOMOGRAPH FOR THE DETERMINATION OF INFORMATION DENSITY ON THE RECORDING SURFACE OF MAGNETIC DRUM MEMORIES



Information Density

(Continued)

Ed. Note: The tables were supplied by the author so that exact points would not have to be read directly from nomograph.

ticular drum and also the abscissa designating the drum speed. The intersection of these two lines establishes the surface speed of the drum. If the frequency is known, locate the point of intersection of the line representing the frequency and the line representing the surface speed of the drum. The abscissa of this point denotes the information density.

As an example, suppose the drum is 6 inches in diameter, the drum speed is 2000 RPM, and the recording frequency is 100 KC. First, select the line representing a diameter of 6 inches and the line representing 2000 RPM. The intersection of these two lines indicates a surface speed of 625 inches per second. Now, select the line representing 100 KC. The intersection of this line with the line representing 625 inches per second indicates the information density is 160 Ferranti bits per inch. This is equivalent to 320 N.R.Z. bits per inch. Hence, once the surface speed has been determined, the information density can be determined for the particular recording frequencies. This is very convenient when the frequency response of a magnetic recording unit is being determined.

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Table 1

Calculations for Surface Speeds

$C = 2\pi r = \pi d$ inches

$$\text{Speed} = \frac{\text{r.p.m.}}{60} (\pi d) \text{ inches/second}$$

diameter—inches	1	1	1	2	2	2	3	3	3	4	4	4
r.p.m.	300	600	1200	300	600	1200	300	600	1200	300	600	1200
Speed—in./sec.	15.71	31.42	62.84	31.42	62.84	125.7	47.13	94.26	188.5	62.84	125.7	251.4
diameter—inches	5	5	5	6	6	6	7	7	7	8	8	8
r.p.m.	300	600	1200	300	600	1200	300	600	1200	300	300	1200
Speed—in./sec.	78.55	157.1	314.2	94.26	188.5	377	110	220	440	126	251.4	502.7
diameter—inches	9	9	9	10	10	10	11	11	11	12	12	12
r.p.m.	300	600	1200	300	600	1200	300	600	1200	300	600	1200
Speed—in./sec.	141.4	282.8	565.6	157.1	314.2	628.4	172.8	345.6	691.2	188.5	377	754.1
diameter—inches	13	13	13	14	14	14	15	15	15	16	16	16
r.p.m.	300	600	1200	300	600	1200	300	600	1200	300	600	1200
Speed—in./sec.	204	408.5	816.9	219.9	439.9	879.8	235.7	471.3	942.6	251.4	502.7	1005

Table 2

Calculations for Cell Density

$$\text{Cell Density} = \frac{\text{Frequency}}{\text{Speed}} \text{ (Ferranti Bits/inch)}$$

Speed in./sec.	100	1000	100	1000	100	1000	100	1000	100	1000	100	1000
Frequency kc.	10	10	20	20	30	30	40	40	50	50	60	60
Cell Density	100	10	200	20	300	30	400	40	500	50	600	60
Speed in./sec.	100	1000	100	1000	100	1000	100	1000	100	1000	100	1000
Frequency kc.	70	70	80	80	90	90	100	100	150	150	200	200
Cell Density	700	70	800	80	900	90	1000	100	1500	150	2000	200
Speed in./sec.	100	1000	100	1000	100	1000	100	1000	100	1000	100	1000
Frequency kc.	300	300	400	400	500	500	600	600	700	700	800	800
Cell Density	3000	300	4000	400	5000	500	6000	600	7000	700	8000	800
Speed in./sec.	100	1000	100	1000	200	1000						
Frequency kc.	900	900	1000	1000	2000	2000						
Cell Density	9000	900	10,000	1000	10,000	200						

For Certain Audio Transistors

Low Frequencies Vary T-Parameters

At low frequencies, equivalent impedances have been approximated by pure resistances. Data presented here reveal that the magnitude of equivalent T-parameters changes radically. Measured characteristic impedances start to change near 50 cps.

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ALTHOUGH there are many equivalent circuit configurations that satisfactorily represent the junction type transistor,[1] the device designer and manufacturer are interested in choosing an equivalent circuit with measurable parameters directly related to the physical quantities that they control in the construction of a transistor. The equivalent T-circuit is therefore frequently used and determination of the correct values for the equivalent T-parameters becomes important.

Low Frequency Measurements

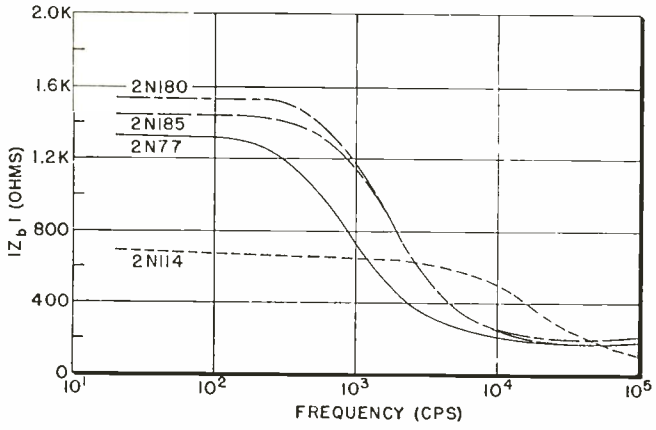
While it is well known that the values of the equivalent T-parameters are frequency dependent it has been generally accepted that at low frequencies the impedances could be approximated by pure resistances. Measurements, however, have revealed that the magnitude of equivalent T-parameters Z_e, Z_b, and Z_c of certain audio transistors change radically over the low frequency range, Figs. 1, 2 and 3. Changes in the measured characteristic impedance values start near 50 cps and continue to 10 KC where limiting values are attained.

Figs. 1, 2, and 3 also illustrate that if a signal frequency of 1 KC were used, the measured values of the equivalent T-parameters would be approximately an "average value" as compared to their extreme values. Even at 270 cps, a commonly used frequency, the parameters are in a transitional state. These changes have been investigated experimentally and theoretically and are generally attributed principally to feedback caused by collector-to-base capacitance.

To support this concept, general equations for the equivalent T-parameters in terms of the hybrid parameters for a common-emitter configuration employing a collector-to-base feedback will be developed that predict range and terminal values of the T-parameters. These l-f parameter values are independent of frequency only if the measuring frequency is sufficiently low: (1) to minimize the feedback effect; and, (2) to assure that the phase shift of the collector current with respect to emitter current is negligible.[2]

Equation Development

To begin the development of the equations for the equivalent T-parameters in terms of the hybrid parameters of a common-emitter configuration, consider the transistor as a four-terminal device which is described by a set of hybrid parameters h_{11}, h_{12}, h_{21}, h_{22}. Conversion of the device from the four-terminal "black-box" concept to a common-emitter



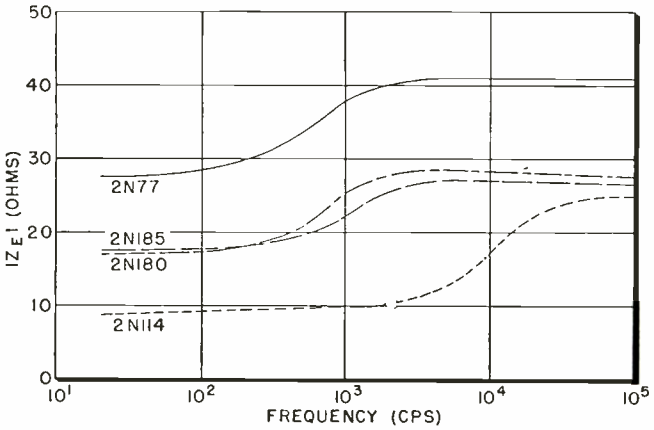


Fig. 1 (left) and Fig. 2 (right): Over l-f range, magnitude of equivalent T-parameters of certain audio transistors change radically.

Transistor Parameters *(Continued)*

configuration is made and the equivalent T-common-emitter parameters are obtained in terms of the common-emitter hybrid parameters.[3]

$$Z_e = \frac{h_{re}}{h_{oe}}$$

$$Z_b = h_{ie} - (1 + h_{fe})\frac{h_{re}}{h_{oe}}$$

$$Z_c = \frac{1 + h_{fe}}{h_{oe}}$$

To this configuration is added a collector-to-base feed back impedance Z_f which results from the series combination of the base diffusion capacitance C_b and the collector capacitance C_c. This results in the equivalent T-circuit representation of a transistor, Fig. 4, and is described by a new set of hybrid parameters[4] h'_{ie} (with a base spreading resistance r'_{bb} added), h'_{rc}, h'_{fe} and h'_{oe} where

$$h'_{ie} = \frac{h_{ie} Z_f}{h_{ie} + Z_f} + r'_{bb}$$

$$h'_{re} = h_{re} + \frac{h_{ie}(1 - h_{re})}{h_{ie} + Z_f}$$

$$h'_{fe} = \frac{h_{fe} Z_f - h_{ie}}{h_{ie} + Z_f}$$

$$h'_{oe} = h_{oe} + \frac{(1 - h_{re})(1 + h_{fe})}{h_{ie} + Z_f}$$

As a final step, assuming that h_{oe}, $h_{re} << 1$ and $(1 \pm h_{re}) \approx 1$, substitution of the h'-parameters into the equivalent T-common-emitter equations is made and the general equations for the equivalent T-parameters in terms of the common-emitter hybrid parameters h_{ie}, h_{re}, h_{fe} and h_{oe} are obtained.

$$Z_e = \frac{h_{re}}{h_{oe}} \left\{ \frac{\frac{h_{ie}}{h_{re}} + Z_f}{h_{ie} + Z_f + \frac{1 + h_{fe}}{h_{oe}}} \right\}$$

$$Z_b = \frac{h_{ie} Z_f}{h_{ie} + Z_f} \left\{ 1 - (1 + h_{fe}) \left[\frac{1 + \frac{h_{re} Z_f}{h_{ie}}}{h_{oe}(h_{ie} + Z_f) + (1 + h_{fe})} \right] \right\} + r'_{bb}$$

$$Z_c = \frac{Z_f}{1 + \frac{h_{oe}(h_{ie} + Z_f)}{1 + h_{fe}}}$$

Parameter Variation Range

To determine the range of the parameter variations, the limits of Z_e, Z_b, and Z_c are obtained as functions of frequency and limiting or boundary values obtained as the frequency tends toward zero and infinite values.

As $f \to \infty$, $Z_f \to 0$

$$Z_e \to \frac{h_{ie}}{1 + h_{fe}} \text{ (assuming } h_{ie}\, h_{oe} << 1) \quad (1)$$

$$Z_b \to r'_{bb} \quad (2)$$

$$Z_c \to 0 \quad (3)$$

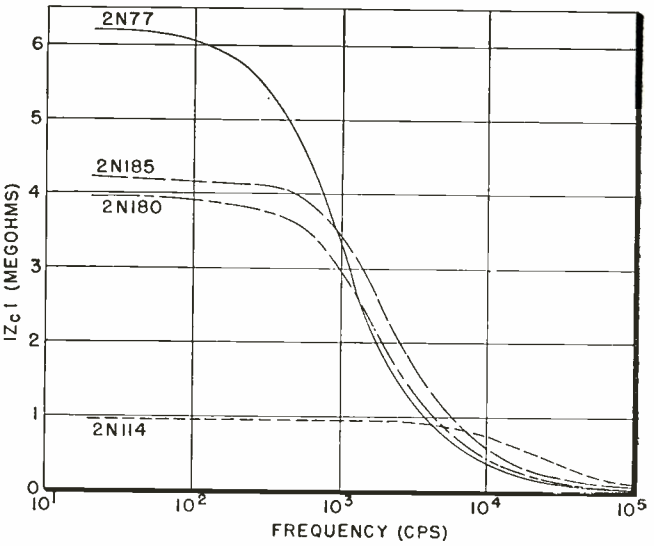
As $f \to 0$, $Z_f \to \infty$

$$Z_e \to \frac{h_{re}}{h_{oe}} \quad (4)$$

$$Z_b \to h_{ie} \left\{ 1 - \frac{(1 + h_{fe})\frac{h_{re}}{h_{ie}}}{h_{oe}} \right\} + r'_{bb} \quad (5)$$

$$Z_c \to \frac{1 + h_{fe}}{h_{oe}} \quad (6$$

Fig. 3: Similar to Figs. 1 & 2. If 1 KC signal is used, measured values are approximately average, compared to their extreme values



For further correlation of measured and predicted performance of the equivalent T-parameters, the mid-point frequency equation for Z_e when Z_e is equal to one-half the sum of its extreme values and the frequency equation of Z_c at its —3 db point were obtained and are

Z_e mid-point frequency

$$f_e = \frac{1}{2\pi C_f (h_{ie}) + \frac{1 + h_{fe}}{h_{oe}}} \quad (7)$$

and Z_c frequency at —3 db point

$$f_c = \frac{\sqrt{.414}\, h_{oe}}{2\pi C_f (1 + h_{fe})} = \frac{h_{oe}}{3.1\pi C_f (1 + h_{fe})} \quad (8)$$

The measured low frequency (50 cps) hybrid parameters of the common-emitter configuration for the transistors utilized were used in conjunction with Eqs. 1 to 8 in predicting the behavior of the equivalent T-parameters with frequency. The hybrid parameters were chosen for the calculations because of their relatively small changes and approximately constant values below 500 cps. The results were in very good agreement with the measured equivalent T-parameters.

Therefore, to measure the resistive values of Z_e, Z_b and Z_c of the equivalent T-parameters accurately, it is necessary to utilize a signal frequency sufficiently low that the feedback impedance can be neglected.

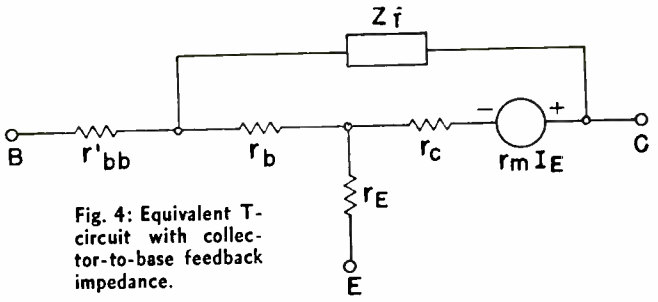


Fig. 4: Equivalent T-circuit with collector-to-base feedback impedance.

For the low frequency audio units used in this investigation, the frequency required was less than 50 cps. Unless this caution is exercised, the common practice of utilizing a fixed small signal frequency of 270 or 1000 cps for parameter measurements for all types of transistors will result in frequency dependent values for many types of transistors.

Acknowledgment

Messrs. R. E. Dorrell, T. A. Prugh and J. M. Stinchfield of these Laboratories assisted and contributed to the work by means of helpful suggestions and discussions.

References

1. Hunter, Lloyd P., *Handbook of Semiconductor Electronics*, McGraw-Hill Book Co., Inc., New York, N. Y., 1956, pp. 11-12.
2. Shea, Richard F., *Principles of Transistor Circuits*, John Wiley and Sons, Inc., New York, N. Y., 1956, p. 485.
3. Hunter, *op. cit.*, pp. 11-13, 11-14.
4. Hunter, *op. cit.*, pp. 11-26, 11-27.

Electronic Calibration Center

THE primary mission of the National Bureau of Standards new Electronic Calibration Center is to calibrate interlaboratory standards for such quantities as voltage, power, and impedance in terms of the national standards maintained by NBS. These interlaboratory standards, in turn, are used to assure the accuracy of reference and working standards in laboratories, on the production line, and in overhaul stations throughout the nation.

The quantity of electronic calibration required today in the design, manufacture, and adjustment of extremely complex electronic weapons, communications equipment, and industrial electronic apparatus is so great that branching chains of measurements are necessary to extend the national standards to the shop or field instruments used for this work. The large number of links in each chain, through which the units of measurement must be transferred, requires the highest practicable accuracy at each step in order to assure adequate accuracy of the shop and field instruments. The Electronic Calibration Center is being equipped to meet these accuracy requirements while handling the increasing calibration workload.

The fundamental system of electrical measurement now employed in the United States uses absolute units, i.e., units derived from the fundamental units of length, mass, and time—the meter, kilogram, and second. Basic to the absolute system of electrical units are the absolute ohm and the absolute ampere. The absolute ohm is derived from the absolute henry, based on an inductor of accurately known dimensions. The absolute ampere is established in terms of the magnetic force on an accurately dimensioned current-carrying coil, measured with a current balance. These basic standards are maintained in the Bureau's laboratories in Washington, D. C.

Other units, such as the watt and the kilowatt hour, are obtained by combining these units and by extending the scale of measurement. The units then are transferred to higher frequencies by appropriate techniques.

Services offered by the Calibration Center cover three broad frequency ranges: (1) low-frequency (zero frequency through about 30 KC); (2) high-frequency; (30 KC through about 300 MC); and (3) microwave (above 300 MC).

* * *

The use of magnetic amplifier operated relays has lagged, probably due to a lack of knowledge about them. An easy-to-follow description of these unique relays is given here. The design engineer will find them useful because of their good reliability, vibration and shock resistance, and low control power requirements for handling large loads.

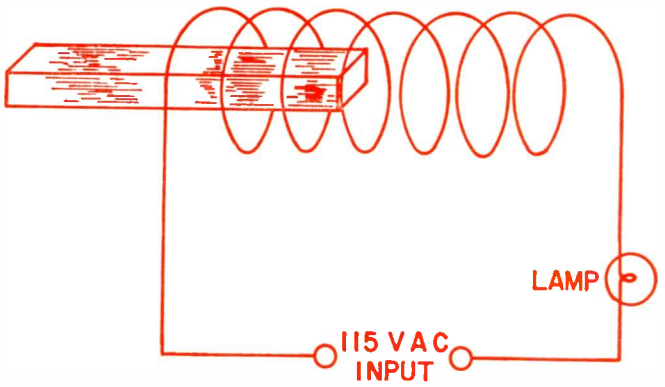


Fig. 1: A simple demonstration of magnetic amplifier principles

For Aircraft and Missiles

Magnetic Amplifier Operated Relays

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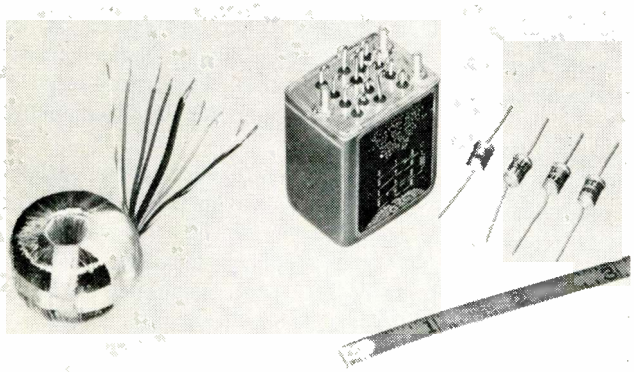
The components are hermetically sealed in a metal container



A MAGNETIC amplifier operated relay? What can it do that a sensitive relay controlling a power relay can't? What advantage does it offer? Is its operation dependable? Let's look at Table 1 (page 153) which shows a few of the characteristics of the sensitive relay and the magnetic amplifier operated relay.

Principle

Let's look inside and see just what a simple magnetic amplifier operated relay looks like. Fig. 1 represents a very early light dimming circuit in which the metal rod was moved in and out of a winding connected in a series with the load. When the rod is moved out of the winding, the inductance is low and most of the line voltage appears across the lamps.

As the core is moved into the coil, the inductance increases and the total impedance of the circuit becomes increasingly greater until very little current remains to light the lamp.

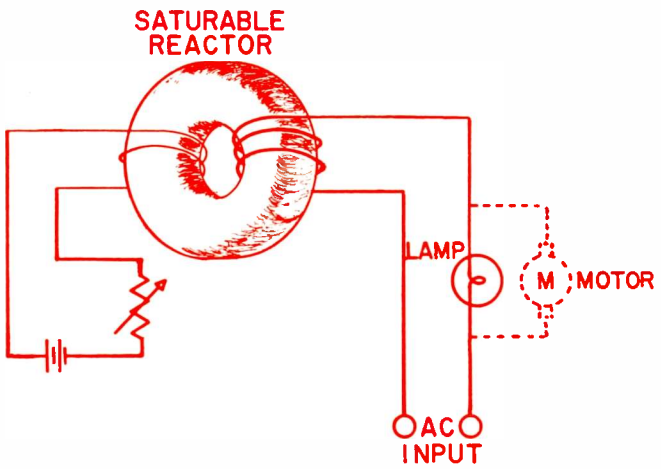
This same light dimming could be accomplished remotely by using a circuit as shown in Fig. 2; or, the speed of a motor could be varied.

With no voltage applied to the control winding, the inductance of the reactor, and hence the impedance of the reactor is high and very little current flows in the series circuit. The lamp thus burns dim or the motor runs at a very slow speed.

As voltage is applied to the control circuit and the amount of the current in the control winding increased by varying the series resistor, the incremental inductance of the reactor is decreased as the core material approaches saturation. As the inductance approaches zero, the impedance of the reactor becomes very low. Most of the line voltage now appears across the lamp or motor, making the lamp burn brightly or the motor run at full speed.

Application

In place of the motor, we can place a full-wave bridge rectifier and a relay coil in the circuit, Fig. 3.



Fif. 2: With little current in control circuit lamp is dim

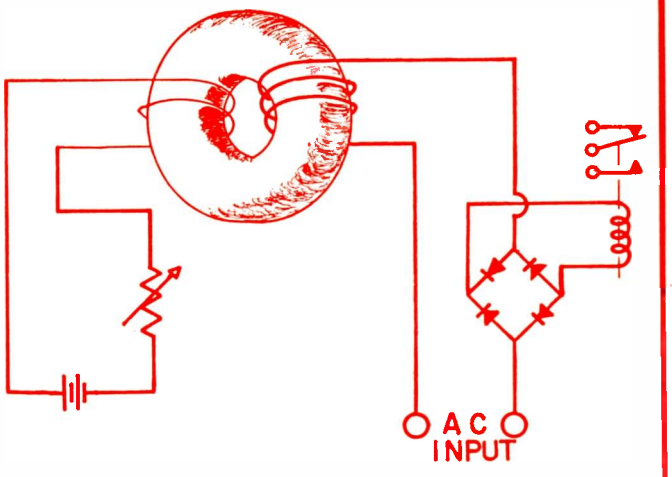


Fig. 3: An elementary magnetic amplifier operated relay

The current in the relay coil will now vary as we adjust the control winding current by the variable resistor.

Now we have an elementary magnetic amplifier operated relay. Its operation, though, would not be quite suited for our application, since the change in the control winding ampere turns must be equal to those of the load plus enough to saturate the core.

By altering the circuit as in Fig. 4, we can operate our relay very efficiently. In this circuit, we have 3 windings on a single core. Using this circuit we operate a relay, whose coil requires 2 watts, with the output of a single iron-constantan thermocouple.

We have achieved a circuit that will amplify a few microwatts to a sufficient power level to operate a heavy duty relay. In this circuit, our relay will remain energized continually from the ac line when no control voltage is applied. When the control winding power is increased to a few microwatts, the relay will drop out.

If for our application it is desired that the relay remain de-energized until control voltage is applied, we can alter the circuit as in Fig. 5. By the proper selection of resistances, the circuit will have very little current flow through the relay coil until a small amount of power is introduced into the control winding.

In Fig. 6 the 2 resistors have been eliminated and a bias winding has been added. By proper selection of bias voltage, we can change the operation of the unit to whatever type desired.

If we apply supply voltage to the line and leave the control and bias windings unconnected, we draw current through the relay coil as indicated by point "A" on the graph of Fig. 7. At point "A," we have zero ampere turns in the control windings and the relay coil current is close to the maximum of the curve. If now we place 4 ampere turns in the bias winding, the relay coil current falls to a very low value as indicated by point "B".

Leaving these 4 ampere turns in the bias winding, and applying 1 ampere turn to the control winding in opposition to the fixed bias (resting at 4 A.T.), results in a net, in the control windings, of 3 ampere turns, as indicated by point "C". By placing only 1 ampere turn of control into our magnetic amplifier, we have caused the relay coil voltage to go from 3 volts to 50 volts.

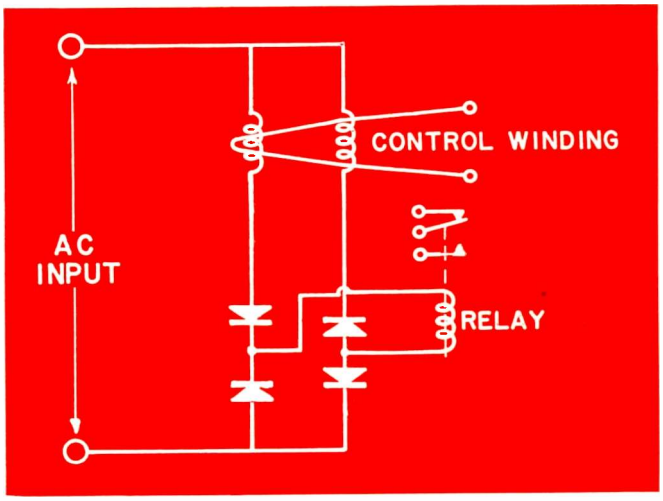
If, for instance, the control winding has 10,000 turns and a resistance of 3000 Ω, we see that the current required in the control winding for this operation is 0.1 milliamps. The power required in the control winding for this operation is 3 microwatts.

Curve Analysis

On the curve, the pick-up voltage of the relay has been indicated by point "D," and the drop-out voltage by point "E".

Since points "D" and "E" can vary with temperature, we can place 16 ampere turn bias into the bias winding, and move the resting point of the circuit over to point "F". By placing 13 ampere turns in the control winding, we can return the mag amp to to point "C" at 3 ampere turn net control.

Fig. 4: Control winding is three coils on the same core



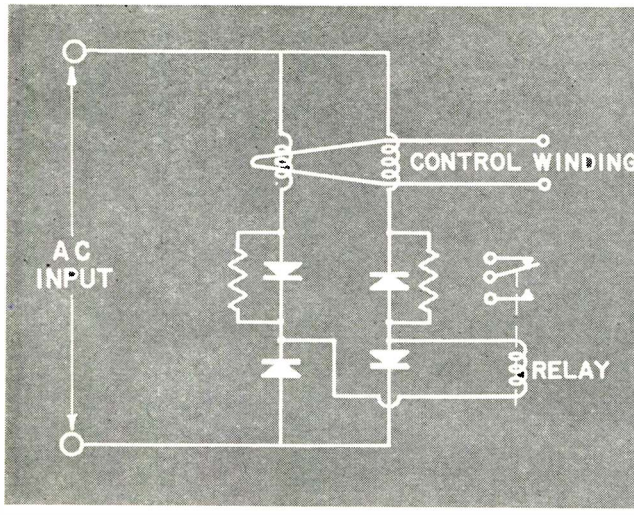


Fig. 5: Resistors keep relay de-energized with no control pwr.

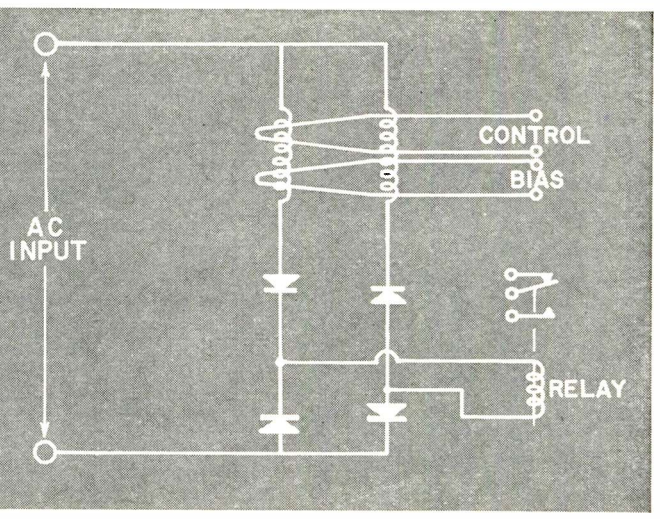


Fig. 6: Bias winding allows selection of relay operation

Relays

Since it now takes a much larger ampere turn change to operate the relay, slight variations that may occur in relay operating currents will be of no consequence when we want to control the operating point of the unit to very close tolerances.

Recent tests on a unit so biased showed a total variation in required control operating current of only 1.4% to operate the relay over −55°C to +85°C with an input line voltage variation of 100 to 130 vac.

By revising circuit constants, almost any reasonable limits of operation can be obtained with this type of unit.

As you will note in Fig. 5, two of the windings are connected to the ac line. These are the 2 saturable reactors wound on separate cores. Each of these cores and their associated windings are wound as separate units. This core consists of 0.002 in. thick iron nickel alloy ribbon wound in the form of a toroidal core. The core is then encased usually in a nylon or phenolic shell upon which the required turns of wire are wound. A similar core is wound in the same manner as the first giving 2 identical toroidal coils.

Construction

These 2 ac windings are then stacked one on top of the other. After these 2 windings have been insulated and stacked, they are ready for the control winding and bias winding to be added. When these final windings have been wound over the 2 cores, and the leadwires attached, we have a complete assembly suitable for use in our magnetic amplifier relay.

Photograph shows the necessary parts to produce the magnetic amplifier. The associated control and ac windings that were just described above are shown in lower left of photograph. A four-pole double throw hermetically sealed relay that this magnetic amplifier controls and, 4 silicon rectifiers required for proper operation of this circuit are also shown. These components are then assembled into a hermetically sealed enclosure.

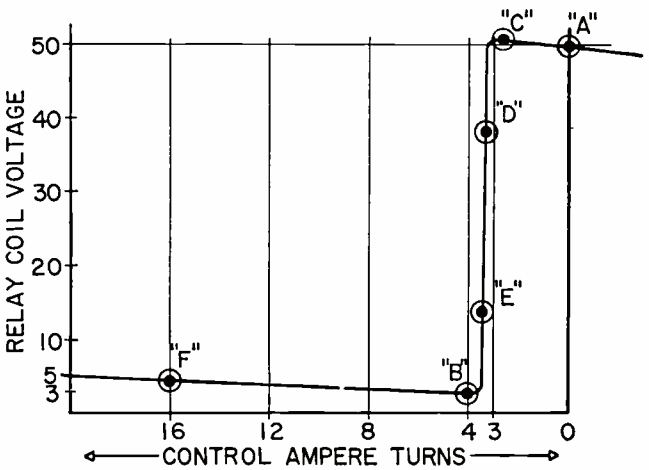
The power drawn from the ac line by a unit of this type is very little more than would be required to operate a similar unit directly from the line.

In today's military aircraft, the major portion of the electrical power is 400 CPS, so the few watts of ac power required to operate a magnetic amplifier are more readily available than power from the rectified power system of the plane.

A few of the applications of the magnetic amplifier operated relay are in yaw and roll control of jet aircraft, missile guidance control receiver, fuel flow control in relation to atmospheric and ram pressure in guided missiles, plate circuit relay in various

(*Continued on page* 153)

Fig. 7: Graph shows control ampere turns effect on relay



By E. T. PFUND, Jr., P. S. KLASKY
and BARD SUVERKROP

Extreme Environmental Testing Determined

Capabilities of Coaxial Cable

As a part of an Air Force sponsored world-wide survey of potentially high-temperature-resistant 50 ohm coaxial cable, six different types have been tested. The extensive tests, which were conducted impartially, exceeded the manufacturers' specifications in an attempt to find rugged coax cable. Some of the findings are enlightening.

Part Two of Two Parts

A SECTION of each Teflon and beaded cable, one ft. long, was assembled with connectors. One connector was clamped securely to a vibration exciter; the other connector being clamped securely to a stationary mounting board. The cable between the connectors was free enough to permit ample movement. A simple harmonic motion having a double amplitude of 0.060 in. with a maximum acceleration of ±15g was applied. The frequency was then varied approximately uniformly between the limits of 10 and 3,000 CPS.

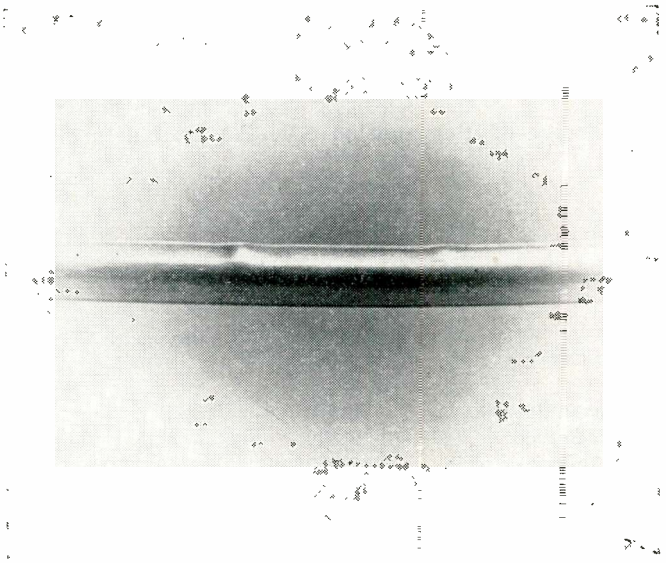
The entire range of frequencies from 10 to 3000 CPS and return to 10 CPS was traversed in approximately 30 minutes. Nine, 30 minute cycles were accomplished in each of two directions (perpendicular and parallel to the axis of the cable) for a total of 9 hours vibration.

All 4 cables passed the test in the perpendicular plane, but only the threaded core Teflon cable survived vibration parallel to the axis of the cable. VSWR measurements taken at 500 MC/s before and after the vibration test showed no change for the latter cable. The connector employed was especially designed for the latter cable to permit operation in vibration environments.

By E. T. PFUND, JR., United ElectroDynamics, Pasadena, Calif. P. S. KLASKY, Untied ElectroDynamics, Pasadena, Calif. BARD SUVERKROP, Capt. U.S.A.F. Air Research & Development Command

In addition, the beaded copper sheathed cable was subjected to 22g at 100 cycles with the results shown in Fig. 6 being obtained. The basic cause of failure with the beaded cables was the requirement for flaring of the tubing end in order to accommodate the UG-1149/U and UG-1150/U connectors. The sheath is weakened from flaring and, consequently, fractures under longitudinal vibration. (Fig. 7). Oxides of the metallic outer sheath were found on the outer periph-

Fig. 6: Copper beaded cable after receiving 22g's at 100 cps showing how vibrating beads distorted outer conductor.



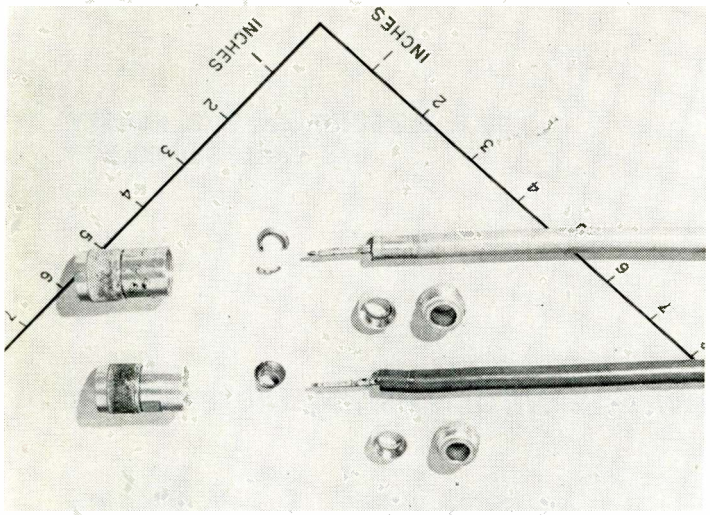


Fig. 7: Sheath fracture of beaded cables caused by subjection to longitudinal vibration while using UG-1149 & UG-1150 connectors.

Co-ax Capabilities *(Concluded)*

ery of the beads after vibration. Connectors causing failure of solid sheathed coaxial cables in vibration environments have been previously encountered at WADC.[9]

The solid sheath and dielectric of the solid-Teflon cable fractured at the center of the sample in the longitudinal axis test.

Capacitance is a function of not only cable dimensions but also of dielectric constant. The dielectric constant of many materials varies appreciably with frequency and temperature. Measurements of cable capacitance at 1000 CPS are valid for Teflon, Teflon-air-and bead-insulated coaxials such as employed in this program. With cables utilizing silica based dielectrics, however, it is important to measure capacitance at 1 MC/s or above, since these materials are much more frequency and temperature sensitive at the low frequencies.

The capacitance of each cable was directly measured to three significant figures at a frequency of 1 KC and reported in Table 3 in micromicrofarads per foot. Electrically short pieces, less than 1/40 of a wavelength of cable, were used for this test.

Velocity Propagation

Velocity of Propagation (V. P.) was determined by measuring the shift of the node on a slotted line when a length of cable was removed from the open end of a sample. The ratio of the physical length removed to the distance the node moved is the V. P. The results are described in Table 3.

Impedance

The characteristic impedance of each cable was determined by calculation from the capacitance and velocity data obtained by measurement. The results are tabulated in Table 3.

The characteristic impedance of a coaxial cable varies as L-C. The behavior of the inductance is influenced by skin effect. Skin effect is retarded in stranded conductors, such as employed for the inner conductor of the solid Teflon cable, as compared to solid conductors, even though the individual strands are not supposed to be insulated from one another.[10]

Dielectric Strength

Dielectric strength measurements were conducted using the 60 cycle test setup employed for the corona measurements. Starting at zero, the applied voltage was increased uniformly until breakdown occurred. The rate of increase was adjusted so that breakdown occurred not more than 60 seconds and not less than 10 seconds after application of the test voltage. Failure was determined by the tripping of a circuit breaker in series with the test coil. The results are recorded in Table 3.

Most breakdown failures in a coaxial cable are caused by the presence of a splinter, sliver, or piece of scale on the inner or outer conductor.[6] Consequently, a process known as sliver burning by the glow discharge method has been developed by Bell Laboratories to improve the dielectric strength of disc-spaced coaxial cables.[6] The process is resorted to both during and after the forming of the coaxial configuration and reportedly results in a marked increase in the voltage at which corona appears.

Heat Exposure

An approximate 7 ft. sample of coaxial cable using solid irradiated polyethylene insulation was subjected to an ambient temperature of 300°C for a period of 2 minutes. The results are shown on the inside cable in Fig. 8. The insulation has cracked the aluminum sheathing and oozed out the crevices. Such a cable obviously does not meet minimum USAF requirements.

Sheath Cracking

An approximate 7 ft sample of the aluminum jacketed solid Teflon was subjected to an ambient temperature of 300°C for approximately one hour. VSWR at 500 MC/s remained less than 1.08:1 during the test period. After 64 minutes, the aluminum sheath cracked as shown on the outside cable in Fig. 9. The cable still meets the minimum USAF requirement of 30 minutes at 300°C.

Table 3

COAXIAL CABLE ELECTRICAL CHARACTERISTICS

Cable	60 cycle Breakdown (volts)	Impedance (ohms)	Capacitance ($\mu\mu$ fd/ft.)	VP (%)
Aluminum Beaded	2,510	51.5	21.8	90.46
Copper Beaded	2,530	52.3	21.7	89.57
Solid Teflon	13,450	50.4	29.05	69.39
Threaded Core	8,352	50.0	24.4	83.35
Solid Irradiated	>22,500	.....	28.7	.....
Foamed Irradiated	4,000	48.5	26.7	78.50

1. Ceramic bead insulated or disc insulated cables presently available can operate for extended periods between 300°C and 500°C depending on the metals and protective coatings employed to prevent oxidation.

2. The lack of commercially available high-temperature resistant low-loss r-f coaxial connectors is preventing utilization of existing high-temperature cables at temperatures much in excess of 250°C. In order to utilize high-dielectric-strength gases or hygroscopic materials as cable dielectrics, sealed connectors will be required.

3. To obtain low-loss characteristics, silver-plated conductors are a requisite. The porosity of silver, however, makes it necessary to consider the corrosion resistance of the underlying metal. In addition, silver-plated conductors are not compatible with certain cable-manufacturing techniques. For example, the drawing and annealing processes required for production of some mineral insulated cables would cause the silver to either diffuse into the base metal or rub off. Also, silver migration into dielectric materials at high humidities must be taken into consideration, especially in solid dielectric coaxials.

4. One of the basic problems confronting the applications engineer is the lack of information concerning operation of components at environments similar to those encountered in the intended application. Coaxial cables and connectors intended for high-temperature use should be tested electrically under severe environmental conditions. When higher temperature applications require creation of a new grade of components, the electrical test temperatures should be raised to the operating temperature of that grade. Such testing would provide invaluable data to the design or systems engineer. Dielectric strength and corona measurements vs altitude are of equal importance. Vibration applied during electrical testing would reveal additional characteristics of coaxial cables intended for use in missiles or aircraft.

5. Based on the limited heat exposure testing conducted, it appears that Teflon insulated cables can operate for short periods of time at temperatures in excess of 300°C. Since the coefficient of expansion of Teflon varies greatly with temperature changes, air-spaced or taped Teflon coaxials should enjoy higher temperature capabilities than solid Teflon types. In order to determine their practical usefulness at such temperatures, further testing should be accomplished. Power breakdown vs time measurements at VHF, UHF and microwave frequencies are a requisite for the missile industry.

Fig. 8: Irradiated polyethylene (inner) and solid Teflon (outer) cable after 300°C exposure for 2 and 64 minutes respectively.

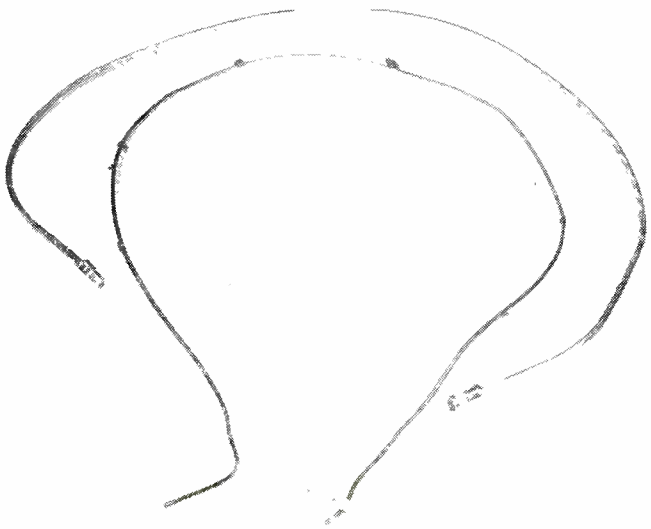


Fig. 9: Copper sheathed beaded cable after 15 min. at 650°C.

[a] Rodriguez[11] of the New York Naval Shipyard has recently described the successful testing of Phelps Dodge Teflon Spirafil cable at temperatures in excess of 300°C.

Acknowledgement

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Bibliography

1. E. T. Pfund, W. F. Croft and Capt. B. Suverkrop, "Progress Report on the Development of Low-Loss High-Temperature Coaxial Cables," *Proceedings 1957 Electronic Components Symposium*, Chicago, May 3, 1957.

2. E. T. Pfund, W. F. Croft and Capt. B. Suverkrop, "Raising the Limits for Coaxial Cable," *Electronic Industries*, January, 1958.

3. Sergeeva, K. K., "Developments in Cable Technology During the Past Five Years (1950-1955)," *Electrosviaz*, Vol. No. 6, 1958, USSR.

4. P. H. Smith, "RF Transmission Line Nomographs," *Electronics*, February, 1949, page 112.

5. R. C. Mildner, "The Power Rating of Radio-Frequency Cables," *Transactions of the A.I.E.E.*, June 6, 1949.

6. A. S. Windeler, "Improving Corona Voltage of Coaxial Cables," *Bell Laboratories Record*, August, 1951, No. 8.

7. G. L. Ragan, "Microwave Transmission Circuits," Radiation Laboratory Series Vol. 9, McGraw-Hill Book Company, 1948.

8. C. R. Cox, "Design Data for Beaded Coaxial Lines," *Electronics*, May 1946, page 130.

9. WCRE Technical Memorandum Report 56-98, "Engineering Evaluation Test of Threaded Core Coaxial Cable," Electronic Components Laboratory, Directorate of Research, 4 April 1956.

10. W. R. Thurston, "The Measurement of Cable Characteristics," *General Radio Experimenter*, Vol. 31, No. 12, May, 1957.

11. G. Rodriguez, "Report of Research on RF Cable Characteristics at High Ambient Temperatures," Material Laboratory, New York Naval Shipyard, Lab Project 5969, Progress Report No. 1, N.S. 672-100, 29 August, 1957.

New Products . . . for the Electronic Industries

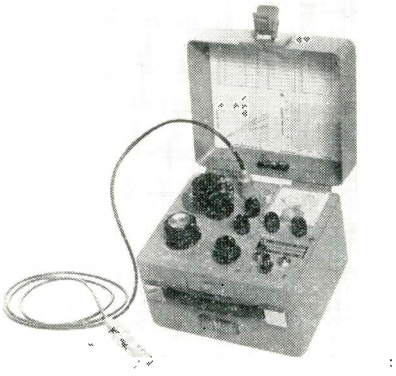
COAXIAL RELAY

The Type RC10 relay has been designed to provide remote switching of 3⅛ in. coaxial lines for use in communications transmitters at frequencies up to 60 MC at 50 kw average power. The unit has a characteristic impedance of 50 ohms and a frequency range of 0 to 100 MC. VSWR is 1.02 max. at 30 MC; 1.05 max. at 60 MC. Crosstalk is almost negligible, being greater than —60 db isolation at 60 MC. The latching type actuator is operated by either 24 or 115 vdc solenoids. Jennings Radio Mfg. Corp., P. O. Box 1278, San Jose, California.

Circle 161 on Inquiry Card, page 83

FREQUENCY METER

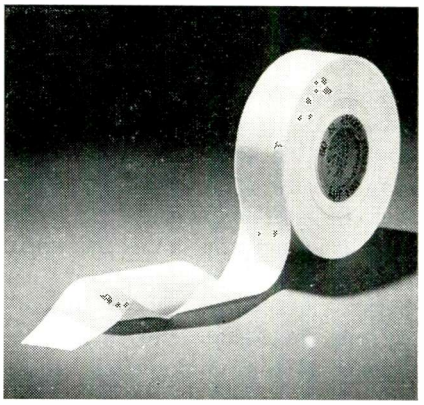
The transistorized Type 5890-B Frequency Meter is for use with land-mobile communications equipment designed to latest FCC split channel specifications as well as adjacent channel requirements. With a built-in thermometer, the crystal controlled instrument covers any r-f channel within the 25 MC to 470 MC communications spectrum, accurate to ±0.00025 percent. It is also a precision instrument for i-f channels in the 100 KC to 100 MC range. Allen B. Dumont Laboratories, Inc., 750 Bloomfield Ave., Clifton, N. J.



Circle 163 on Inquiry Card, page 83

INSULATING TAPE

Tape No. X-1060 is a pressure-sensitive tape for holding and insulating electrically over a broad temperature range. It meets the requirements of MIL-I-18622 and Bu Ships Specification S-6202. It can be used between broad functional temperature limits of —50°C to +180°C. Dielectric strength is 7000 v, insulation resistance is 7500 megohms and tensile strength is 150 lbs/in. Arc resistance ozone resistance and corona resistance are "good" as measured by 3M. Minnesota Mining and Manufacturing Co., 900 Bush St. St. Paul, Minn.



Circle 165 on Inquiry Card, page 83

PEAK-METER PROBE

A frequency-compensated probe extends the range of the Model PTM-7 Peak-Meter from 300 volts up to 3000 volts. The peak-meter measures voltage pulses which are too fast to measure on conventional voltmeters. It responds to the peak value of the waveform regardless of shape and holds the reading until a reset button is pressed. An electronically regulated power supply furnishes all the dc operating voltages and is regulated to 1% against line fluctuations. Control Devices, Inc., 8299 E. Nine Mile Road, Warren, Mich.

Circle 162 on Inquiry Card, page 83

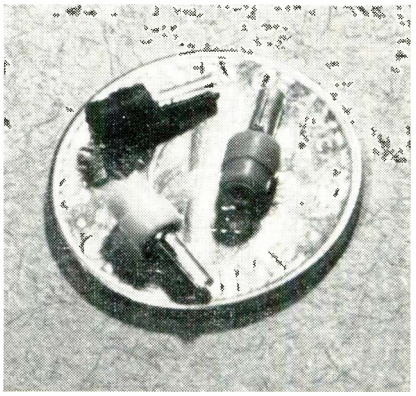
TERMINAL KIT

Intended for limited distribution, this kit contains a sampling of solderless electrical terminals and matching application tooling, designed to meet the needs of development and research laboratories. Special terminals to meet unusual requirements may be obtained to supplement the standard designs of pre-insulated terminals and taper pins contained in the kit. The kit is also stocked with catalogs and instruction pamphlets. It is not intended for use in mass production departments. Amp Inc., Harrisburg, Pennsylvania.

Circle 164 on Inquiry Card, page 83

SLOTTED-LUG TERMINAL

The Type FT-SM-65 SL is a subminiature "Pres-Fit" feed through terminal featuring a heat-treated, beryllium-copper insert. The use of this alloy means greater resistance to bending and breaking. With a bushing O.D., of 0.125 in. and an overall height of 0.294 in. this "Press-Fit" terminal is especially suitable for ultra-compact electronic assemblies. The thru hole permits feeding the lead wire from bottom to top where the soldering can be done on one side only. Sealectro Corporation, Mamaroneck, New York.

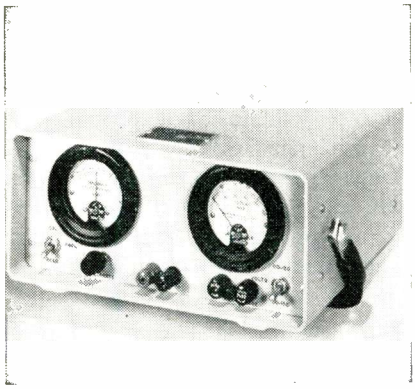


Circle 166 on Inquiry Card, page 83

New Products . . . for the Electronic Industries

FREQUENCY-VOLTMETER

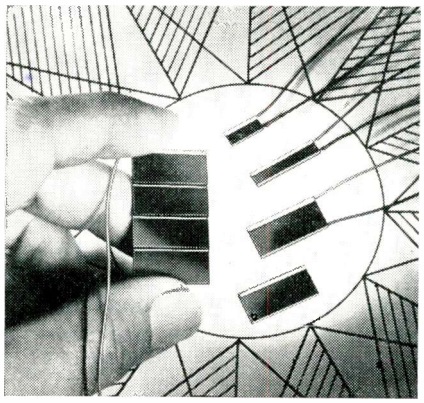
The Model 7500 combines the 6506 frequency meter in the same case with a voltmeter. The same power provides the signals for simultaneous measurement of frequency and voltage. The frequency meter provides laboratory precision of 0.1 for the 397 to 403 CPS range. The unit is not damaged with inputs from 350 to 450 CPS. The dual scale voltmeter has ±2% accuracy from 0 to 150 v. and ±0.3% from 110 to 120 v. Accuracy is maintained from —55°C to 71°C. Varo Mfg. Co., Inc., 2201 Walnut St., Garland, Texas.



Circle 167 on Inquiry Card, page 83

SILICON SOLAR CELLS

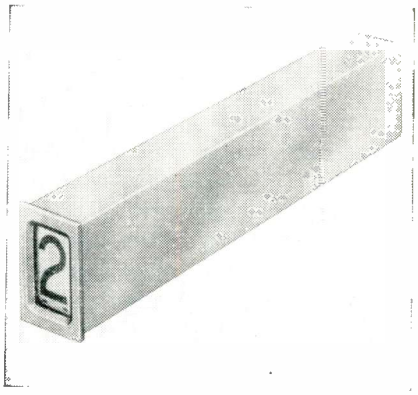
These cells can convert 10% and higher of the radiant energy falling on their surface. Designed to military specifications, they are available for both commercial and military applications, and can provide an output of approximately 9 w per sq. ft. of active cell area in bright sunlight. The contact is permanently bonded to the silicon wafer. Individual cells are obtainable, with or without color coded pigtail leads, in sizes ½ x 1 cm —½ x 2 cm—1 x 2 cm. International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif.



Circle 169 on Inquiry Card, page 83

DIGITAL INDICATOR

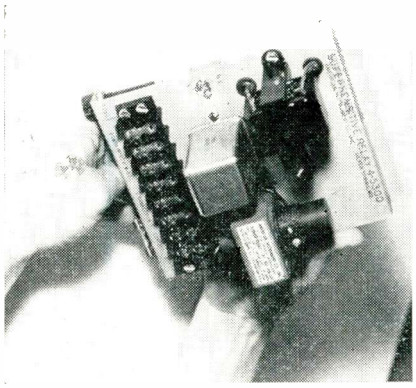
This one inch character, motor driven digital indicator, operates on a direct drive basis and does not rely on the use of intermittent drive mechanisms to position the characters. Numbers 0 through 9 and two blanks are displayed in sequence in response to four bit binary coded decimal input. Operating on an open circuit principle, complete code agreement of both binary ones and binary zeros is checked to assure positive and correct positioning of the indicator. Westinghouse Air Brake Co., Union Switch & Signal Division, Swissvale, Pa.



Circle 171 on Inquiry Card, page 83

SENSITIVE RELAY

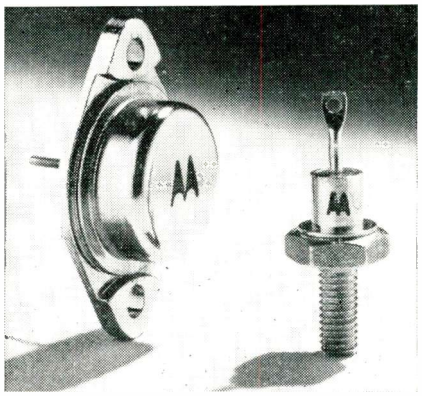
This relay is designed for actuation by thermo-regulators and other delicate contact-making devices. It is designed with an optimum control circuit current of 10 milliamperes ac. Normally-open or normally closed operation may be selected with a switch. Power required is 117/208/230 volts ±10%, 50/60 CPS, 17 va. Control circuit is 12 v ac. Closure time is 0.4 seconds, independent of external control resistance. "Fail-safe" operation is provided. American Instrument Company, Inc., 8030-8050 Georgia Ave., Silver Spring, Md.



Circle 168 on Inquiry Card, page 83

ZENER DIODES

These silicon Zener Regulator Diodes are available in 10 w and 50 w power ratings. The 10MZ series which is rated for 10 w at 55°C is housed in the JETEC standard 10-32 stud package, while the 50MZ (50 w) series uses the TO-3 package with either plug-in or solder-in features as well as series interlock construction for protection against overvoltage on load. Both families are available with either anode or cathode connected to case for maximum circuit flexibility. Motorola, Inc., 4545 W. Augusta Blvd., Chicago, Ill.



Circle 170 on Inquiry Card, page 83

TIME STABILITY TESTER

The Model 5015 measures the variation in time spacing of two pulse edges: pulse-width jitter, relative jitter, and pulse repetition rate jitter. It also measures the time delay in the firing of a hydrogen thyratron. This tester can measure such delays up to about 4 microseconds. Supplied with the tester are: one low-capacitance probe and three video cables BNC to BNC (line cord is permanently attached). Power input is 115 v ±10%, 50 to 60 CPS, 300 w. Laboratory for Electronics, Inc., 75 Pitts Street, Boston, Massachusetts.

Circle 172 on Inquiry Card, page 83

WASHINGTON News Letter

IMPORTANT ROLE—Deputy Secretary of Defense Donald A. Quarles emphasized recently that the military capability of the U. S. is "critically dependent upon electronics," both today and far into the future. He stated that statistics indicate that at least 60% of all the electronics engineers in this country are now engaged to some degree in work on military programs. The electronics engineering profession is percentage-wise the most heavily engaged in military work. "It is not an exaggeration to say that most of these major new weapon systems available for use or under development today are completely dependent upon electronic devices for their successful operation," he stressed.

FM SUBSIDIARY COMMUNICATIONS—The FCC was asked by the Electronic Industries Association to include its inquiry into possible expansion of the "subsidiary communications" operations of FM broadcasters in its upcoming proceeding on present and future uses of the frequencies between 25 and 890 megacycles instead of its present plan of a separate study of this new phase of FM operations. The EIA also recommended that the FCC should promulgate engineering standards for use in FM multiplexing of stereophonic broadcasting for entertainment purposes.

PHYSICIANS' RADIO—The American Medical Association has requested the FCC to establish a separate Physicians' radio service with mobile radio operations. For physicians in communities above 50,000 population the AMA asked the FCC to assign a block of ten frequencies in the 150 megacycle band and two frequencies in the 40 megacycle band and the frequency assignments should be made to the central office of the medical society furnishing communications service to doctors. The Association also proposed that the FCC permit non-commercial educational FM stations to multiplex their broadcast channels so that this service could be used for doctors' postgraduate study and medical conferences.

EXTENSIVE TV STUDY—By early next year an extensive staff study of frequency allocation problems related to television which will prepare all appropriate technical and economic data is slated to be submitted to the FCC Commissioners. The FCC Broadcast Bureau staff plans to submit to the Commissioners, by some time next January, all needed information on three possible solutions of the UHF-VHF television problem—an all VHF system, with more channels than at present; an all UHF system; or deintermixture of VHF and UHF assignments in the same service areas.

ELECTRONICS ADVISOR—With a comprehensive background in naval electronics and for the past decade in industry, Commodore A. J. Spriggs (USN, ret.), Vice President in charge of the Packard-Bell Electronics Corp.'s eastern operations, is serving on loan from that company for one year as Advisor to Director Donald S. Parris of the Electronics Division of the Business & Defense Services Administration of the U. S. Department of Commerce. His selection was regarded as of key importance to this governmental agency, particularly with the increasing importance of electronics in the nation's defense. Commodore Spriggs held a number of key electronics assignments during his 30-year Navy career and from 1943 to 1946, when he retired, was Director of Electronics in the Office of the Chief of Naval Operations.

PAY TV CONGRESSIONAL HEARINGS—Chairman Oren Harris (D., Ark.) of the House Interstate & Foreign Commerce Committee has announced that his committee contemplates hearings on Pay Television early next year and "may possibly open the sessions" during December. Besides Rep. Harris' announcement, the possibility of hearings by the House Committee was strengthened by the fact that the House Committee has requested submission of detailed information regarding commitments, negotiations, or plans involving closed circuit Pay TV operations from three Bell System Companies, Skiatron TV, and the professional baseball and football teams in San Francisco and Los Angeles.

FCC MICROWAVE PROGRESS—An indication that the FCC is moving toward action in its study of future usage and allocation policies for the frequency bands above 890 megacycles was given in the presentation to the Commissioners by its staff in a report summarizing the various positions advanced in the lengthy oral hearings before the en banc Commission in mid-1957. Most of the questions involved in the hearing, concerning public safety, industrial and land transportation uses of microwave, are expected to be resolved by the FCC by either future policy pronouncements such as the intercity TV relay systems case or by rulemaking proceedings such as the assignment of frequencies for aeronautical telemetry.

National Press Building
Washington 4

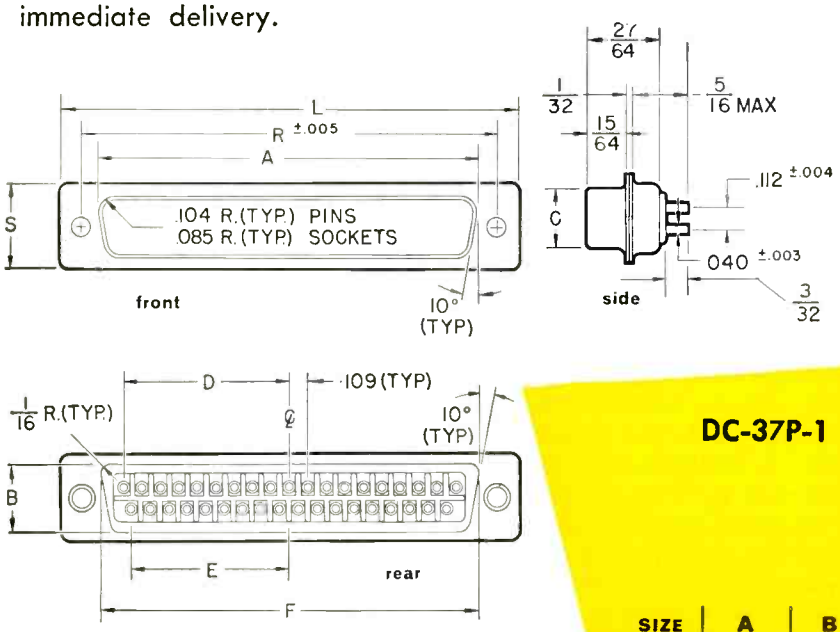
ROLAND C. DAVIES
Washington Editor

NEW PRINTED CIRCUIT SUB-MINIATURE CONNECTORS BY CINCH:

More than thirty years experience in the design and manufacture of standard electronic components insure Cannon Connectors by CINCH to be of the highest quality materials, fabricated to specifications to maintain consistent quality of product; highest standards throughout all operations.

D-SUB-MINIATURES: PRINTED CIRCUIT PIN AND SOCKET INSERTS

D Sub-Miniature plugs and sockets with printed circuit pin and socket inserts are now available as listed for immediate delivery.



CONDENSED DATA

SHELL MATERIAL—Steel with cadmium plate finish

CONTACT MATERIAL—Copper alloy with gold over silver plate

INSULATION MATERIAL—nylon or Diallyl-phthalate

POLARIZATION—keystone shell shape

CURRENT RATING—5 amperes

WIRE SIZE—#20 AWG

NUMBER OF CONTACTS—9, 15, 25, 37, or 50

VOLTAGE—D's will withstand a test voltage (60cps ac rms) of 1300 volts and show no evidence of breakdown. The test voltage is applied for a period of 1 minute between the contacts and between the contacts and the shell.

DIMENSION TAB

SIZE	A	B	C	D	E	F	L	R	S
DE- 9P-1	45/64	27/64	23/64	.216	.162	49/64	1-13/64	63/64	31/64
DE- 9S-1	41/64	27/64	5/16	.216	.162	49/64	1-13/64	63/64	31/64
DA-15P-1	1 - 1/64	27/64	23/64	.378	.324	1 - 3/32	1-17/32	1 - 5/16	31/64
DA-15-S1	31/32	27/64	5/16	.378	.324	1 - 3/32	1-17/32	1 - 5/16	31/64
DB-25P-1	1 - 9/16	27/64	23/64	.652	.598	1 - 5/8	2 - 5/64	1-55/64	31/64
DB-25S-1	1-33/64	27/64	5/16	.652	.598	1 - 5/8	2 - 5/64	1-55/64	31/64
DC-37P-1	2-13/64	27/64	23/64	.978	.924	2 - 9/32	2-23/32	2 - 1/2	31/64
DC-37S-1	2-11/64	27/64	5/16	.978	.924	2 - 9/32	2-23/32	2 - 1/2	31/64
DD-50P-1	2 - 7/64	17/32	15/32	.933	.879	2-11/64	2 - 5/8	2-13/32	39/64
DD-50S-1	2 - 5/64	17/32	27/64	.933	.870	2-11/64	2 - 5/8	2-13/32	39/64

Manufactured by Agreement with Cannon Electric Company

Cinch ELECTRONIC COMPONENTS

Centrally located plants at Chicago, Illinois; Shelbyville, Indiana; LaPuente, California; St. Louis, Missouri.

CINCH MANUFACTURING CORPORATION

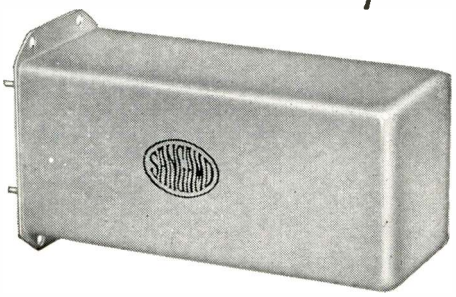
1026 South Homan Ave., Chicago 24, Illinois

Subsidiary of United-Carr Fastener Corporation, Boston, Mass.

Do You Have Critical Filter Problems?

SANGAMO MAY HAVE THE ANSWER TO YOUR PROBLEM

Sangamo Electric Company has been designing and building specialty filters since 1927. These filters have been used in a wide variety of metering, telephone and military equipment produced by Sangamo, and by a limited group of electrical and electronic manufacturers. Sangamo's thirty years of filter design and manufacturing experience is now available to the industry.



Here's a Typical Example: The filter illustrated was required for use in a circuit which was designed to amplify extremely small signals in the range of 25 KC to 26 KC.

BASIC OPERATIONAL AND DESIGN SPECIFICATIONS:

Meet applicable requirements for military apparatus.

Operate in a plate circuit of an amplifier presenting an effective generator impedance of 47,000 ohms and to drive the grid circuit of the following amplifier stage.

Operate at signal level as low as 10 microvolts.

Must be well shielded against external fields.

Passband ripple not to exceed 1 db. from 25 KC to 26 KC.

Minimum rejection shall be 35 db. at 28 KC and 40 db. at 23 KC.

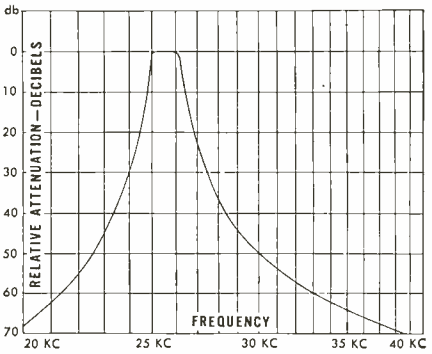
The phase shift, from one production filter to another, shall not vary more than 5° at any point in the 25 KC to 26 KC bandpass.

The phase shift and attenuation characteristics must be reproducible over a long period of years to insure properly functioning spare parts.

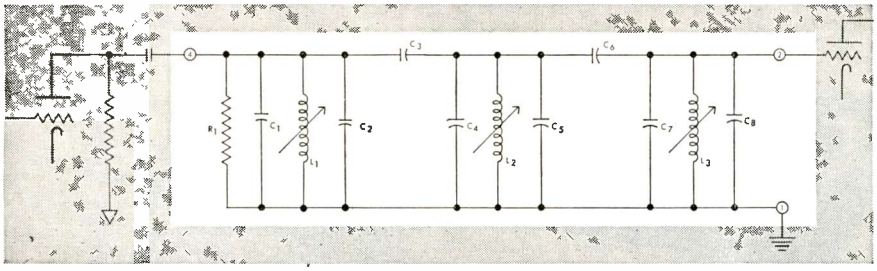
Temperature range 0° to 85°C.

SANGAMO SOLUTION TO PROBLEM

The above requirements were met by using three parallel tuned circuits properly coupled by capacitors. Selection of the L-C ratios, coupling, and circuit Qs were made in order to fulfill the overall response requirements and at the same time present the proper load to the driving amplifier stage. Stability requirements were obtained by using Sangamo silvered mica capacitors. Negative temperature coefficient capacitors were inserted in parallel with the tuned circuits to correct for the positive temperature coefficient of the inductors. A phase shift variation of 2.5° maximum from 25 KC to 26 KC has been consistently maintained during eight years of production on these units. The universal wound coils are enclosed in powdered iron cups with moveable slugs for precise adjustment of the response and the phase shift. These inductors manufactured by Sangamo have uniform distributed capacity and Q. The cup-enclosed inductance coils are in turn housed in a die-cast aluminum enclosure. This housing lends physical rigidity to the coupled structure and assists in minimizing magnetic interaction between the enclosed inductors. The entire filter assembly is enclosed in a hermetically sealed drawn steel case. The terminals are of the extremely rugged compression glass type.



Relative response curve of this Sangamo bandpass filter.



C_1, C_4, C_7—Temperature Compensators
C_2, C_3, C_5, C_6, C_8—Sangamo Silvered Mica Capacitors

Write us today for an engineering analysis of your specialized filter applications. Sangamo's engineers are ready to help you.

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

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ALPHABETICAL LISTING OF

CIRCLE THE NUMBERS OPPOSITE THE NAMES OF THE

105 **Acme Electric Corporation**—Voltage stabilizers
92 **Aetna Life Insurance Company**—Business life insurance
79 **Aircraft Radio Corporation** — Ceramic insulated connectors
47 **Airtron, Inc., A Division of Litton Industries**—Microwave relay waveguide components.
112 **Alford Manufacturing Company**—Coaxial switches
10 **Allen Brodley Co.**—Power ferrite for flyback transformers
66 **Alpha Wire Corporation**—Wire and cable fabrication
67 **Alphlex Tubing Division Alpha Wire Corporation**—Plastic tubing and sleeping
116 **American Instrument Co., Inc.**—Refrigerated test cabinets
72 **Amperex Electronic Corp.** — Miniature twin triode
Amphenol Electronics Corporation — Ground support equipment connectors
57 **Armco Steel Corporation** — Nickel-iron magnetic alloys
30 **Audio Development Company** — Transformers & filters
94 **Automatic Manufacturing Division of General Instrument Corp.** — Silicon rectifiers
36 **Barker & Williamson, Inc.** — Subminiature toroids
68 **BJ Electronics, Borg-Warner Corporation** — Digital transducers, Instrumentation & Recording Systems
56 **Blaw-Knox Company, Equipment Division**—Microwave towers
119 **Bliley Electric Company**—Ultrasonic delay lines
2 **Bomac Laboratories, Inc.** — Microwave tubes
31 **Bourns Laboratories, Inc.** — Potentiometers
70 **Bruno-New York Industries Corp.**—Lead cutting & bending machine for axial lead components
93 **Brush Instruments Division of Clevite Corporation**—Recording systems
9 **Burnell & Co., Inc.**—Variable toroids
27 **Burnell & Co., Inc.**—Constant delay filters
54 **Bussmann Mfg. Division McGraw-Edison Co.**—Fuses and fuseholders
29 **Cannon Electric Co.**—Miniature & conventional solenoids
26 **Centralab A Division of Globe-Union Inc.**—Laminated phenolic switches
99 **Chicago Standard Transformer Corporation**—Transistor transformers
41 **Cinch Manufacturing Corporation, Subsidiary of United-Carr Fastener Corp.** —Printed circuit sub-miniature connectors
59 **Corning Glass Works**—Trimmer capacitors
101 **Cutler-Hammer, Inc.**—Toggle switches
17 **Dale Products Inc.**—Deposited carbon film resistors
18 **Dale Products Inc.** — Non-inductive power resistors
58 **Delco Radio Division of General Motors** —High power transistors
87 **Designers for Industry** — Frequency standards
125 **Dialight Corporation** — Ultra-miniature indicator lights
102 **Dimco-Gray Company** — Snapslide fastener
113 **DuMont Instrument Division, Allen B. DuMont Laboratories, Inc.**—Oscilloscope
129 **Eico**—Electronic catalog
81 **Electra Mfg. Co.**—Carbon film resistor
95 **Electro-Motive Mfg. Co., Inc., The**—Ceramic disc capacitors
46 **Electronic Tube Corporation** — Oscilloscopes, cathode-ray tubes
34 **Elgin National Watch Company, Electronics Division**—Relays
19 **Engelhard Industries, Inc., Baker Contact Division**—Precious metal contacts
20 **Engelhard Industries, Inc., Chemical Division**—Rhodium plating
21 **Engelhard Industries, Inc., Chemical Division**—Gas generator
8 **Engineered Electronics Company**—Neon glow tube & incandescent lamp indicators
28 **Erie Electronics Division, Erie Resistor Corp.**—Modular resistor package with wire leads
33 **ESC Corporation** — Wide band video transformers
89 **Ferroxcube Corporation of America**—Ferrite recording head cores
65 **Fluocarbon Products Inc. Division of United States Gasket Co.**—Miniature connectors
91 **Formica Corporation, Subsidiary of American Cynamid**—High temperature laminated plastic insulator
126 **Freed Transformer Co., Inc.**—Inductance Bridge, Megohmmeter
130 **F X R Incorporated**—Microwave Equipt.
77 **Gates Radio Company, Subsidiary of Harris-Intertype Corporation**—Speech input system
82 **General Chemical Division, Allied Chemical Corp.**—High purity germanium
108 **General Electric Company**—Voltage regulators
118 **General Electric Company**—Voltage regulators
122 **General Electric Company**—Voltage regulators
114 **General Precision Laboratory Incorporated**—Closed circuit TV equipment
80 **General Transistor Corporation** — High voltage NPN transistors
88 **Graphic Systems**—Visual control board
96 **Handicraft Tools, Inc., A Division of X-Acto, Inc.**—Industrial knives with interchangeable blades
74 **Houston Fearless Corp.** — TV camera mounts, pedestals & dollys
7 **Hughes Aircraft Company, Hughes Products**—Precision crystal filters
49 **Hycon Eastern, Inc.** — Crystal filters, Digital timing generator, tape searching unit, oscillator, telemetering diplexers
111 **Illinois Condenser Company**—Sub-miniature electrolytic capacitors
120 **Illmitronic Engineering**—Plastic wrap
60 **Institute of Radio Engineers, The**—The IRE National Convention and the Radio Engineering Show
4 **International Rectifier Corporation** — Silicon diode without heat link
3 **International Rectifier Corporation** — Silicon diodes, High temperature
5 **International Rectifier Corporation** — Stud mounted silicon diode
15 **International Resistance Corporation**—R-F chokes and wire wound resistors
123 **International Resistance Corporation**—Sub-miniature potentiometers
106 **Johnson Co., E. F.**—Ceramic soldered capacitors
104 **Jones Division, Howard B., Cinch Manufacturing Corp.** — Shielded type plugs & sockets
25 **Koster Solder Company**—Solder
45 **Kittleson Company** — Electronic Manufacturer's Representatives
64 **Klein & Sons, Mathias**—Pliers
61 **Kleinschmidt Division of Smith-Corona Marchant Inc.**—Teleprinter communications equipment
97 **Kulka Electric Corp.**—Power outlets
43 **Lenz Electric Manufacturing Co.**—Wire & cable
86 **Magnetic Amplifiers Inc.**—Static inverter supply
78 **Marconi Instruments** — Vacuum tube voltmeter
39 **Motorola Semiconductors, Motorola, Inc.** —Zener diodes
55 **Minnesota Mining & Mfg. Co., Instrumentation Tape Div.**—Magnetic instrumentation tape
35 **National Lead Company**—Solder specialists
63 **New Hermes Engraving Machine Corp.** —Engraving machine

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ADVERTISERS IN THIS ISSUE

ADVERTISERS FROM WHOM YOU DESIRE FURTHER INFORMATION

127 **Panoramic Radio Products, Inc.**—Spectrum analyzer
107 **Patwin A Division of the Patent Button Company**—Digital readout indicator
51 **Phelps Dodge Copper Products**—Coaxial cable
11 **Raytheon Manufacturing Company, Microwave & Power Tube Operations**—Magnetrons & klystrons
52 **Raytheon Manufacturing Company, Commercial Equipment Div.**—Microwave relay system

PROFESSIONAL ENGINEERING OPPORTUNITIES

Circle number of company on card at right from whom you desire further information.

504 **International Telephone & Telegraph Corp., ITT Compounds Div.**—Engineering personnel
505 **Melpar, Incorporated**—Engineering personnel
506 **National Cash Register** — Engineering personnel
507 **Raytheon Manufacturing Company, Missile Systems Div.**—Engineering personnel
502 **Systems Development Corp.**—Engineering personnel

109 **Radio Receptor Company, Inc., Subsidiary of General Instrument Corporation**—Selenium rectifier
1 **Radio Materials Company**—Ceramic disc capacitors
124 **Red Bank Division, Bendix Aviation Corp.**—Transistors
121 **Rohn Mfg. Corp.**—Communication towers
48 **Rotron Manufacturing Co., Inc.**—Blowers and fans
76 **Sangamo Electric Company**—Filters
75 **Sarkes Tarzian Inc.**—Video level control unit
53 **Sarkes Tarzian Inc., Rectifier Division**—
22 **Scintilla Division Bendix Aviation Corporation**—
73 **Secode Corporation** — Selective control devices
131 **Servo Corporation of America**—Servos
84 **Shielding, Inc.**—RF shielding enclosure
50 **Spencer-Kennedy Laboratories, Inc.** — Filters, amplifiers, pulse generator
32 **Sperry Semiconductor Division, Sperry Rand Corporation** — Silicon PNP transistors
6 **Sprague Electric Company**—Carbon film resistors
28 **Sprague Electric Company**—Metallized paper capacitors
14 **Stackpole Carbon Company, Electronic Components Div.**—
69 **Stromberg-Carlson A Division of General Dynamics Corp.**—Relays with plug-in mountings
13 **Tektronix, Inc.**—Oscilloscopes
44 **Tensolite Insulated Wire Co.**—Hook-up wire
12 **Texas Instruments Incorporated**—Silicon transistors
16 **Texas Instruments Incorporated**—Voltage regulators
37 **Tinnerman Products, Inc.**—Clips for capacitors and other cylindrical parts
110 **Tung-Sol Electric Inc.**—Power triodes
115 **United Transformer Corp.** — Transistor transformers
40 **Varian Associates, Instrument Division**—Strip chart recorders
100 **Waters Manufacturing, Inc.**—Dial type potentiometer
24 **Weller Electric Corp.**—Soldering irons with built-in temperature control
98 **Wells Industries Corporation**—Dry air supply for electric equipment
103 **Westinghouse Electric Corporation, Electronic Tube Div.**—VHF beam power pentodes
117 **West Texas Utilities Company**—Industrial location opportunities
71 **Williams & Co., C. K.**—Ferric oxides, magnetic iron oxides, and powders

Employment—Use the handy card below to get more information on the engineering positions described in the "Professional Opportunities" Section which begins on page 179 of this issue.

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502	507	512	517	522
503	508	513	518	523
504	509	514	519	524
505	510	515	520	525

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New Products—December '58

234 **Block, terminal**—Camblock Corp.
189 **Capacitor**—P. R. Mallory
169 **Cells, silicon solar**—International Rectifier Corp.
243 **Cleaner, ultrasonic**—Narda Ultrasonics
175 **Connectors**—Cannon Electric Co.
178 **Connectors, tube cap**—Alden Products Co.
170 **Diodes, zener**—Motorola, Inc.
230 **Detector, distance**—Bently Scientific
179 **Divider, voltage**—Rinco, Inc.
238 **Dual Feed Horn**—D. S. Kennedy & Co.
236 **Echoraser**—Audio Devices, Inc.
192 **Commutator, electronic** — Packard Bell Computer Corp.
171 **Indicator, digital** — Westinghouse Air Brake Co.
241 **Inverter**—Electrosolids Corp.
187 **Inverters**—Spectrol Electronic Corp.
176 **Irons, soldering**—Weller Electric Co.
164 **Kit, terminal**—AMP, Inc.
237 **Meter, distortion**—Barker & Williamson, Inc.
163 **Meter, frequency** — Allen B. Dumont Labs., Inc.
233 **Meter, millivolt**—B & H Instruments, Inc.
235 **Microphones**—Electro-Voice, Inc.
240 **Modulator, amplitude**—Kay Electric Co.
182 **Motor, miniature**—Western Gear Corp.
174 **Motor, servo**—John Oster Mfg., Co.
186 **Phototube, multiplier**—RCA Tube Division
232 **Player, tape**—International Radio & Electronics Corp.
242 **Plotter, impedance**—Alford Mfg., Co.
162 **Probe, peak-meter**—Control Devices, Inc.
231 **Reference, voltage** — Transitron Electronic Corp.
193 **Regulators, zener**—Hoffman Electronics
161 **Relay, coaxial** — Jennings Radio Mfg., Corp.
181 **Relays, delay**—Curtiss-Wright Corp.
169 **Relay, sensitive** — American Instrument Co., Inc.
191 **Resistors, carbon film** — Dale Products Inc.
177 **Resistors, precision**—Ohmite Mfg., Co.
239 **Resistor, variable**—Centralab, Inc.
165 **Tape, insulating**—Minnesota Mining and Manufacturing Co.
166 **Terminal, slotted-lug**—Sealectro Corp.
172 **Tester, time stability**—Laboratory for Electronics, Inc.
244 **Tower, self-supporting**—Rohn Mfg., Co.
173 **Transformer, input**—Microtran Co.
190 **Transformers, transistor**—United Transformer Corp.
188 **Transistors, PNP**—Sperry Semiconductor Co.
180 **Tube, storage** — Westinghouse Electric Corp.
185 **Tube, traveling wave** — Sylvania Electric Products, Inc.
195 **Voltmeter, digital** — Beckman Instruments, Inc.
167 **Voltmeter, frequency**—Varo Mfg., Co.
196 **Switch, ferrite**—Raytheon Mfg., Co.
194 **Power supply**—P. R. Mallory & Co.

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NEW HIGH VOLTAGE NPN TRANSISTORS ALLOW TUBE REPLACEMENT AND CIRCUIT COMPATIBILITY

ACTUAL SIZE

GT's new high voltage germanium alloyed junction transistors now allow the same optimization as formerly could be realized only with vacuum tubes. These characteristics plus conventional "transistor" advantages offer new design opportunities in computers, magnetic memory cores, data processing equipment, gas filled indicator tubes and other applications where reduction of space, weight and high reliability are prime requisites.

The GT 1200 is particularly suited to drive gas filled display tubes, such as the Burroughs Nixie ® and Pixie ®, without changing existing circuitry other than altering voltages so as not to exceed the rating of the transistor.

		GT 1200
Collector to Base Voltage (Emitter Open)	$I_C = 25\ \mu A$	90 Volts Min.
Emitter to Base Voltage (Collector Open)	$I_E = 25\ \mu A$	20 Volts Min.
Collector to Emitter Voltage (Punch Through)	$I_E = 25\ \mu A$	90 Volts Min.

Supplied in TO-9 case

GT 1201 — GT 1202, in addition to driving gas filled display tubes, are ideally suited for driving high inductance loads, driving transformer coupled loads and allow more nearly perfect impedance matching. These transistors are fast devices capable of handling high impedance loads and large signal swings.

		GT 1201	GT 1202
Collector to Base Voltage (Emitter Open)	$I_C = 25\ \mu A$	75 Volts Min.	45 Volts Min.
Emitter to Base Voltage (Collector Open)	$I_E = 25\ \mu A$	20 Volts Min.	20 Volts Min.
Collector to Emitter Voltage (Punch Through)	$I_E = 25\ \mu A$	75 Volts Min.	45 Volts Min.

Supplied in TO-9 case

Write today for Bulletin GT 1200

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GENERAL TRANSISTOR

C O R P O R A T I O N

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WIRE—
In the Electronic Industry

For the electronic design engineer here is a presentation of significant wire information. Included are: ASA & ASTM wire gauge standards; a general summary of Mil Specs; a graphical summary of MIL-W-76A; color coding for hook-up and component interconnection wire; aircraft wiring code designations; and a flexible wire chart for consumer electronic equipment and appliances per Underwriters' Labs.

RESISTIVITY OF METALS*

(As compared to Copper)

Aluminum (pure)	1.70
Brass	3.57
Cadmium	5.26
Chromium	1.82
Copper (hard drawn)	1.12
Copper (annealed)	1.00
Iron (pure)	5.65
Lead	14.3
Nickel	6.25-8.33
Phosphor Bronze	2.78
Silver	0.94
Tin	7.70
Zinc	3.54

*Approx.—Various alloys will change factors given.

This is the first in a planned series of editorial features on wire and cable and their applications in the electronic industry.

RESISTANCE CONVERSION

$$R_t = R_o\left[1 + \alpha\,(t - t_o)\right]$$

R_t = Resistance at operating temperature
R_o = Resistance at a known temperature such as table below
t = Operating temperature
t_o = Temperature for a known resistance and α
α = Temperature coefficient of resistance at t_o (0.00393/degree C for table below)

AMERICAN WIRE GAUGE*

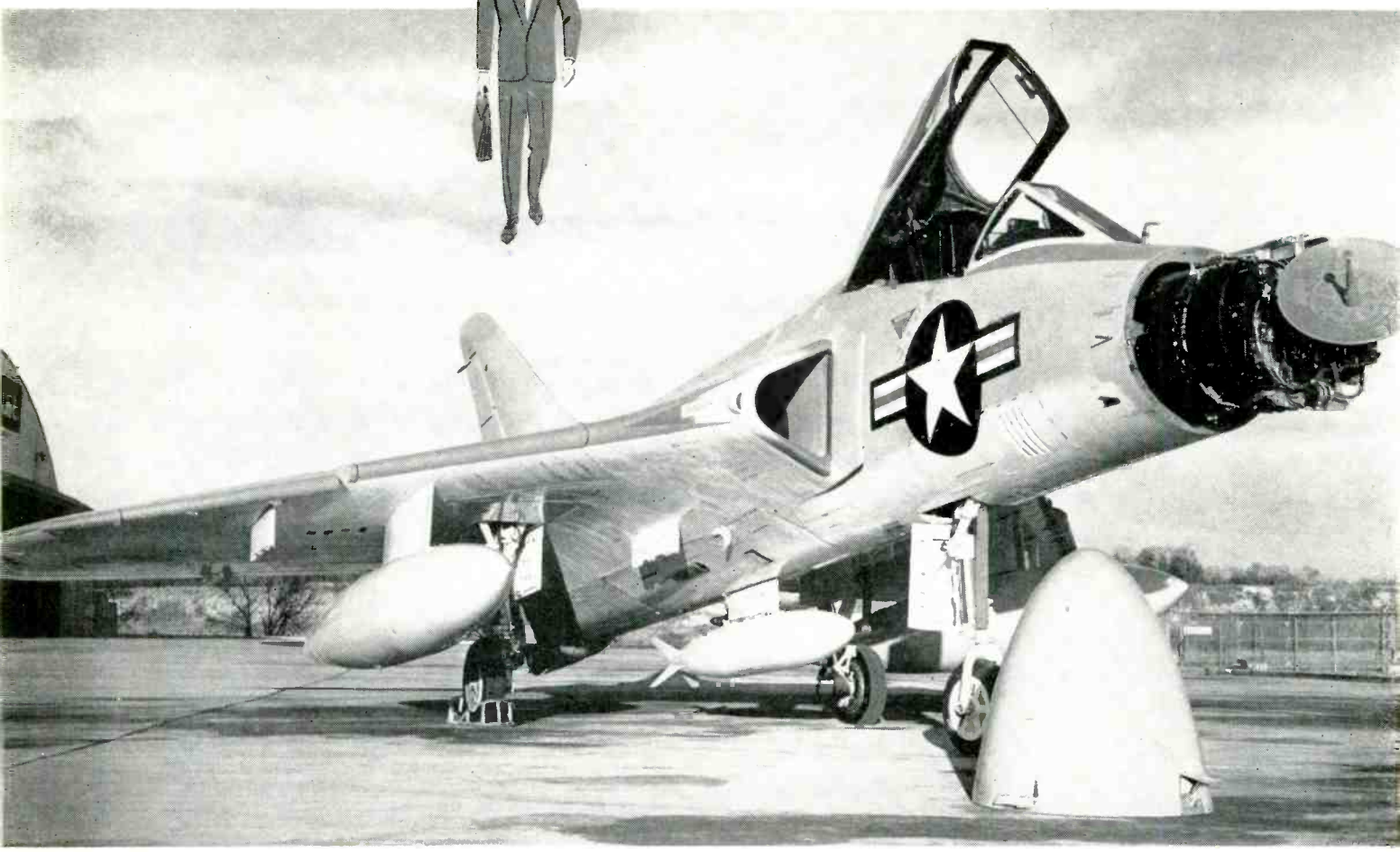
Nominal Diameters and cross-sectional areas of bare, solid round, annealed copper wires at 20° C.

DIMENSIONS — WEIGHTS — RESISTANCES

AWG	Diam. (In.)	Area (Cir. Mil)	Weight (Lbs/M Ft.)	D.C. Resist. (Ohms/M Ft.)
#40	.0031	9.61	.0291	1080
#39	.0035	12.2	.0371	847
#38	.0040	16.0	.0484	648
#37	.0045	20.2	.0613	512
#36	.0050	25.0	.0757	415
#35	.0056	31.4	.0949	331
#34	.0063	39.7	.120	261
#33	.0071	50.4	.153	206
#32	.0080	64.0	.194	162
#31	.0089	79.2	.240	131
#30	.0100	100.	.303	104
#29	.0113	128	.387	81.2
#28	.0126	159	.481	65.3
#27	.0142	202	.610	51.4
#26	.0159	253	.765	41.0
#25	.0179	320	.970	32.4
#24	.0201	404	1.22	25.7
#23	.0226	511	1.55	20.3
#22	.0253	640	1.94	16.2
#21	.0285	812	2.46	12.8
#20	.0320	1020	3.10	10.1
#19	.0359	1290	3.90	8.05
#18	.0403	1620	4.92	6.39
#17	.0453	2050	6.21	5.05
#16	.0508	2580	7.81	4.02
#15	.0571	3260	9.87	3.18
#14	.0641	4110	12.4	2.52
#13	.0720	5180	15.7	2.00
#12	.0808	6530	19.8	1.59
#11	.0907	8230	24.9	1.26
#10	.1019	10380	31.4	.9988
#9	.1144	13090	39.6	.7925
#8	.1285	16510	50.0	.6281
#7	.1443	20820	63.0	.4981
#6	.1620	26240	79.4	.3952
#5	.1819	33090	100.	.3134
#4	.2043	41740	126	.2485
#3	.2294	52620	159	.1971
#2	.2576	66360	201	.1563
#1	.2893	83690	253	.1239
1/0	.3249	105600	319	.09825
2/0	.3648	133100	403	.07793
3/0	.4096	167800	508	.06182
4/0	.4600	211600	641	.04901

*These wire sizes are recommended by ASTM and ASA. They are considered practical sizes.

How the man from Tensolite cuts assembly costs



Westinghouse Aero 13 Armament Control System, mounted in nose of Navy F4D Douglas carrier-based interceptor, is typical of systems using FLEXOLON *wire for faster assembly, lower production costs.*

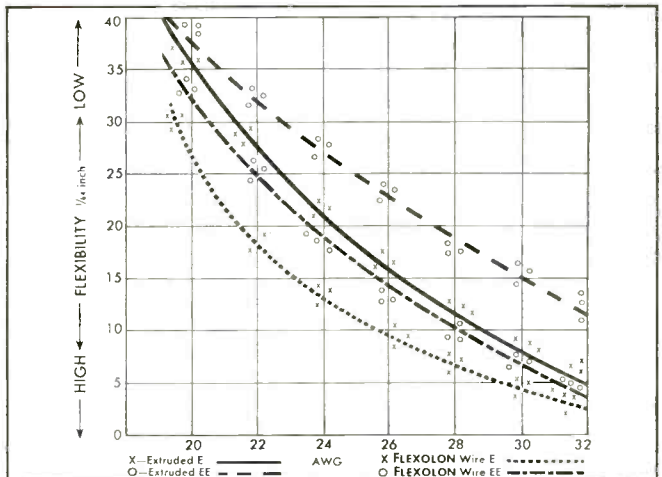
FLEXOLON hook-up wire with Raybestos-Manhattan R/M "Teflon" tape proves most flexible

Developed and manufactured to answer industry's demands for increased wire flexibility, new FLEXOLON high temperature hook-up wire meets with ease the extra-flexibility requirements of today's most intricate circuit layouts.

FLEXOLON wire's greater flexibility was proven in a recent series of tests on the new hook-up wire and wires of other construction. In test after test FLEXOLON wire, insulated with Raybestos-Manhattan "Teflon" tape, proved consistently more flexible than all other high temperature hook-up wires tested.

The flexibility advantage of FLEXOLON wire is cutting assembly costs for many manufacturers. At Westinghouse, for example, the new hook-up wire makes an easier job of wiring intricate harnesses for armament control systems . . . assuring faster assembly and production.

Surpassing the requirements of MIL-W-16878C . . . and providing greater dielectric strength and higher average concentricity . . . new FLEXOLON hook-up wire is another example of Tensolite's continuous leadership in miniature wire development.



FLEXIBILITY COMPARISON OF FLEXOLON WIRE AND EXTRUDED WIRE

Plot of flexibility as recorded in tests proves greater flexibility of FLEXOLON *wire with R/M "Teflon" tape insulation. For complete testing data, call the man from Tensolite, or write for free* FLEXOLON *hook-up wire bulletin.*

Tensolite INSULATED WIRE CO., INC.

West Main Street, Tarrytown, N. Y. • Pacific Division: 1516 N. Gardner St., Los Angeles, Calif.

FLEXOLON is a trademark of Tensolite Insulated Wire Co., Inc. TEFLON is a registered trademark of the DuPont Company

Circle 44 on Inquiry Card, page 83

Synopsis of
Government Wire Specifications

Some of the more common wire specifications are given below in a brief form to aid the engineer in determining what a particular specification is.

MIL-W-76A—This specification covers synthetic-resin-insulated electrical hookup wire and cable for use at temperatures from 40°C to 80°C. It is approved by the Army, Navy and Air Force. This supercedes JAN-C-76 and MIL-W-12410 (Sig. C). Applications cover the electronic field and it is probably the most used specification. More information is given on a following page.

MIL-W-583A—Electrical magnet wire for fabricating armature coils, field coils, solenoid coils, transformer coils, and other such windings intended for use in electrical and electronic equipment.

MIL-W-3861—This specification covers solid, bunch-stranded, concentric-lay-stranded, and rope-lay-stranded round electrical wire fabricated from copper having a minimum purity of 99.900%, silver content being counted as copper.

MIL-W-5086A—Covers 600 volt single-conductor insulated copper wire for aircraft electrical use. It is intended for use in ambient temperatures from —67°F to 135°F. May be used to ambient temperatures to 221°F with suitable derating. Voltages to 600 v. rms.

ML-W-5274A—Covers aircraft wire which has a voltage rating of 600 volts. Operating temperature range is—55°C to 60°C.

MIL-W-6370B—This covers insulated wire for use in external aircraft antennas.

MIL-W-7072A (ASG)—Low-tension, 600 volt insulated, single-conductor, aluminum wire for aircraft electrical power distribution systems.

MIL-W-7139A—Requirements for 600 volt, single conductor, insulated, copper wire to provide continuous operation at a total temperature up to 400°F, and to operate for a short time in the event of a fire. Intended for airframe wiring.

MIL-W-8777A (ASG)—Covers aircraft wire with an operating temperature range from—55°C to 150°C at 600 volts. Primary insulation calls for silicon rubber and calls for an outer brad or protective cover. It is resistant to flame, fuels, abrasion, fungus, and solvents.

MIL-W-16878C (Navy)—This specification covers wire designed for the internal wiring of meters, panels and electrical and electronic equipment to have minimum size and weight consistent with service requirements. The temperature rating of wire ranges from 80°C to 200°C with potential ratings from 75 to 3,000 volts rms.

MIL-W-19583 (Navy)—Wire, electrical, magnet, high temperature Magnet wires covered are divided into three temperature ranges—130°C, 180°C and 200°C. AWG sizes from 4 to 46.

MIL-C-17B—This specification covers flexible shielded cables, employing solid and semi-solid dielectrics, for use as r-f transmission lines in radar and communications systems of the Armed Services. It covers coaxial, dual coaxial, twin conductor, and twin lead.

MIL-C-915A (Ships)—Specification covers electric cable for shipboard use. Cables fall into the following general classifications: cables for nonflexing use; cables for repeated flexing service; cables, thin-walled; and miscellaneous wires.

MIL-C-3432A—This specification covers light-, intermediate-, and heavy-duty, flexible and extra-flexible, single-conductor and multiconductor cable, shielded and unshielded, for use in circuits of 300 and 600 volts rms. It also covers heavy-duty, multiconductor, unshielded cable containing ground wires.

MIL-C-3883—Covers single-wire and multi-wire electrical cord, in which wires are all of the same wire size for use in audio-frequency applications. This is a braided armored cable among whose applications are for shipboard use.

MIL-C-5186 (USAF)—Two-conductor Cordage CO-219 for microphone extension cords in military aircraft.

MIL-C-5252B (USAF)—A type of 5-conductor Cordage WM-53/U for use with Jack U-82/U as extensions for combination headsets-microphones.

MIL-C-5756B (ASG)—This covers 600 volt heavy-duty, single-conductor wire and multiconductor electric cable for severe flexing service. It has a jacket or cover of synthetic- or natural-rubber compounds. Intended for power cables, lighting equipment, portable generating equipment and temporary power distribution systems.

MIL-C-5898A (USAF)—One type of four-conductor cordage, designated Cordage WF-5/U. It is for use with Jack U-61/U to make-up combination headset-microphone extension cords for aircraft.

MIL-C-7078A—This specification covers the application of shields to types listed under MIL-W-5086A.

MIL-C-25038 (USAF)—Specification covers high temperature and fire-resistant electric cable for aircraft. Cable is nickel clad copper with insulations that will operate in an ambient temperature of 650°F. It is for use in aircraft electrical circuits which may be subject to flames.

MIL-C-25622A—Covers one type of two-conductor cord designated Cord, Electrical WD-34/U. It is for use with microphones and must withstand at least 25,000 flexing cycles.

MIL-E-9085A (USAF)—Covers a 5-conductor cord, WM-85/U, which is used with plug connector U-94( )/U for aircraft intercom. set AN/AIC-10 portable mike switch.

MIL-E-9088A (USAF)—A 4-conductor cord, WF-14/U, which is used with telephone jack U-92( )/U for intercom. set AN/AIC-10 as extension cord.

NAS-702—Specification by National Aircraft Standards Committee covers wire which operates at 105°C. It is presently finding use as a general purpose and hookup wire in aircraft for voltages to 2500 volts.

NAS-703—National Aircraft Standard covers high temperature, insulated, copper hook-up wire. Voltage ranges are 600 and 1000 volts. Temperature range is to 200°C from AWG 32-8.

Standard Color Codes for Wire

ANTENNA AND GROUND LEADS

When leads for antenna and ground connections are provided on the receiver, it shall be standard to color code the antenna lead blue and the ground lead black. Special antenna connection leads shall be coded with combinations of blue and black.

CHASSIS WIRING

Where color coding is so used, it shall be standard to employ the following schedule of solid colors for chassis hook-up and component-lead wire insulation:

Seq. No.	Color Name	Circuit Name
0	Black	Grounds, grounded elements, and returns
1	Brown	Heaters or filaments, off ground
2	Red	Power Supply B plus
3	Orange	Screen grids
4	Yellow	Cathodes
5	Green	Control Grids
6	Blue	Plates
7	Violet	Not Used
8	Gray	A.C. Power Lines
9	White	Above or below ground returns, AVC, etc.

TELEVISION CHASSIS WIRING

Body and Tracer Colors	Circuit Name
Black (solid)	Grounds (grounded elements and grounded returns)
Black-Brown	Identified ground (as grounded heater or fil)
Black-Red	Identified ground (as grounded B minus)
Black-Yellow	Identified ground (as grounded cathode)
Black-Green	Identified ground (as grounded grid)
Brown (solid)	Heaters or filaments (above or below ground)
Brown-Red	Identified htr or fil (as rectifier htr or fil)
Brown-Yellow	Identified htr or fil (any auxiliary htr or fil)
Brown-Green	Identified htr or fil (any auxiliary htr or fil)
Brown-White	Heater or filament center tap (not grounded)
Red (solid)	Power supply B plus (general or main stem)
Red-White	Identified B plus (as unfiltered B from fil)
Red-Blue	Identified B plus (as above main stem)
Red-Yellow	Identified B plus (as below main stem)
Red-Green	Identified B plus (intermediate voltage)
Red-Black	Identified B plus (intermediate voltage)
Red-Blu-Yel	Identified B plus (intermediate voltage) (see Black-Red and White-Red for B minus)
White (solid)	Bias supply, B or C minus (main stem)
White-Red	B minus below ground (maximum value)
White-Orange	C minus (intermediate fixed value)
White-Yellow	C minus (intermediate fixed value)
White-Green	C minus (preferred for AVC bias)
White-Brown	C minus (intermediate AVC bias)
White-Black	Alternative ground or off-ground connection
White-Blue	Internal antenna or to antenna coil
Wht-Red-Blu	Universal substitute wire
Green (solid)	Control grids and diode plates (General)
Green-White	Diode plate (if identified from control grid)
Green-Red	Identified grid (as thyratron control grid)
Green-Yellow	Identified grid (as oscillator control grid)
Blue (solid)	Plates, except diode plates (General)
Blue-Red	Identified plate (as rectifier plate and HV AC)
Blue-Yellow	Identified plate (as Osc. plate or "anode grid")
Yellow (solid)	Cathodes (above or below ground)
Yellow-Red	Identified cathode (as pwr. amp. cathode)
Yellow-Green	Identified cathode (as picture tube cathode)

I-F TRANSFORMERS

Blue —plate lead.
Red —"B" + lead.
Black —grid (or diode) return.
Green —grid (or diode) lead.

NOTE: If the secondary of the i-f transformer is center-tapped, the second diode plate lead is green-and-black striped, and black is used for the center-tap lead.

A-F TRANSFORMERS

Blue —plate (finish) lead of primary.
Red —"B" + lead (this applies whether the primary is plain or center-tapped).
Brown—plate (start) lead on center-tapped primaries. (Blue may be used for this lead if polarity is not important.)
Green —grid (finish) lead to secondary.
Black —grid return (this applies whether the secondary is plain or center-tapped).
Yellow—grid (start) lead on center-tapped.

NOTE: These markings apply also to line-to-grid and tube-to-line transformers.

NAVY CABLE COLOR CODE

Per Specification MIL-C-915A (Ships)

Conductor No.	Base Color	Tracer Color	Tracer Color
1	Black		
2	White		
3	Red		
4	Green		
5	Orange		
6	Blue		
7	White	Black	
8	Red	Black	
9	Green	Black	
10	Orange	Black	
11	Blue	Black	
12	Black	White	
13	Red	White	
14	Green	White	
15	Blue	White	
16	Black	Red	
17	White	Red	
18	Orange	Red	
19	Blue	Red	
20	Red	Green	
21	Orange	Green	
22	Black	White	Red
23	White	Black	Red
24	Red	Black	White
25	Green	Black	White
26	Orange	Black	White
27	Blue	Black	White
28	Black	Red	Green
29	White	Red	Green
30	Red	Black	Green
31	Green	Black	Orange
32	Orange	Black	Green
33	Blue	White	Orange
34	Black	White	Orange
35	White	Red	Orange
36	Orange	White	Blue
37	White	Red	Blue
38	Brown	.....	
39	Brown	Black	
40	Brown	White	
41	Brown	Red	
42	Brown	Green	
43	Brown	Orange	
44	Brown	Blue	

Wire Color Codes (Cont'd)

MIL-STD-122 COLOR CODE

This is the color code standard for chassis wiring of electronic equipment for all services.

Color	Circuits
Black	Grounds, grounded elements, and returns
Brown	Heaters, or filaments, off-ground
Red	Power supply B+
Orange	Screen grids
Yellow	Cathodes
Blue	Plates
Violet	Power Supply, minus
Gray	AC power lines
White	Miscellaneous, above ground returns, AVC, etc.

POWER TRANSFORMERS

Primary Leads—Black
If Tapped:
Common—Black
Tap—Black & Yellow Stripe
Finish—Black & Red Stripe

High-Voltage Plate Winding—Red
Center-Tap—Red & Yellow Stripe

Rectifier Filament Winding—Yellow
Center-Tap—Yellow & Blue Stripe

Filament Winding No. 1—Green
Center-Tap—Green & Yellow Stripe

Filament Winding No. 2—Brown
Center-Tap—Brown & Yellow Stripe

Filament Winding No. 3—Slate
Center-Tap—Slate & Yellow Stripe

NATIONAL ELECTRICAL CODE

Multi-Wire Circuits

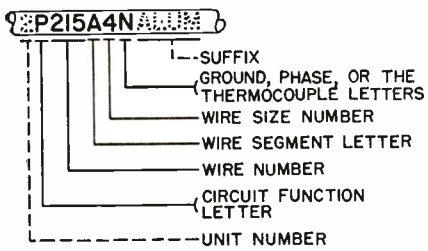
If installed in raceways as open work, or as concealed knob and tube work, the conductors of multi-wire branch circuits and 2-wire branch circuits connected to the same system shall conform to the color code.

If more than one multi-wire branch circuit is carried through a single raceway the ungrounded conductors of the additional circuit may be of colors other than those specified. All circuit conductors of the same color must be connected to the same ungrounded feeder conductor throughout the installation.

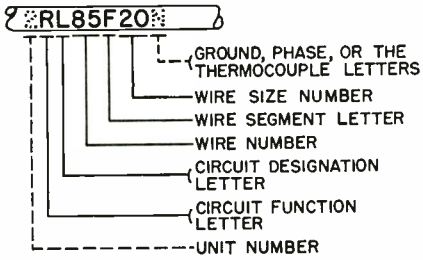
Circuits	Colors
3-wire	Black, red, white
4-wire	Black, red, white, blue
5-wire	Black, red, white, blue, yellow

Ground only, Green if not bare.

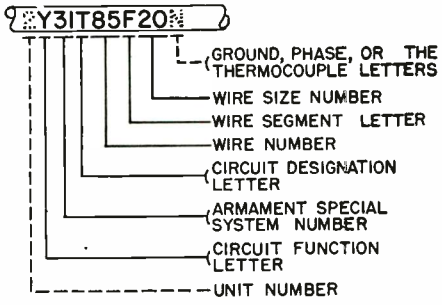
Aircraft Wiring Designations



AS APPLIED TO ALL CIRCUIT FUNCTIONS EXCEPT R, S, T, AND Y



AS APPLIED ONLY TO CIRCUIT FUNCTIONS R, S, AND T



AS APPLIED ONLY TO CIRCUIT FUNCTION Y

Examples of wire identification are shown above. The key designation, which is the circuit function letter, is listed in alphabetical order below. This designation letter enbales the engineer to determine what circuit a particular lead is used for.

FUNCTION LETTER	CIRCUITS
A	ARMAMENT: Bomb suspension and release Torpedo Depth charge Guns Gun heater Chemical Rocket Sight Turret Warning
B	PHOTOGRAPHIC: Gun camera Mapping camera Reconnaissance camera Camera intervalometer Camera doors Camera heaters Warning

(Continued)

ELECTRONIC WIRE REFERENCE SECTION

FUNCTION LETTER	CIRCUITS
C	CONTROL SURFACE: Automatic pilot Booster Control tabs Diving brakes Flight Horizontal stabilizer Landing flaps Water-rudder position Trim tabs Wing flaps Warning
D	INSTRUMENT (other than flight or engine instruments): Ammeter Oil-flap position Cowl-flap position Coolant-flap position Air pressure Free air temperature Landing-gear position Hydraulic pressure Cabin pressure Carbon monoxide Landing-flap position Propeller-pitch position Instrument vacuum pump Horizontal-stabilizer position Trim-tab position Water pressure Voltmeter Clock Warning
E	ENGINE INSTRUMENT: Carburetor air temperature Bearing temperature Tailpipe temperature Carburetor anti-icing fluid quantity Fuel mixture Torque meter Brake mean effective pressure Fuel flow Fuel quantity Fuel capacity Cylinder head temperature Oil pressure Coolant temperature Oil temperature Manifold pressure Fuel pressure Propeller anti-icing fluid quantity Engine oil quantity Tachometer Synchroscope Warning
F	FLIGHT INSTRUMENT: Bank and turn Rate of climb Directional gyro Air position Ground position Compass (including flux gate and other stabilized compasses) Gyro horizon Attitude gyro Driftmeter Altimeter Airspeed Accelerometer Pitot-static tube heater Warning
G	LANDING GEAR, wing folding: Actuator Retraction Wheel brakes Down lock Wing folding

FUNCTION LETTER	CIRCUITS
G	Ground safety Arresting hook Wheel steering Up lock Wheel spinning Warning
H	HEATING, VENTILATING, & DE-ICING: Anti-icing (general) Battery heater Cabin heater Cigarette lighter De-icing (general) Heated flying suits Galley Windshield defroster Windshield defogger Windshield de-icer Heater blanket Oil immersion heater Refrigeration Cabin supercharger Ventilation Water heater Oxygen heater Warning
I	Not used
J	IGNITION: Booster Vibrator Distributor Electronic Jet assist takeoff Magneto ground wiring Warning
K	ENGINE CONTROL: Carburetor air flap Blower ratio Cowl flap air shutter Intercooler flap Oil cooler shutter Propeller feathering Propeller synchronizer Propeller pitch Supercharger regulator Starter Warning
L	LIGHTING: Approach Flasher-coder Cockpit Drift Cabin Formation Cargo Interior Instrument Section (fuselage) Landing Exterior Running, position, navigation Passing Search Taxi Anchor Warning
M	MISCELLANEOUS ELECTRIC: Windshield spray Bilge pump Cargo door Water distillation Windshield wiper Hoist Enclosure operation Positioners; seat, pedal Special test equipment Winches; target, glider

FUNCTION LETTER	CIRCUITS
N	Unassigned[2]
O	Not used
P	D-C POWER: Wiring in the d-c power or power-control system shall be identified by the circuit function letter "P."
Q	FUEL AND OIL: Fuel valves Fuel booster-pump motor Mixture control Oil dilution Engine primer Fuel-transfer-pump motor and control Jettison fuel tanks Fuel-loading-pump motor Oil-transfer-pump motor and control Oil-booster pump Oil-scavenger pump Throttle control Fuel-pump motor Oil diverter Oil valves Water injection Warning
R	RADIO (navigation and communication):[3] RA—Instrument landing RC—Command RD—Radio direction finding RF—VHF liaison RH—Homing RL—Liaison RM—Marker beacon RN—Navigation RS—SHF command RU—UHF command RV—VHF command RX—Recorder RZ—Interphone, headphone
S	RADAR:[3] SA—Altimeter SF—Intercept SG—Gunlaying SM—Mapping SN—Navigation SQ—Bombing SR—Recorder SS—Search SV—Special systems SW—Warning SX—Recognition (IFF)
T	SPECIAL ELECTRONIC:[3] TA—Adapters TB—Radar control TC—Radio control TD—Airborne announcing TF—Repeat back TG—GM homing TK—Telemetering TL—Attitude indicator TM—Chaff dispenser TN—Navigation TQ—Transmitters and receivers
T	TR—Receivers TS—Anti-submarine (ASW) TT—Transmitters TW—Weather devices TX—Television transmitters TY—Television receivers TZ—Bombing devices
U	MISCELLANEOUS ELECTRONIC: Electronic wiring for which no "R," "S," or "T" designation has been assigned by the procuring activity shall have the circuit function letter "U" assigned. Examples of wiring for which the circuit function letter "U" will be assigned are common leads to electronic equipments and systems interconnection wiring, such as antenna or power circuits common to more than one equipment or system.
V	D-c power and d-c control cables for a-c systems shall be identified by the circuit function letter "V."
W	WARNING & EMERGENCY (in addition to those listed under other circuit functions): Enclosure release and locks Fire extinguishers Flare release Submersion actuator Bailout alarm Seat ejector Fire detector Oxygen indicator No-smoking sign Fasten-belts sign Intercrew buzzer or light
X	A-C POWER: Wiring in the a-c power system shall be identified by the circuit function letter "X."
Y	ARMAMENT SPECIAL SYSTEMS: Y*A—Air to air Y*B—Air to surface Y*C—Multimode Y*M—Missile-guidance Y*T—Turret[3] *Armament special system number
Z	Unassigned[2]

These function and designation codes apply to MIL-W-5088B (ASG). Changing circuit function letter F to read "Handling Gear (when required)" and assigning Z as "Guidance", these designations will also with minor exceptions meet MIL-W-8160B, Installation of Guided Missile Wiring.

1 Circuit function and circuit designation letters of electrical and electronic wires and cables shall be as specified. Typical circuits are listed under their respective circuit functions.

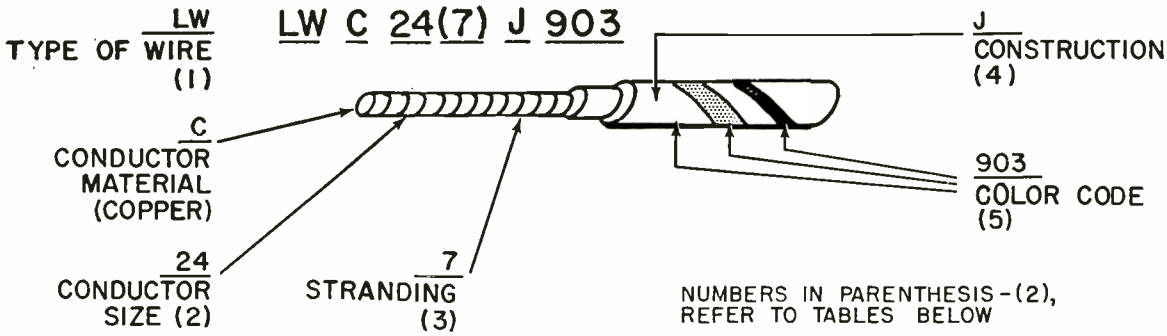
2 Unassigned circuit function or circuit designation letters shall not be used until formally assigned by joint action of Air Force and Navy.

3 The cable identification code for wires and cables having functions listed under circuit function letters "R," "S," "T," and "Y" shall be obtained from the procuring activity.

(a) Blocks of numbers for cable identification of circuit function letters "R," "S," and "T" are assigned to each complete equipment by the Aeronautical Standards Group at the request of the procuring activity. A block of numbers is not assigned to composite equipment such as AN/ARC-25. The cable numbers assigned to each complete equipment, such as AN/ARR-15 or AN/ART-13, are utilized in the composite wiring diagram. Contractors requiring these numbers shall obtain them from the procuring activity.

Type Designation for MIL-W-76A

Military specification MIL-W-76A is given in detail to aid wire users. This is perhaps the most used specification in the electronic field. This specification supersedes JAN-C-76 and MIL-W-12410(SigC).



1—TYPE OF WIRE

Type MIL-W-76A and MIL-W-12410(SigC)	Type JAN-C-76	Remarks
LW	....	Small-size, 300-volt rms wire not covered by JAN-C-76. Primarily intended for use in miniature equipment.
....	WL	A 600-volt rms wire covered only by JAN-C-76. For most applications, this wire is to be superseded by type MW, a 1000-volt rms wire of comparable size. However, where type WL was used in miniature equipments at voltages less than 300 volts rms, type LW may be used for replacement.
MW	SRIR	Types MW, HW, and HF are equivalent to types SRIR, SRHV, and SRRF, respectively, and may be used for direct replacement. Types MW, HW, and HF are available in a wider variety of constructions than types SRIR, SRHV, and SRRF, including nylon jacket, shield and combinations thereof.
HW	SRHV	
HF	SRRF	
FX	....	A 500-volt rms, nylon-jacketed wire not covered by JAN-C-76. This is a special-purpose type for use primarily in Army Ordnance Corps applications. Type FX supersedes wire covered by Frankford Arsenal Specifications FXS-1063.

2—TYPE OF WIRE & CONDUCTOR SIZE

Type of Wire	Conductor Size Range (AWG)	Application Characteristic	Voltage Rating, Maximum Volts, rms
LW	30 to 20	General purpose	300
MW	24 to 12	General purpose	1,000
HW	22 to 16	General purpose	2,500
	14 to 6		600
HF	24 to 16	Radio frequency	1,000
FX	30 to 00	Special purpose	500

3—STRANDING REQUIREMENTS

AWG Nominal	Number of Strands (Min.)	AWG Nominal	Number of Strands (Min.)
30	3	10	37
28	7	8	127
26	7	7	127
24	7	6	127
22	7	4	127
20	7	2	161
18	16	1	259
16	19	0	259
14	19	00	259
12	19		

4—CONSTRUCTION

Symbol	Covering Over Insulated Wire
U	None
J	Jacket
B	Braid
S	Shield
JS	Jacket and shield
BS	Braid and shield
SJ	Shield and outer jacket
JSJ	Jacket, shield, and outer jacket
BSJ	Braid, shield, and outer jacket

5—COLOR CODE

0	Black	5	Green
1	Brown	6	Blue
2	Red	7	Violet (purple)
3	Orange	8	Gray (slate)
4	Yellow	9	White

First number signifies body color.

Second number is first stripe (larger than second stripe).

Third number is second stripe.

Example: 903—White/Black/Orange.

Flexible Cord—U/L Specifications

NOTES TO TABLE

1. Except for Types AFPO, CFPO, PO-1, PO-2, PO, SP-1, SP-2, SPT-1, SPT-2, TP, TPT, and AVPO, individual conductors are twisted together.

2. Type PO-1 is for use only with portable lamps, portable radio receiving appliances, portable clocks and similar appliances which are not liable to be moved frequently and where appearance is a consideration.

3. Types TP, TPT, TS, and TST are suitable for use in lengths not exceeding eight feet when attached directly, or by means of a special type of plug, to a portable appliance rated at 50 watts or less and of such nature that extreme flexibility of the cord is essential.

4. Type K is suitable for use on theatre stages.

5. Rubber - filled or varnished - cambric tapes may be substituted for the inner braids.

6. Types S, SO and ST are suitable for use on theatre stages, in garages and elsewhere, where flexible cords are permitted by this code.

7. Traveling cables for operating, control and signal circuits may have one or more non-metallic fillers or may have a supporting filler of stranded steel wires having its own protective braid or cover. Cables exceeding 100 feet in length shall have steel supporting fillers, except in locations subject to excessive moisture or corrosive vapors or gases.

Where steel supporting fillers are used, they shall run straight through the center of the cable assembly and shall not be cabled with the copper strands of any conductor.

Trade Name	Type Letter	Size AWG	No. of Conductors	Insulation	Braid on Each Conductor	Outer Covering	Use		
							Attached to an Appliance	Damp Places	Not Hard Usage
Parallel Tinsel Cord	TP See Note 3	27	2	Rubber	None	Rubber			
	TPT See Note 3	27	2	Thermoplastic	None	Thermoplastic	Attached to an Appliance	Damp Places	Not Hard Usage
Jacketed Tinsel Cord	TS See Note 3	27	2 or 3	Rubber	None	Rubber	Attached to an Appliance	Damp Places	Not Hard Usage
	TST See Note 3	27	2 or 3	Thermoplastic	None	Thermoplastic	Attached to an Appliance	Damp Places	Not Hard Usage
Asbestos-Covered Heat-Resistant Cord	AFC	18, 16 14	2 or 3	Impregnated Asbestos	Cotton or Rayon	None	Pendant	Dry Places	Not Hard Usage
	AFPO		2		None	Cotton, Rayon or Saturated Asbestos			
	AFPD		2 or 3						
Cotton-Covered Heat Resistant Cord	CFC	18, 16 14	2 or 3	Impregnated Cotton	Cotton or Rayon	None	Pendant	Dry Places	Not Hard Usage
	CFPO		2		None	Cotton, Rayon or Saturated Asbestos			
	CFPD		2 or 3						
Parallel Cord	PO-1	18	2	Rubber	Cotton	Cotton or Rayon	See Note 2	Dry Places	Not Hard Usage
	PO-2	18, 16					Pendant or Port.		
	PO	18-10							
All Rubber Parallel Cord	SP-1	18	2	Rubber	None	Rubber	Pendant or Portable	Damp Places	Not Hard Usage
	SP-2	18, 16							
All Plastic Parallel Cord	SPT-1	18	2	Thermoplastic	None	Thermoplastic	Pendant or Portable	Damp Places	Not Hard Usage
	SPT-2	18, 16							
All Plastic Parallel Cord	SPT-3	18-12	2 or 3	Thermoplastic	None	Thermosplastic	Refrigerators or Room Air Conditioners	Damp Places	Not Hard Usage
Lamp Cord	C	18-10	2 or more	Rubber	Cotton	None	Pendant or Portable	Dry Places	Not Hard Use
Armored Cord	CA	18, 16, 14	2	Rubber	Cotton	Fibrous and Metal Armor	Pendant or Portable	Dry Places	Hard Usage
Twisted Portable Cord	PD	18-10	2 or more	Rubber	Cotton	Cotton or Rayon	Pendant or Portable	Dry Places	Not Hard Usage
Reinforced Cord	P-1	18	2 or more	Rubber	Cotton	Cotton over Rubber Filler	Pendant or Portable	Dry Places	Not Hard Use
	P-2	18, 16							Hard Usage
	P	14-10							
Moisture-Proof Reinforced Cord	PW-1	18	2 or more	Rubber	Cotton	Cotton, Moisture-Resistant Finish over Rubber Filler	Pendant or Portable	Damp Places	Not Hard Use
	PW-2	18, 16							Hard Usage
	PW	14-10							
Braided Heavy Duty Cord	K See Note 4	18-10	2 or more	Rubber	Cotton	Two Cotton, Moisture-Resistant Finish See Note 5	Pendant or Portable	Damp Places	Hard Usage
Vacuum Cleaner Cord	SV	18	2	Rubber	None	Rubber	Pendant or Portable	Damp Places	Not Hard Usage
	SVT			Thermoplastic		Thermoplastic			
Junior Hard Service Cord	SJ	18, 16	2, 3 or 4	Rubber	None	Rubber	Pendant or Portable	Damp Places	Hard Usage
	SJO					Oil Resist. Compound			
	SJT			Thermoplastic or Rubber		Thermoplastic			
Hard Service Cord	S See Note 6	18-10	2 or more	Rubber	None	Rubber	Pendant or Portable	Damp Places	Extra Hard Usage
	SO					Oil Resist. Compound			
	ST			Thermoplastic or Rubber		Thermoplastic			
Rubber-Jacketed Heat-Resistant Cord	AFSJ	18, 16	2 or 3	Impregnated Asbestos	None	Rubber	Portable	Damp Places	Portable Heaters
	AFS	18, 16,14							
Heater Cord	HC	18-12	2, 3, or 4	Rubber and Asbestos	Cotton	None	Portable	Dry Places	Portable Heaters
	HPD				None	Cotton or Rayon			
Rubber-Jacketed Heater Cord	HSJ	18-16		Rubber and Asbestos	None	Cotton and Rubber	Portable	Damp Places	Portable Heaters
Jacketed Heater Cord	HS	14-12	2, 3, or 4	Rubber and Asbestos	None	Cotton and Rubber or Neoprene	Portable	Damp Places	Portable Heaters
All-Neoprene Heater Cord	HPN	18-16	2	Neoprene	None	Neoprene	Portable	Damp Places	Portable Heaters
Heat and Moisture Resistant Cord	AVPO	18-10	2	Asbestos and Var. Comb.	None	Asbestos, Flame-Retardant, Moisture Resistant	Pendant or Portable	Damp Places	Not Hard Usage
	AVPD		2 or 3						
Range Cable	SR	8-4	3 or 4	Rubber	None	Rubber or Neoprene	Portable	Damp Places	Ranges
	SRT	8-4	3 or 4	Thermoplastic	None	Thermoplastic	Portable	Damp Places	Ranges

Extradop

(Continued from page 56)

KC synchronization signal is "tapped off" the cable. It is then frequency-multiplied for use in the reference channel of a standard Dovap receiver. The return signal from the missile transponder is compared to the reference signal in the receiver output. The longer baseline thus provided allows a Dovap solution of greater accuracy than is possible with the standard short-baseline configuration.

Evaluating Extradop at the presently assigned Dovap frequencies without disrupting operation of the latter's stations presented a problem. Frequency synthesizing equipment was designed and fabricated which allowed Dovap stations to continue operation during the test periods. This equipment consists of special dividers plus the normal multipliers. Single-sideband techniques were used to assure that the 32 KC would produce the required end frequency. A Radio Frequency Authorization (RFA) has now been approved by the government so that the extra synthesizing equipment can be disbanded. When the frequency change becomes final, operation will be turned over to range operators for full support of missile test launches.

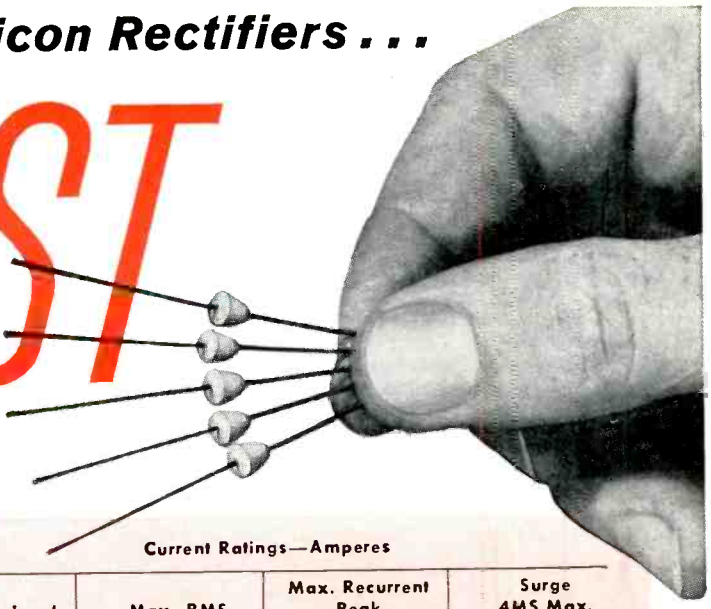
Results of the evaluation illustrate that the system design is sound and workable. The basic techniques are proven and further extension of the principle is planned for use with other trajectory-measuring systems on the range such as Azusa. Semi-active tracking will then be possible from stations not directly interrogating a missile.

RCA's CW Radar Engineering where this system was conceived, designed, and evaluated is under the management of F. P. Stoklas. J. M. Schwartz, under the leadership of J. W. Martin, is the Laboratory Technician T. F. Project Engineer. Development Barry fabricated and installed the equipment.

Tarzian F Series Silicon Rectifiers . . .

UTMOST

. . . in Performance

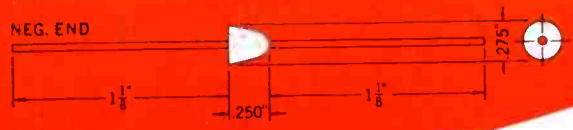


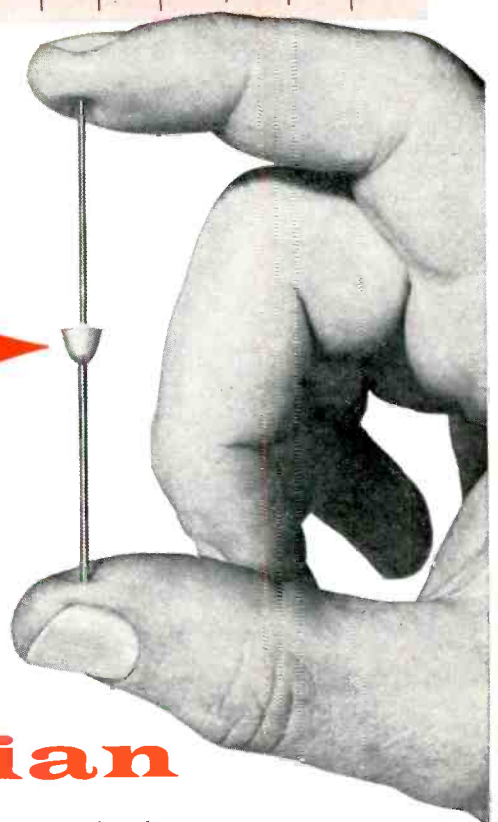
Ratings

S.T. Type	Max. Peak Inverse Volts	Max. RMS Volts	Current Ratings—Amperes											
			Max. D.C. Load			Max. RMS			Max. Recurrent Peak			Surge 4MS Max.		
			55°C	100°C	150°C	55°C	100°C	150°C	55°C	100°C	150°C	55°C	100°C	150°C
F-2	200	140	.75	.5	.25	1.875	1.25	.625	7.5	5.	2.5	75	75	35
F-4	400	280	.75	.5	.25	1.875	1.25	.625	7.5	5.	2.5	75	75	35
F-6	600	420	.75	.5	.25	1.875	1.25	.625	7.5	5.	2.5	75	75	35

. . . in Ultra Small Size

Dimensions





. . . in Low Price

Tarzian

research, engineering and production know-how have combined to develop the "utmost" in a small size, very low cost silicon rectifier with giant performance. If your problem is miniaturization, or cost, or tough application, the solution is in the Tarzian F series.

Send for Design Note #31

Sarkes Tarzian, Inc., Rectifier Division

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IN CANADA: 700 WESTON RD., TORONTO 9, TEL. ROGER 2-7535 **EXPORT:** AD AURIEMA, INC., NEW YORK CITY

New Tech Data for Engineers

Test Equipment

Cedco Electronics, Inc., Erie, Pa., has issued a series of bulletins which describe a new line of test equipment for the electronic field. Bulletins describe a square-wave generator, semiconductor rectifier and diode tester, and a crystal calibrator-marker generator. Complete information is given in these multicolored bulletins.

Circle 197 on Inquiry Card, page 83

Coil Calculations

A 4-page technical bulletin entitled "Tele-Hints," subject Air Dux is available from Illumitronic Engineering, Sunnyvale, Calif. Data sheets contain complete information for winding and calculating coils. Technical bulletin is complete with tables and graphs.

Circle 198 on Inquiry Card, page 83

Electrical Insulation

Bulletin No. 28 issued by Insulation Mfrs. Corp., 565 W. Washington Blvd., Chicago 6, Ill., is a 32-page bulletin describing shaped wood and plastic wedges, formed fibre and polyester film wedges; plain or cuffed, creased or formed slot insulators, fabricated paper, coated fabric and plastic insulating parts and other kinds of specially made insulators. Data and charts as well as pictures and drawings make it easy for the engineer to select the proper size, shape or form of insulator.

Circle 199 on Inquiry Card, page 83

Power Supply Cords

Belden Mfg. Co., Chicago, Ill., has just issued Catalog 1758, which shows a new and expanded line of stock power supply cords and cord sets for all types of appliances, tools, machines, and all other electrical equipment.

Circle 200 on Inquiry Card, page 83

Insulating Tapes

A new folder briefly describing the stock item insulating products for extreme temperature applications has just been published by The Connecticut Hard Rubber Co., 407 East St., New Haven 9, Conn. The folder covers pressure-sensitive and self-adhering Teflon, fiberglass and silicone rubber tapes for —100°F to 500°F.

Circle 201 on Inquiry Card page 83

Rate Turntable

A 4-page technical report issued by Sterling Precision Corp., 229 Binney St., Cambridge 42, Mass., describes their T848 Rate Turntable which is used for calibrating and evaluating rate gyros.

Circle 202 on Inquiry Card, page 83

Cables and Wires

Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago 47, Ill., has just issued a 32-page 2-color catalog, M-53B, which describes their electrical cables and wires for component parts, electronic equipment, intercommunication, microphones, microwave communications systems, P. A. systems, radio, recorders, sound systems, stereo record changers, television, and test instruments. Complete information is given in easy-to-follow tabular form.

Circle 203 on Inquiry Card, page 83

Magnetic Shielding

A 31-page Manual No. 101-122 is a comprehensive summation describing design and fabricating techniques for non-shock sensitive non-retentive Netic and Co-Netic magnetic shielding in standard gauges. Twelve pages of physical data and graphs as well as various suggested test techniques for evaluating shielding of both high and low intensities are included. Magnetic Shield Div., Perfection Mica Co., 1322 No. Elston Ave., Chicago 22, Ill.

Circle 204 on Inquiry Card, page 83

Fasteners

Western Sky Industries, 21301 Cloud Way, Hayward, Calif., have issued a 32-page booklet which describes their various types of fasteners. Brochure is complete with mechanical data and outline drawings. These H-K fasteners have applications in the missiles, computers and communications equipment fields.

Circle 205 on Inquiry Card, page 83

Silicon Controlled Rectifier

The General Electric Co., Semiconductor Products Dept., Syracuse, N. Y., has published a 17-page booklet entitled "Application Notes for ZJ-39A Silicon Controlled Rectifier" which describes circuit fundamentals for use of the newly developed controlled rectifier. Booklet is presented like a technical paper and is complete with circuit diagrams and application information.

Circle 206 on Inquiry Card, page 83

Electro-Mechanical Kits

A 16-page catalog, TDS 1110-1 providing complete features and specifications on all servoboard electromechanical assembly components, is available from Servo Corp. of America, 20-20 Jericho Turnpike, New Hyde Park, L. I., N. Y. Included are mounting components, component hangers, component clamps, bearing hangers, shaft components, gears, service units, limit stops, switch assemblies and clutches and differentials.

Circle 207 on Inquiry Card, page 83

Conductor Slide Rule

A handy logarithmic conductor slide rule has been designed by Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa., to aid customers in selecting dimensions of aluminum foil or sheet for use in strip-wound electrical coils. The rule provides a ready means of converting from standard wire sizes in copper or aluminum to an equivalent aluminum strip conductor. Wire size is set on a reference scale, and a wide range of equivalent strip conductor size combinations of width and thickness are shown on a selector scale.

Circle 208 on Inquiry Card, page 83

Precision Welding

A short-form catalog has been prepared by Vacuum Tube Products Co., Inc., 2020 Short St., Oceanside, Calif., which describes its line of precision electronic welding equipment. Welding equipment is specially designed to join light-gauge materials ranging from 0.0003 to 0.080 in.

Circle 209 on Inquiry Card, page 83

Fine Wire Coil Winder

Electromatic Equipment Co., 175 Fifth Ave., New York 10, N. Y., have issued a technical bulletin which describes the Frieske & Hoepfner line of automatic precision fine wire coil winding machines which are imported from West Germany. Complete information is given in this technical bulletin.

Circle 210 on Inquiry Card, page 83

Microwave Tubes

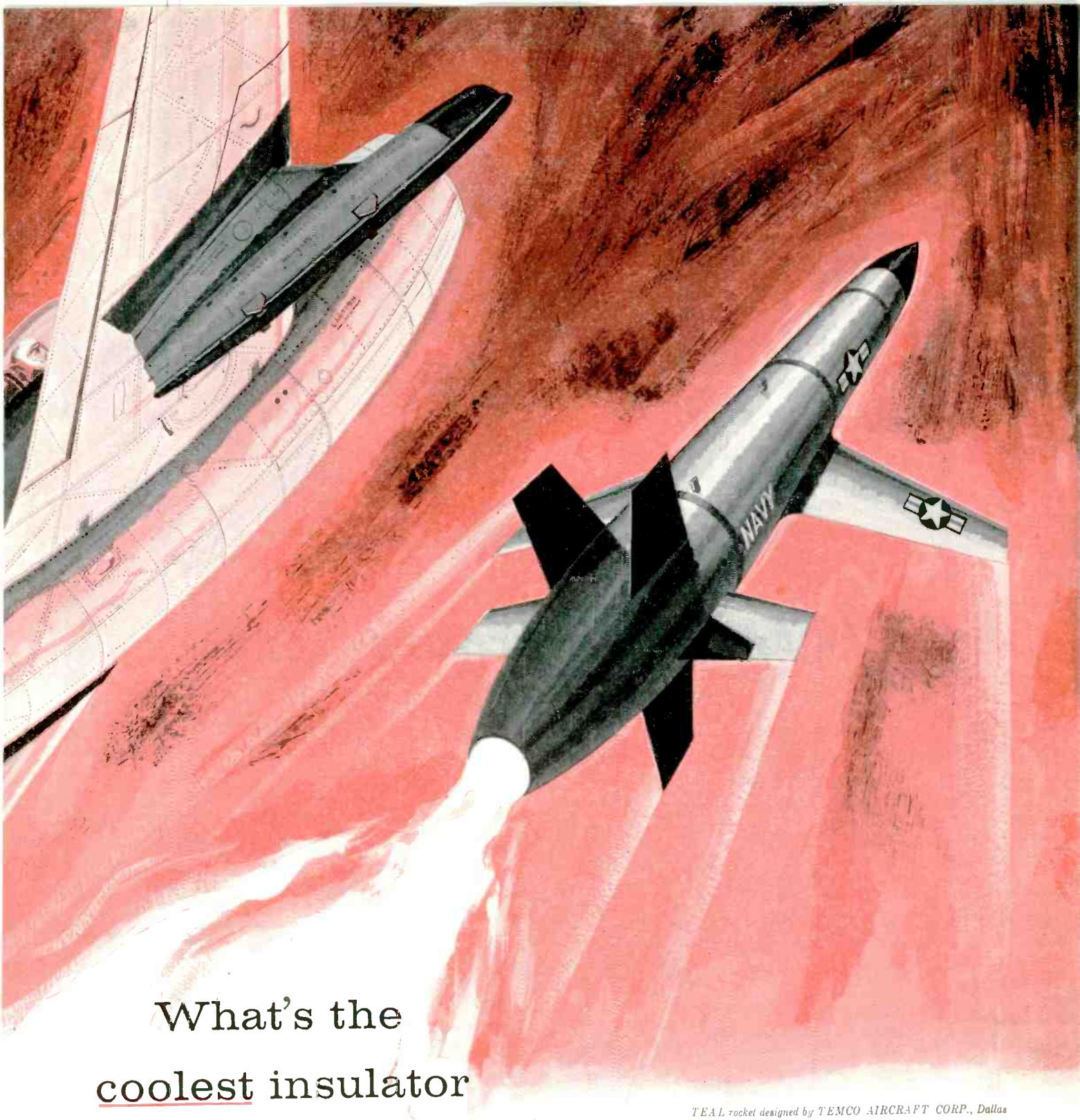
Varian Assoc., 611 Hansen Way, Palo Alto, Calif., have issued a 36-page, 3-colored catalog which describes in complete detail their microwave tubes such as klystrons, backward wave oscillators, traveling wave tubes and their related components. Catalog is complete with photographs, electrical and mechanical specifications.

Circle 211 on Inquiry Card, page 83

Magnetic Amplifiers

A 36-page illustrated bulletin on the construction, operation and use of magnetic amplifiers has been published by Vickers Inc., Electronic Products Div., 1815 Locust St., St. Louis 3, Mo. By means of text and diagrams the bulletin explains the principles of magnetic amplifiers. Cutaway drawings and exploded views provide details of design and construction. Simplified schematic drawings show how amplifiers are incorporated into equipment. Bulletin 1105-1 is a basic text on magnetic amplifiers.

Circle 212 on Inquiry Card, page 83



What's the coolest insulator for hot products?

TEAL rocket designed by TEMCO AIRCRAFT CORP., Dallas

FORMICA® laminated plastic . . . . withstands 2500° F for 8 minutes in the Navy's XKDT-1 rocket drone. A modified standard Formica grade successfully insulates the solid propellant engine case and blast tube against this inferno.

This is the heat insulator Formica research developed by combining great mechanical strength with high heat resistance. It has helped break the heat barrier in aviation, missile and space craft.

This type of heat insulator can be useful in your hot products, too. In fact, product designers are getting more "assists" from Formica laminated plastics than any other material. Standard grades available for immediate use in your projects . . . without extensive delays for research and development. Forty-eight hour Streamliner shipment of most grades. For further information, write for bulletins 829 and 856-A. Formica Corporation, subsidiary of American Cyanamid, 4536 Spring Grove Ave., Cincinnati 32, Ohio.

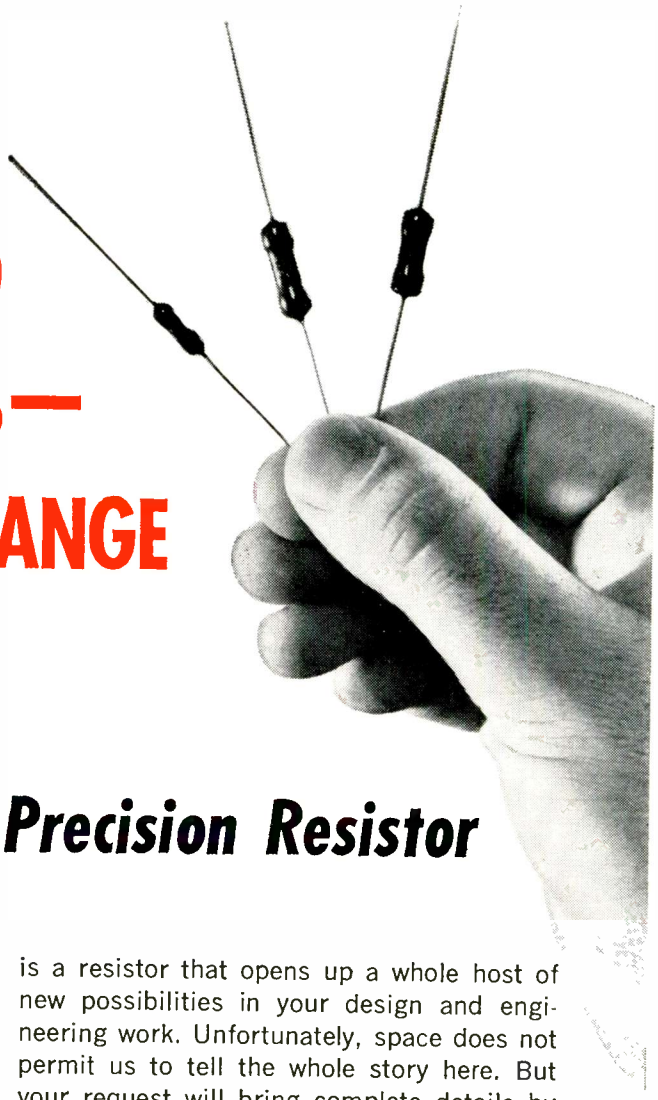
FORMICA® Laminated Plastic

a product of CYANAMID

Circle 91 on Inquiry Card, page 83

FI-1966

TESTED AT 125°C UNDER FULL LOAD FOR 1,000 HOURS— LESS THAN 1% CHANGE



New ELECTRA Series 125 Precision Resistor

Here is a brand new carbon film resistor that represents a greater-than-ever achievement in combining precision, stability and small physical size. Here is the kind of superior performance that formerly was available only in much larger, more costly components. It is a resistor that opens up a whole host of new possibilities in your design and engineering work. Unfortunately, space does not permit us to tell the whole story here. But your request will bring complete details by return mail . . . including prices.

CHECK THESE OUTSTANDING TEST RESULTS*

TEMPERATURE CYCLE

Initial	Final	% Change
235.6	235.8	.08
236.6	236.7	.04
236.1	236.2	.04
235.7	235.8	.04
235.4	235.5	.04
235.2	235.4	.08
237.7	237.8	.04
236.3	236.4	.04
236.5	236.6	.04
237.0	237.2	.08

MOISTURE

Before	After	% Change
235.5	236.0	.21
237.4	237.5	.04
235.3	235.6	.13
236.2	236.6	.17
235.9	236.2	.13
236.9	237.4	.21
235.6	236.0	.17
235.4	235.6	.08
236.5	237.1	.25
236.1	236.6	.21

LOAD-LIFE 125° C

Initial	After	% Change
233.5	233.9	.27
233.1	233.5	.27
233.0	233.4	.27
233.7	233.9	.18
234.8	235.1	.23
233.5	233.6	.14
233.9	234.1	.18
233.1	233.5	.27
232.8	233.0	.18
233.8	234.0	.18

TOTAL IMMERSION IN SOLDER AT 550° F. FOR 5 SECONDS

Initial	Final	% Change
140.5	140.6	.07
139.5	139.5	0
140.0	140.0	0
139.3	139.4	.07
140.3	140.3	0
139.9	139.9	0
139.6	139.6	0
139.4	139.4	0
139.7	139.7	0
139.6	139.6	0

*Typical Data CF½ When Tested to Mil R10509B

Electra Part No.	Mil Style	Wattage	Mil Resistance Range	Manufactured Resistance Range	Maximum Rated Voltage
CF⅛	RN60B	⅛	10 ohms 1 meg	10 ohms 1 meg	250
CF¼	RN65B	¼	10 ohms 2 meg	10 ohms 2 meg	300
CF½	RN70B	½	10 ohms 2.5 meg	10 ohms 5 meg	350

EXCLUSIVE NEW COATING IS THE KEY — Developed only after long study and experimentation, it is Electra's exclusive new Type R-5 coating that is primarily responsible for the superior performance of the new Series 125 Resistor. It is a coating that offers a new high in protection against heat, moisture, rough handling and other enemies of reliability.

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4051 Broadway Kansas City, Missouri

Circle 81 on Inquiry Card, page 83

Announcing

An Important New Addition to B&A's line of "Electronic Grade" Chemicals

B&A supplies ingots of intrinsic or first reduction metal individually wrapped in polyethylene, six to a corrugated shipping box. Germanium dioxide is packaged in standard screw-cap bottles.

Special High Purity

GERMANIUM

Dioxide First Reduction Metal Intrinsic Metal

Now Baker & Adamson offers the electronic industry a dependable, domestic source for high purity germanium and germanium dioxide—part of America's leading line of electronic chemicals.

You get all these advantages with B&A Germanium:

Dependable, domestic source: Why rely on uncertain foreign sources for this key raw material when B&A has it—*domestically produced, always readily available!* By using B&A as your source for both raw material and scrap reclaiming you can cut inventory requirements, effect other economies.

Lower volatile! B&A Germanium Dioxide contains about 0.5% less volatile than many other oxides . . . will thus yield about 0.5% more metal when reduced.

Dustless! B&A Germanium Dioxide is free from fine particles. Dust losses, often a problem, are sharply reduced.

Higher bulk density! The bulk density of B&A Germanium Dioxide is 60% to 70% higher than many other oxides. Therefore the boats which carry oxide through the reducing furnace will yield about 60% more metal for each furnace pass.

Save on scrap tolls! B&A can handle all grades of scrap with lower toll charges on low assay material.

Investigate all these advantages of B&A Germanium *now*. Call your nearest B&A sales office.

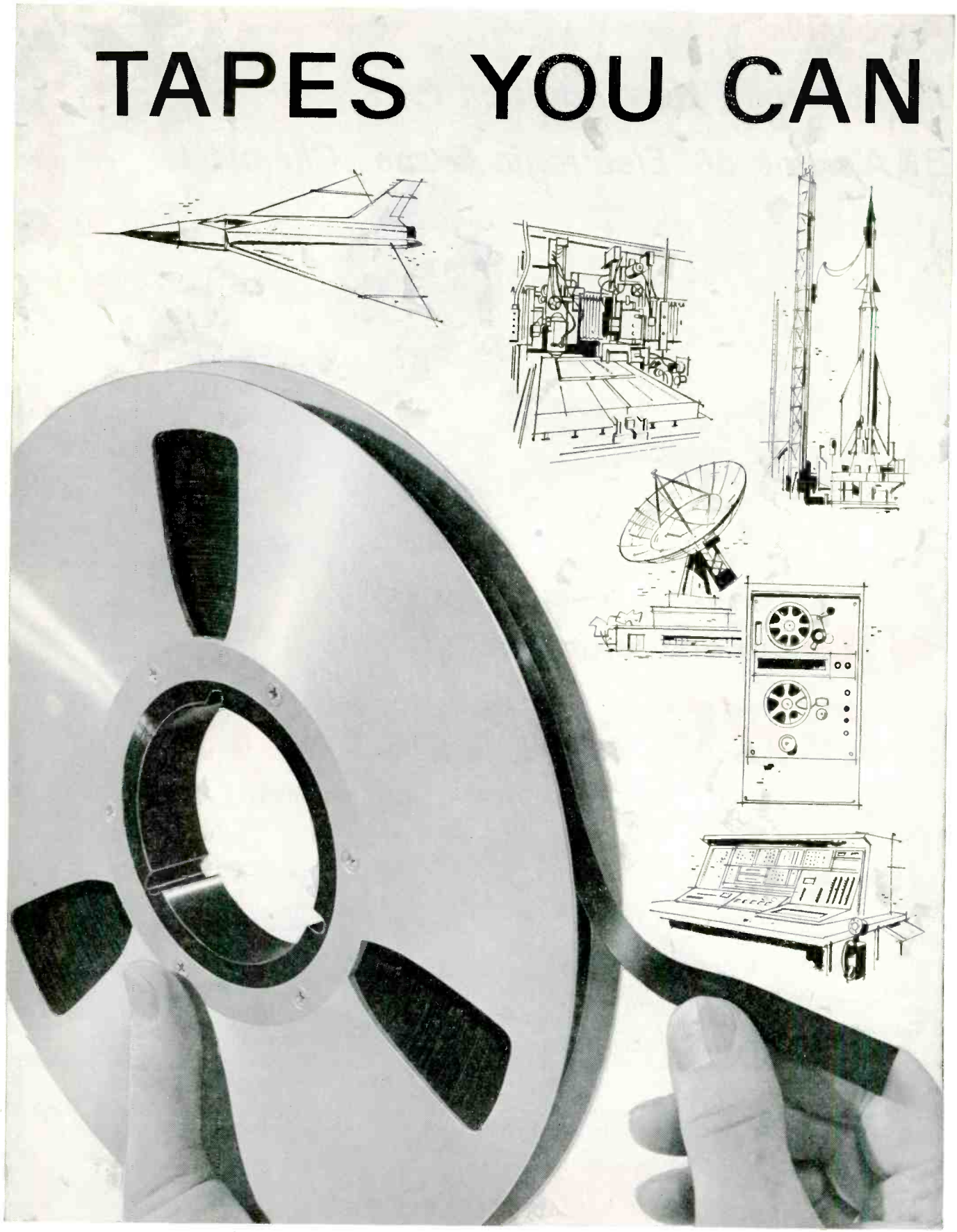
BAKER & ADAMSON®
"Electronic Grade" Chemicals

Allied Chemical

GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N. Y.

Offices: Albany • Atlanta • Baltimore • Birmingham • Boston • Bridgeport • Buffalo • Charlotte • Chicago • Cincinnati • Cleveland (Miss.) • Cleveland (Ohio) Denver • Detroit • Houston • Jacksonville • Kalamazoo • Los Angeles • Milwaukee • Minneapolis • New York • Philadelphia • Pittsburgh • Portland (Ore.) Providence • San Francisco • St. Louis • Seattle • Kennewick, Vancouver and Yakima (Wash.)

TAPES YOU CAN



MINNESOTA MINING AND MANUFACTURING COMPANY

. . . WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

The term "SCOTCH" is a registered trademark of 3M Company, St. Paul 6, Minn. Export: 99 Park Avenue, New York. Canada: London, Ontario.

TRUST because only SCOTCH BRAND

REG. U.S. PAT. OFF.

Instrumentation Tapes assure absolute dependability inch after inch...reel after reel

You can't afford to compromise with accuracy, reliability and uniformity in critical recording work – instrumentation, computers, machine tool control and other technical applications. You need a magnetic tape of *proven* instrumentation quality, "SCOTCH" Brand Magnetic Tape.

These are precision tapes – engineered in the world's leading tape laboratories to meet your specific needs. You can *trust* "SCOTCH" Brand Instrumentation Tapes because they're made of only flaw-free materials and every reel put to more than 100 rigid quality control tests.

PHYSICAL AND MAGNETIC PROPERTIES OF "SCOTCH" BRAND MAGNETIC TAPES—INSTRUMENTATION QUALITY




Tape Number Description	108 Std. Instrumentation	109 Std. Instrumentation	128 Hi-Output Instrumentation	159 Extra Play Instrumentation
Physical Properties				
Backing Material	Polyester	Acetate	Polyester	Polyester
Thickness in mils Backing Coating	1.45 .55	1.42 .55	1.45 .65	.92 .35
Ultimate Tensile Strength ¼" Wide — Room Condition	9#	5.8#	9#	7#
Yield Strength 5% Stretch in ¼" Width	5.4#	4.5#	5.4#	3.8#
Elongation at Break	100%	25%	100%	100%
Coefficient of Friction	0.33	0.33	0.30	0.33
Residual Elongation	0.5%	1.5%	0.5%	0.5%
Slitting Tolerances	+.000 ins. —.004 ins.	+0.0% —0.8%	+.000 ins. —.004 ins.	+.000 ins. —.004 ins.
Toughness Tear — grams	26	3	26	12
Impact — Kc — cms	100	20	100	70
Coefficient of Expansion* Humidity (units per % RH change)	1.1 x 10^{-5}	15 x 10^{-5}	1.1 x 10^{-5}	1.1 x 10^{-5}
Temperature (units per °F.)	2 x 10^{-5}	3 x 10^{-5}	2 x 10^{-5}	2 x 10^{-5}
Temperature Limits for Safe Use Low High	—40°F. +140°F.	—40°F. +140°F.	—40°F. +185°F.	—40°F. +140°F.
†Relative Wear Ability	100%	100%	250%	100%
Magnetic Properties				
Intrinsic Coercivity (Hci)	250	250	240	240
Oersteds Retentivity (Brs) Gauss	700	700	1100	1100
Remanence (Flux lines/ ¼" tape)	0.6	0.6	1.2	0.6
Relative Output in db at 1% distortion** 15 mil Wave Length	0	0	+6	0
Relative Sensitivity in db** 15 Mil Wave Length 1 Mil Wave Length	0 0	0 0	+3.5 0	+1.5 +3.5
Erasing Field	1000	1000	900	800
Uniformity at 15 Mil Wave Length Within a Roll Roll to Roll	±3% ±10%	±3% ±10%	±3% ±10%	±3% ±10%
Dropout Count*** Errors/1 Roll	1	1	1	1

*These coefficients are unitless and represent the change per % RH or degree Fahrenheit over the following ranges:
Humidity: 20% RH to 80% HR
Temperature: -30°F. to +130°F.

**At optimum bias for each tape type.

***Measured by recording 200 non-return pulses per inch on a 0.035" track. A reduction to less than 50% normal signal amplitude constitutes a signal error. Zero errors are measured by saturating the tape undirectionally. Each spurious signal greater than 10% of normal signal amplitude constitutes a zero error. Errors per roll based on recording 7 tracks on rolls ½" x 2500'.

†Relative wear ability is considered as 100% for 109 Tape. Relative output is established by 109 which is designated as zero. All other tapes are expressed as gradations from this reference point.

FREE BOOKLET! Get all the facts about America's most complete line of instrumentation quality tapes. Mail this coupon for your free specification catalogue.

Minnesota Mining & Mfg. Co., Instrumentation Tape Div.
900 Bush Avenue, St. Paul 6, Minnesota
Please send me a free copy of your instrumentation booklet.

NAME_____

POSITION_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

Circle 55 on Inquiry Card, page 83

WHAT MAKES A SCOPE GOOD?

As every engineer knows, the qualities that make a scope really *good* frequently lie beyond the range of the published specifications. Of two scopes offering virtually identical specs, one may become the universally-accepted favorite, while the other gathers dust in the corner. What are these qualities that spell the difference between "so-so" and really "good"?

DEPENDABILITY

The good scope must be designed and built to provide day-in, day-out, "up-to-specs" performance. It is capable of service longevity in keeping with the monetary investment.

VERSATILITY

In addition to its prime function of providing consistently accurate displays within its specified ranges, a good scope has inherent versatility in its selection and method of sweep modes, synchronization and acceptable types of input.

EASE OF OPERATION

There's little point in a "Buck Rogers" approach to instrumentation. All control functions should be as automatic and simple as possible, thereby permitting the engineer to apply more time and talent to the actual design and investigation procedures.

the results are in—

THE DU MONT 401-A HAS IT!

401-A HIGHLIGHTS

IDENTICAL X- AND Y-AMPLIFIERS
Sensitivity: 10 mv/cm, (100 mv full-scale)
Frequency Range: dc to 100 kc, down less than 3 db at 100 kc.

SWEEPS
Range: 250 msec/cm to 5 usec/cm in 17 steps.
Modes: Selection of driven or automatic.
Synchronization: Front panel selection of internal, external or line.

DEPENDABILITY
Stability: Drift does not exceed 1 cm from center in an 8-hour period, including 10% variations in line voltage.
Components: Hand-crafted wiring. Components tested to exceed specifications. Cathode-ray tube—tight-tolerance 5ADP.

POWER SUPPLY
All operating potentials regulated. Choice of electronic regulation or self-regulating transformer.

MECHANICAL
Size: 401-A, 15½" x 8¾" x 21"; 401-AR (Rack version), 8¾" x 14⅝" x 18¾"—panel 19" wide.
Weight: Approximately 45 pounds.
Access: Side panels removable for access to all points.

PRICE **$430**
F.O.B. Clifton, N. J., U.S.A.

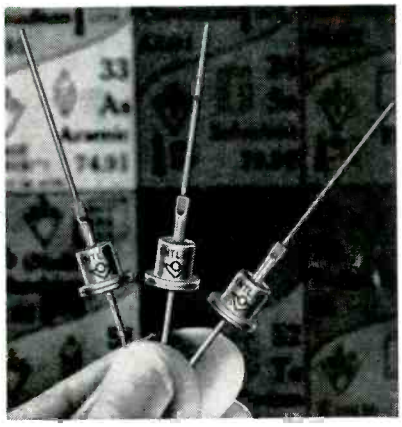
For complete details and specifications, write to:

DU MONT®
INSTRUMENT DIVISION
ALLEN B. **DU MONT LABORATORIES,** Inc., 760 Bloomfield Ave., Clifton, N. J., U.S.A.

INTERNATIONAL RECTIFIER CORPORATION

A WORLD OF DIFFERENCE THROUGH RESEARCH

RECTIFIER NEWS



Military Type High Temperature Silicon Power Diodes Operate to 165° C

For military or industrial applications where high temperature operation is a must, International Rectifier offers two series of axial lead, hermetically sealed power diodes. Both supply full rated power under convection cooling without a heat sink.

JETEC series 1N536-1N540 and 1N1095-96 operates at −65°C to +165°C with output currents to 750ma. PIV ratings from 50 to 600v. Bulletin SR-202A describes them.

For power supply or magnetic amplifier use, 16 JETEC types are listed in Bulletin SR-132E. Ratings: 50 to 600v PIV at 300ma. Temperature range: −65°C to +150°C.

The high forward conductance and extremely low leakage of these diodes permits rectification efficiencies to 99% at power frequencies; up to 70% at 50kc.

CIRCLE READER SERVICE CARD NO. 3

Ratings: 100 to 600 PIV, up to 500ma

Miniaturized Silicon Diodes For Military and Commercial Use.

Write for Bulletin SR-203

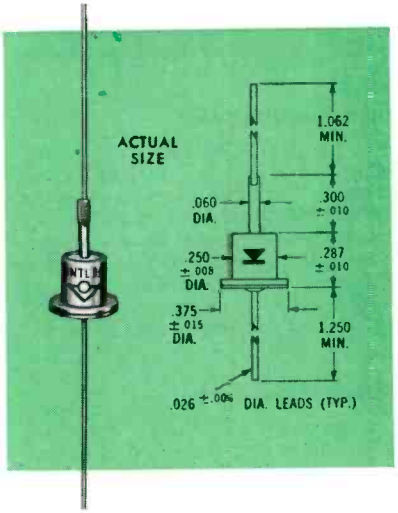
Hermetically Sealed Industrial Silicon Diodes Provide 750ma Output Without Heat Sink

Diodes in this series have been designed to provide optimum reliability and efficiency to your industrial or commercial equipment circuits. By eliminating the space consuming heat sink, you can also realize economies in equipment size as well as assembly time and costs.

Rectified dc output current ratings to 750ma at 50°C can be obtained with PIV voltages ranging from 100 to 500v.

The diode junction is hermetically sealed in an all-welded, shock-proof housing . . . a mechanical construction assuring physical strength and a positive safeguard against contaminants. This adds up to the really important feature — long term reliability! For complete specifications . . .

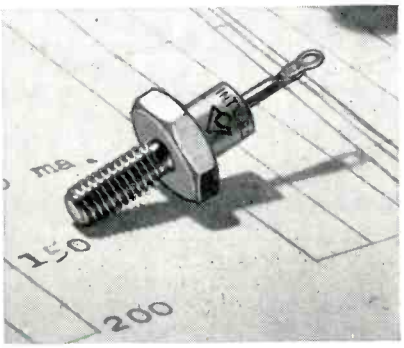
CIRCLE READER SERVICE CARD NO. 4



Absolute Maximum Ratings (at 60 cps. Resistive or Inductive Load)

DIODE TYPES	SD-91	SD-92	SD-93	SD-94	SD-95	SD-91A	SD-92A	SD-93A	SD-94A	SE-95A
Peak Inverse Voltage, Volts	100	200	300	400	500	100	200	300	400	500
RMS Input Voltage, Volts	70	140	210	280	350	70	140	210	280	350
Continuous D.C. Voltage, Volts	100	200	300	400	500	100	200	300	400	500
Rectified D.C. Output Current, ma. at 50° C Ambient	550	550	550	550	550	750	750	750	750	750
at 100° C Ambient	300	300	300	300	300	500	500	500	500	500
Max. Surge Current (1 cycle), Amps.	10	10	10	10	10	15	15	15	15	15
Max. Operating Frequency, Kilocycles	50	50	50	50	50	50	50	50	50	50
Ambient Operating Temperature, °C	−65°C to +125°C					−65°C to +125°C				
ELECTRICAL CHARACTERISTICS										
Max. D.C. Forward Voltage Drop at 25°C	1.5 volts @ 550 ma dc (all types)					1.3 volts @ 750 ma dc (all types)				
Min. Series Resistance (Capacitive Load) (ohms)	6.8	6.8	6.8	6.8	6.8	4.7	4.7	4.7	4.7	4.7
Max. Leakage Current (mA.) at Rated Continuous D.C. Voltage at 100°C	1.0	1.0	1.0	.80	.65	0.5	0.5	0.5	0.4	0.3

High Temperature Stud Mounted Silicon Diode Series Includes Nineteen JETEC and JAN Types.



These silicon power rectifiers are designed for conduction cooling by mounting directly onto the chassis. Ratings from 400ma to one amp. are possible at PIV ratings of from 50 to 600 volts.

Power supply types 1N607 thru 1N614 and magnetic amplifier types featuring low leakage current and high forward conductance are included in Bulletin SR-135C.

JAN types 1N253, 1N254, 1N255 for the military are in full production.

CIRCLE READER SERVICE CARD NO. 5

FOR SAME DAY SERVICE ON PRODUCT INFORMATION DESCRIBED ABOVE, SEND REQUEST ON YOUR COMPANY'S LETTERHEAD

EXECUTIVE OFFICES: EL SEGUNDO, CALIFORNIA · PHONE OREGON 8-6281 · CABLE RECTUSA
BRANCH OFFICES: NEW YORK: 132 EAST 70TH ST., ...TRAFALGAR 9-3330 · CHICAGO: 205 W. WACKER DR., ...FRANKLIN 2-3888 · NEW ENGLAND: 17 DUNSTER ST., CAMBRIDGE, MASS., ...UNIVERSITY 4-6520 · PENNSYLVANIA: SUBURBAN SQUARE BUILDING, ARDMORE, PENNA., ...MIDWAY 9-1428 · MICHIGAN: 199 COOLIDGE HIGHWAY, BERKELEY, MICH., ...LINCOLN 8-1144

New Tech Data for Engineers

Precision Potentiometers

Engineering bulletin No. 40 issued by Technology Instrument Corp. of Calif., 7229 Atoll Ave., N. Hollywood, Calif., is a new 6-page engineering bulletin, complete with graphs and schematics, discussing the comparison between sine-cosine and linear potentiometer methods of phase dividing.

Circle 213 on Inquiry Card, page 83

Vacuum Components

Jennings Radio Mfg. Corp., 970 McLaughlin Ave., P. O. Box 1278, San Jose 8, Calif., is an 8-page booklet describing fixed and variable capacitors, transfer relays and power switches. Catalog is complete with photographs and the information is presented in tabular form.

Circle 214 on Inquiry Card, page 83

Hex-Socket Screws

A 44-page catalog G-57 describes the Allen Mfg. Co., Hartford 2, Conn., complete line of Hex-Socket screws and Allen nuts. Complete technical information is included along with photographs, outline drawings, and available tools.

Circle 215 on Inquiry Card, page 83

Miniaturized VT VM

Miniaturized electronic voltmeters in four basic styles are described in a 4-page, short-form catalog, No. 10-A just issued by Metronix, Inc., Chesterland, Ohio. Data includes performance specifications, dimensions, photographs and prices.

Circle 216 on Inquiry Card, page 83

Measuring Equipment

A 4-page short-form catalog describing Eldorado instrumentation is now available from Eldorado Electronics, 2821 Tenth St., Berkeley, Calif. The new bulletin briefly describes the accelerator current integrator, universal photomultiplier, photometer, milli-microsecond time-to-pulse-height converter, multi-channel pulse height analyzer, non-overloading linear amplifier and milli-microsecond time measuring system. Specifications and prices are included.

Circle 217 on Inquiry Card, page 83

Transistorized Power Supplies

Lambda Electronics Corp., 11-11 131 St., College Point 56, N. Y., is a 6-page, 2-color brochure which describes a full line of transistorized power supplies. Brochure is complete with photographs, outline drawings, electrical and mechanical specifications.

Circle 218 on Inquiry Card, page 83

Magnetic Tape Splicing

A how-to-do-it folder which shows a series of drawings on how to make professional magnetic tape splices is being offered by Minnesota Mining and Mfg. Co., Dept. M8-340, 900 Bush St., St. Paul, Minn. The 3-color folder also lists valuable tips on tape editing and storage. The folder tells how to cut the tape, how to butt the edges together properly, and what will happen if the wrong angle is used.

Circle 219 on Inquiry Card, page 83

Reactor Preamplifier

CONTROL, Box 391, Butler, Pa., has issued a new bulletin describing a standard preamplifier type PA4401-001 3VA. The bulletin, P-15, describes both physical and electrical characteristic curves. Also included are instructions to design engineers for ordering non-standard preamplifier models, with variations in 4 of the 5 control windings. Each preamplifier is used to receive and amplify signals so minute they would be lost on a larger reactor.

Circle 220 on Inquiry Card, page 83

Teflon Tubing

The Driver-Harris Co., Harrison, N. J., have issued Bulletin 158, 5 pages, which describes the Surf Chemical Inc.'s line of Teflon tubing. Sizes of the tubing available are in tabular form along with drawings and ordering information. Also extrusions are included such as rods, coaxial cables, cores and aircraft and industrial hose liners.

Circle 221 on Inquiry Card, page 83

Electric Motors

A catalog of fractional horsepower electric motors has been prepared by Carter Motor Co., 2760 A.W. George St., Chicago 18, Ill. A dozen small motors are shown in the catalog ranging from 1/1000 to ⅓ h.p. and including universal, DC, AC and permanent magnet types, induction, gear motors, governor and brake motors. These are illustrated with dimensional diagrams, and complete specifications.

Circle 222 on Inquiry Card, page 83

Magnetic Heads

The Applied Magnetics Corp., P. O. Box 425, Santa Barbara Airport, Bldg. 304, Goleta, Calif., has issued a 4-page bulletin describing the methods and materials used in the manufacture of AMCO magnetic recording heads and shows pictures of various types of heads and head assemblies designed for specific applications.

Circle 223 on Inquiry Card, page 83

Power Tetrodes

"Care and Feeding of Power Tetrodes," application bulletin No. 8, issued by Eitel-McCullough Inc., San Bruno, Calif., gives complete information in text book style about power tetrodes. Booklet is complete with photographs, schematics, tables, and photographs.

Circle 224 on Inquiry Card, page 83

Linear Servo Accelerometers

Date File 410, linear servo accelerometers, issued by Donner Scientific Co., Concord, Calif., is a 2-color, 4-page brochure which contains photographs, electrical and mechanical specifications, and outline drawings.

Circle 225 on Inquiry Card, page 83

Magnetic Core Testing

A 12-page technical bulletin MM-2, "Testing of Rectangular Hysteresis Loop Magnetic Cores" is available from the General Ceramics Corp., Keasbey, N. J. It describes in detail the system and equipment developed for use in testing magnetic cores. The bulletin includes an analysis of the parameters of core characteristics and the test requirements that must be met to ensure the selection of cores to specific levels of performance.

Circle 226 on Inquiry Card, page 83

Selenium Rectifiers

Syntron Co., 263 Lexington Ave., Homer City, Pa., has issued an 8-page catalog giving complete description, data and specifications for their full line of high voltage glass or phenolic tube cartridge-type selenium rectifiers. Catalog shows dimensional outlines and circuit diagram and explains Syntron's stack coding.

Circle 227 on Inquiry Card, page 83

Microwave Equipment

Alfred Electronics, 897 Commercial St., Palo Alto, Calif., has issued a 4-page, 2-color brochure which describes their line of traveling wave tube amplifiers, microwave oscillators, microwave levelers, specialized high voltage power supplies and vacuum station control equipment. Brochure is complete with photographs and electrical and mechanical specifications.

Circle 228 on Inquiry Card, page 83

L-F Decade Oscillator

Technical information is available from Muirhead & Co. Ltd., which describes in detail their D-880-A Two-Phase Low Frequency Decade Oscillator. The oscillator is capable of two outputs that are 90° apart. Frequency range is from 0.01 cps to 11.2 kc. Unit finds many applications in the servo-engineering field.

Circle 229 on Inquiry Card, page 83

another
RADIO RECEPTOR
semiconductor
achievement

3* AMP/IN²

with the revolutionary new

Tri-AMP

SELENIUM RECTIFIER

3 times normal current density

- life expectancy of 100,000 hours.
- 26 volt cells — lower forward voltage drop.
- no parallel devices for voltage division.
- no series devices for load sharing.

THE DIFFERENCE AT A GLANCE!

New Tri-AMP 3-phase Bridge		Standard Type 3-phase Bridge	
Dimensions	Amp.	Dimensions	Amp.
4" x 4" *Fan Cooled	54	4" x 4" Fan Cooled	16.8
4" x 4" Convection Cooled	18	4" x 4" Convection Cooled	6.7

Now you'll understand why conventional selenium rectifiers are now obsolete!

Not just a variation of standard selenium rectifiers — TRI-AMP is a *new* selenium semiconductor with far greater reliability, operating at *three times* the current density of standard stacks. It has the overvoltage and overcurrent advantages of selenium, which means there is no need for the expensive and elaborate protective devices so necessary when using other semiconductors.

Our Radio Receptor plant, working with unique equipment developed by Siemens of West Germany, is now producing TRI-AMP selenium semiconductors for immediate delivery. Please request full information from Section EI-12R.

General Instrument Corporation also includes Automatic Manufacturing Division, F. W. Sickles Division, Micamold Electronics Manufacturing Corporation (subsidiary)

GENERAL INSTRUMENT
SEMICONDUCTORS

semiconductor division
RADIO RECEPTOR COMPANY, INC.
Subsidiary of General Instrument Corporation
240 Wythe Avenue, Brooklyn 11, N. Y.

GENERAL INSTRUMENT DISTRIBUTORS: *Baltimore:* D & H Distributing Co. • *Chicago:* Merquip Co. • *Cleveland:* Pioneer Electronic Supply • *Los Angeles:* Valley Electronics Supply Co., Burbank • *Milwaukee:* Radio Parts Co., Inc. • *New York City:* Hudson Radio & Television Corp., Sun Radio & Electronic Co. *Philadelphia:* Herbach & Rademan, Inc. • *San Francisco:* Pacific Wholesale Co. • *Seattle:* Seattle Radio Supply • *Tulsa:* Oil Capitol Electronics

First family of power triodes made specifically for series regulation!

Tung-Sol/Chatham power triode family covers every series regulator need!

Now designers can specify a premium quality Tung-Sol/Chatham tube for all series regulator sockets. Tung-Sol/Chatham's family of power triodes — the first designed and produced specially for series regulator service — meets all design requirements and assures maximum reliability and life at all times.

Types include the new 100 Watters, 7241 and 7242, medium mu or low mu-high current. 12 or 26 Volt heater versions available on most types. All embody sturdy construction features that contribute to overall ruggedness and long hours of heavy-duty operation.

Compare the ratings below against your particular application! If you desire complete data sheets . . . or you have a specific design problem, contact us today! We'll be glad to give whatever assistance we can. Just write: Tung-Sol Electric Inc., Newark 4, N. J., Commercial Engineering Offices: Bloomfield and Livingston, N. J., Culver City, Calif., Melrose Park, Ill.

TUNG-SOL®

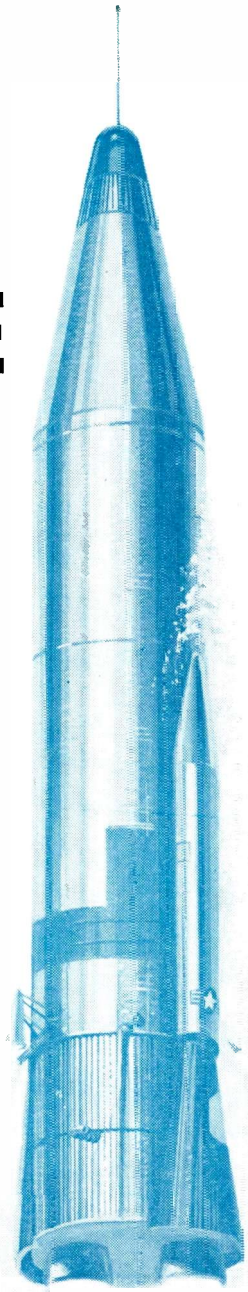
TYPICAL VALUES				
	Total Plate Current	Range of Tube Voltage Drop	Minimum Tube Drop	Grid Voltage Swing
5998	200 ma	80 v	45 v	20 v
6528	400	65	70	10
7242	600	80	70	13

PERTINENT CHARACTERISTICS PER TUBE				
	Max. Plate Current	Max. Plate Voltage	MU	Gm
5998	280	275	5.5	28,000 umhos
6528	600	400	9.0	74,000 umhos
7242	900	400	9.0	111,000 umhos

TUBE TYPES BY PLATE DISSIPATION RATINGS			
Total Plate Dissipation	26 to 30 W	60 W	100 W
Low Mu	6AS7G, 6082 6080WA, 7105	6336A 6394A	7241
Medium Mu	5998	6528	7242

THE FIRST COUNT-DOWN WAS . . .

Inside AN R.F. SHIELDING ENCLOSURE

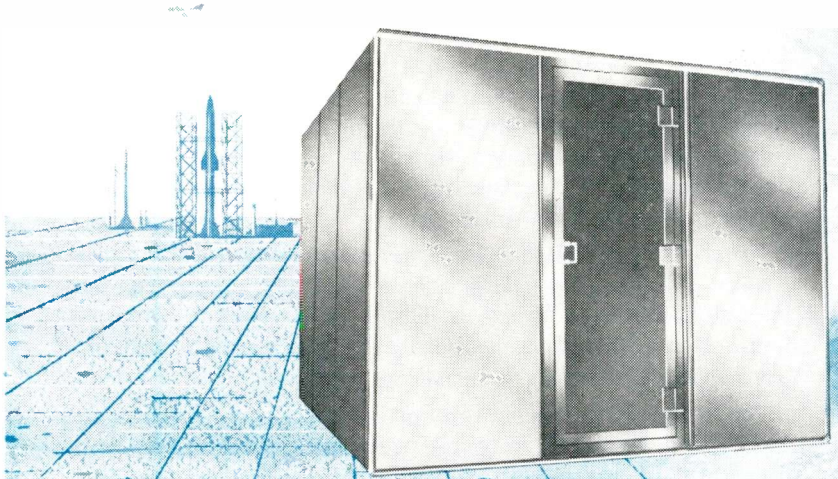


Proper functioning of critical missile electronic guidance systems demands exhaustive pretesting in the laboratory, on the production line and at the launching site. One very important pre-testing procedure is analyzing the performance of electronic components, sub-systems and systems in an area completely free of RF interference.

Shielding, Inc. is a supplier of RF Shielding enclosures for use in both the Thor and Atlas programs. As a designer and producer of RF shielding enclosures from the **largest ever built** to standard, modular rooms, Shielding has the experience and abilities to fill critical RF shielding requirements — with either a standard or custom-designed enclosure.

Missile and communication equipment manufacturers and government officials know from experience that Shielding enclosures offer the **highest RF shielding effectiveness** available for construction material used . . . incorporate **extra mechanical design features** and **installation versatility** not found in conventional enclosures.

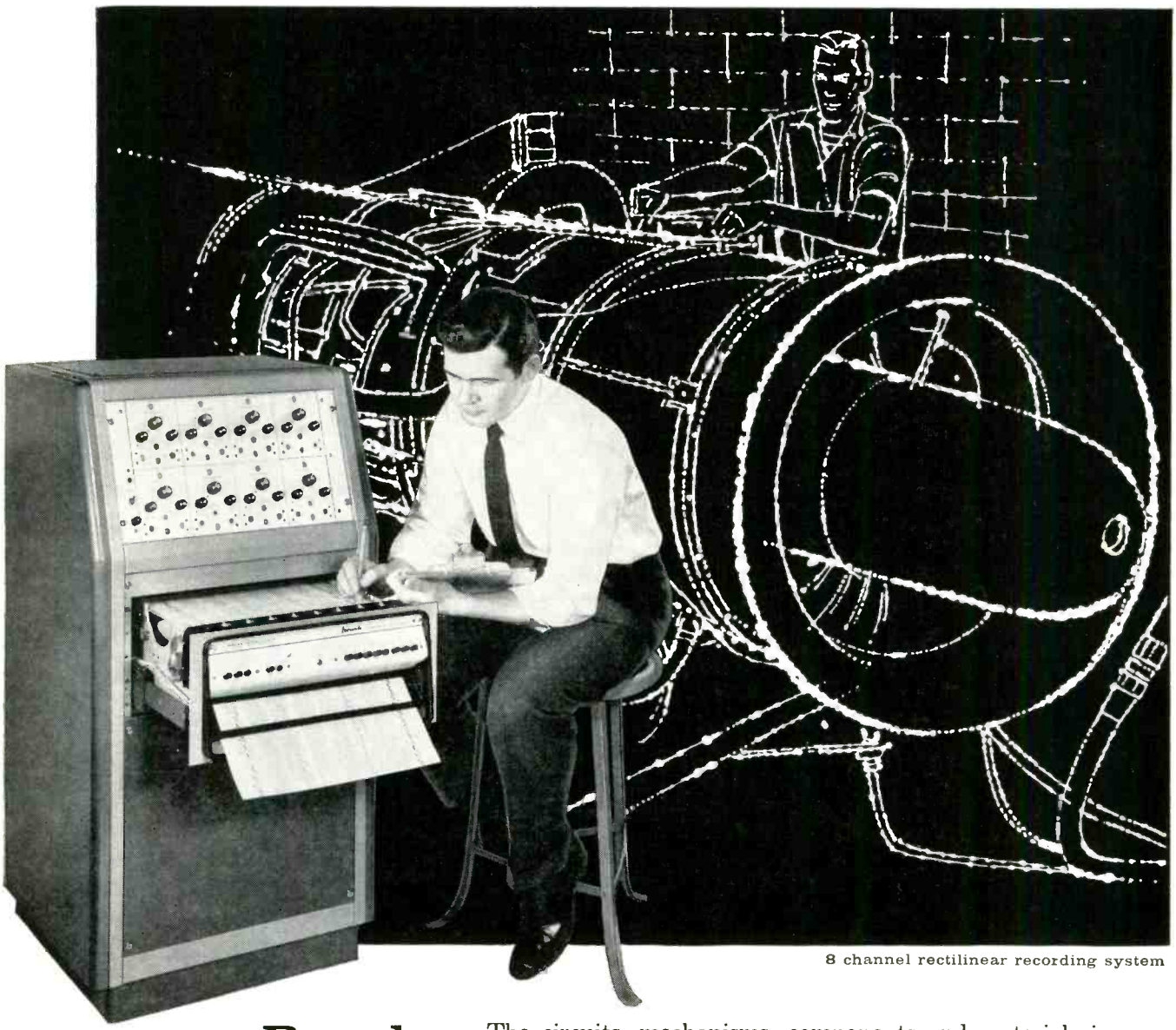
Whatever your RF interference needs, Shielding will deliver an enclosure to your specifications. Write or wire, outlining your problems, to Shielding, Inc. You will receive a prompt appraisal.



SHIELDING, INC.

65 N. READE AVE.
RIVERTON, N. J.

CHICAGO — R. EDWARD STEMM • DENVER — WILLIAMS & ASSOCIATES • FORT WORTH — MITCHELL SPEAIRS COMPANY • SEATTLE — G. M. GILLETT COMPANY
LOS ANGELES — CARL A. STONE ASSOCIATES, INC. • CANADA — STARK ELECTRONICS SALES LTD., AJAX, ONTARIO



8 channel rectilinear recording system

Brush ultralinear recording systems

...WHEN RELIABILITY IS OF VITAL CONCERN

The circuits, mechanisms, components and materials in this 8-channel recording system have *already proved their reliability* in Brush instrumentation now in use in the most critical applications—such as radar surveillance, computer readout, missile checkout on remote test ranges . . . in extremes of temperature, humidity and other abnormal conditions. At Brush, the high reliability factor is always a basic consideration in design.

In the system shown here, trace presentation is rectilinear. Thermal writing provides clear, sharp traces, excellent for reproduction. Eight chart speeds, stepped from .4 to 100 mm/sec., operate by pushbutton controls. The system readily adapts to pertinent MIL specs.

With their wide measurement ranges, Brush *Ultralinear* Recording Systems may be used for development and checkout of industrial as well as military equipment. Factory branches, service and warehousing at Arlington, Va., Boston, Cleveland, Los Angeles, San Francisco and Seattle; engineering representatives in all key locations.

ASK FOR NEW CATALOG
Describes 2, 4, 6 and 8 channel systems—rack and mobile—ink, electric and thermal writing.

brush INSTRUMENTS
DIVISION OF
3405 PERKINS AVENUE CLEVITE CORPORATION CLEVELAND 14, OHIO

Circle 93 on Inquiry Card, page 83
Circle 94 on Inquiry Card, page 83 →

SILICON RECTIFIERS

designed and manufactured to meet

THE NEW JAN SPECIFICATIONS

For AXIAL LEAD TYPES

JAN 1N538 (MIL-E-1/1084A)	JAN 1N540 (MIL-E-1/1085A)	JAN 1N547 (MIL-E-1/1083A)

now from AUTOMATIC

Maximum Values for AUTOMATIC Military Type Silicon Rectifiers designed to meet the new JAN MIL-E-1 Specification

Type No.	Peak Reverse Voltage (VDC)	DC Output Current @ 25° C. Ambient (MA)	DC Output Current @ 150° C. Ambient (MA)	Maximum Reverse Current* (MA)	Mounting	MIL-E-1 Technical Spec. Sheet No.
JAN 1N538	200	750	250	0.350	Axial lead	1084A
JAN 1N540	400	750	250	0.350	Axial lead	1085A
JAN 1N547	600	750	250	0.350	Axial lead	1083A

*Averaged over 1 cycle for inductive or resistive load with rectifier operating at full rated current at 150° C. ambients.

PRODUCTION QUANTITIES OF ALL TYPES AVAILABLE FOR FAST DELIVERY

Naturally, you can get these new axial lead JAN types direct from AUTOMATIC, and from authorized distributors throughout the country — and at prices that reflect General Instrument's years of volume production experience.

Together with the earlier JAN type stud mount group, AUTOMATIC now covers the entire medium power silicon rectifier field for the requirements of every military application.

More information? A complete set of data sheets is yours for the asking. Please write us today.

GENERAL INSTRUMENT SEMICONDUCTORS

General Instrument Corporation also includes F. W. Sickles Division, Radio Receptor Co., Inc., and Micamold Electronics Manufacturing Corporation (Subsidiaries)

AUTOMATIC MANUFACTURING

MASS PRODUCERS OF ELECTRONIC COMPONENTS

AUTOMATIC MANUFACTURING DIVISION OF GENERAL INSTRUMENT CORPORATION
65 GOUVERNEUR STREET, NEWARK 4, N. J

High Precision Radar Speeds Air Mapping

Airborne surveying equipment capable of charting an area the size of West Virginia in 12 hours has been developed by the Air Research and Development Command's (ARDC) Wright Air Development Center (WADC), Dayton, Ohio.

The system utilizes an improved version of high precision, short range navigation radar (HIRAN).

A closed-circuit television system is used on the C-130 mapping aircraft to guide it along parallel photographic flight lines. The television camera, which has a 70° vertical and 45° horizontal scanning range, transmits a picture to a 7-inch scope used by the photo-navigator.

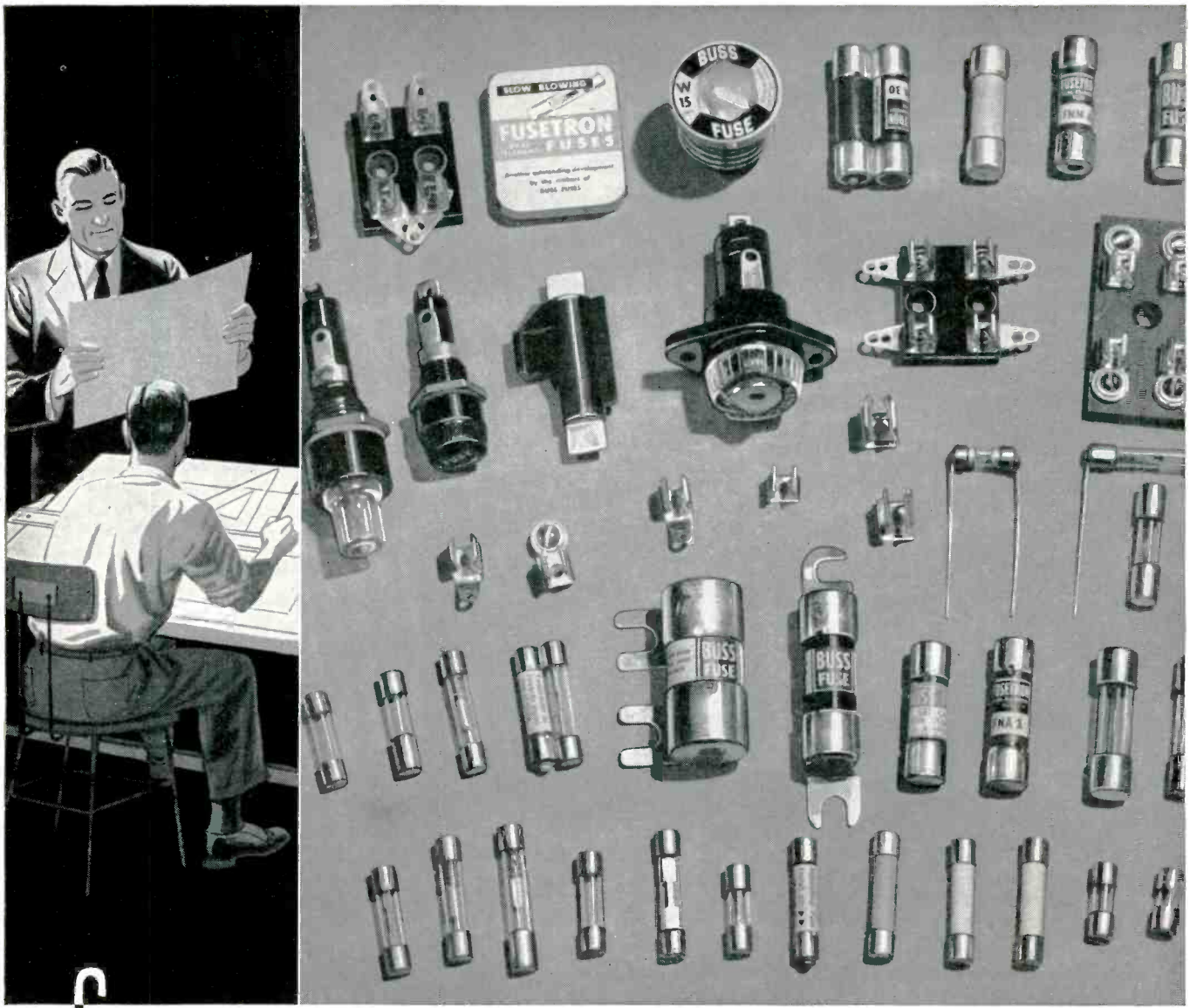
Gyro-stabilized camera mounts hold the photo mapping cameras in level position despite in-flight motions of the airplane.

An airborne profile recorder verifies true altitude with a radar altimeter which determines the shape and height of terrain features by measuring the time of return of a radar beam from the plane to the ground. A sensitive pressure altimeter is used for cross reference.

Corrections for humidity, temperature and pressure are picked up by parachute-borne radiosondes (airborne meteorographs that automatically transmit meteorological data by radio) dropped from the plane during the photo-mission. Information on prevailing atmospheric conditions are transmitted by the radiosondes to the plane where they are recorded on chart paper. Data collected is reduced after the flight and coordinated with the photos taken during the flight.

3-D ANTENNA

Hughes' E. W. Templin and Dr. N. A. Begovich stand in front of novel antenna of their new "Frescanar" radar which simultaneously computes distance, bearing, height.



Guard against needless trouble and shutdowns

. . . by specifying dependable BUSS fuses!

Should a fuse fail to protect your equipment if electrical trouble occurs . . . unnecessary damage results. Or, if a fuse blows needlessly your equipment is shutdown without good cause.

Why risk faulty fuses causing trouble and reflecting on the service and reliability of your equipment? You can be sure of dependable electrical protection by specifying BUSS fuses.

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.

One source for all your fuse needs.

To meet your needs, — the BUSS line of fuses is most complete . . . plus a companion line of fuse clips, blocks and holders.

To help you on special problems in electrical protection . . .

. . . BUSS places at your service the facilities of the world's largest fuse research laboratory and its staff of engineers. If possible, our engineers will help you select a fuse readily available in local wholesalers' stocks so users can easily obtain fuses for replacement.

For more information on the complete line of BUSS and FUSETRON Small Dimension Fuses and Fuseholders, write for bulletin SFB.

Bussmann Mfg. Division
McGraw-Edison Co., University at Jefferson, St. Louis 7, Mo.

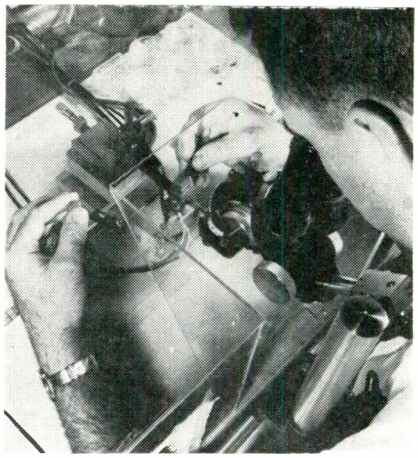
1258

BUSS fuses are made to protect — not to blow, needlessly

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

BUSS MAKES A COMPLETE LINE OF FUSES FOR HOME, FARM, COMMERCIAL, ELECTRONIC, AUTOMOTIVE AND INDUSTRIAL USE.

TRANSISTOR TECHNIQUE



At Bell Telephone Labs T.B. Light is using a newly developed method of compression bonding to join gold leads to a transistor.

Space Data and Satellite Control

A solution of the problem of control of a space vehicle's orientation was indicated by Dr. A. J. Dessler, of Lockheed's space physics department, in a paper presented before the American Astronautical Society meeting at Stanford University.

The instrument described by Dessler is mounted in the forward part of a satellite where a small hole lets atmospheric gas molecules into the instrument. The stream of air molecules rushing through the hole is chopped by a system of whirling blades. The flutter of the air in force hits a microphone and produces a tone. Proper orientation with respect to direction of motion is indicated by a steady tone resulting from uniform distribution of the air molecules through the chopper.

Pitching or yawing results in an uneven distribution of the air stream and loss of the signal that actuates controls to keep the vehicle in the proper attitude. Since the density of the air affects the intensity of the tone produced by the air stream scientists may more accurately predict lifetimes of space vehicles subjected to atmospheric drag.

Lockheed Missile's Brochure

Lockheed Missile System Division has just prepared a two-color brochure which describes in detail the organization, aims, and the benefits of employment at their firm.

Copies of "Space . . . The New Frontier" may be obtained by writing directly to Miss Joan Fraters, Lockheed Missile Systems Div., 962 W. El Camino Real, Sunnyvale, Calif.

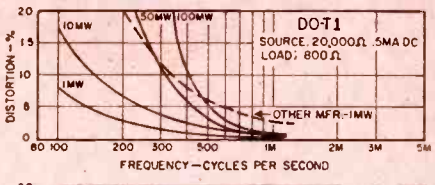
TO MAKE YOUR EQUIPMENT SMALLER YET MORE RELIABLE

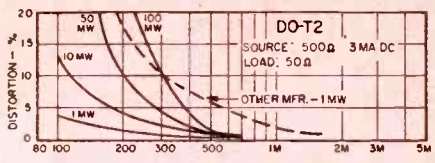
REVOLUTIONARY TRANSISTOR* TRANSFORMERS, HERMETIC TO MIL-T-27A

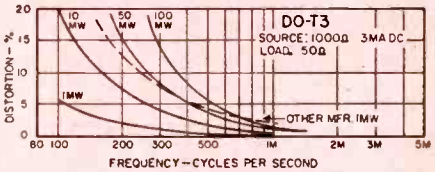
Conventional miniaturized transistor transformers have inherently poor electrical characteristics, perform with insufficient reliability and are woefully inadequate for many applications. The radical design of the new UTC DO-T and DI-T transistor transformers provides unprecedented power handling capacity and reliability, coupled with extremely small size.

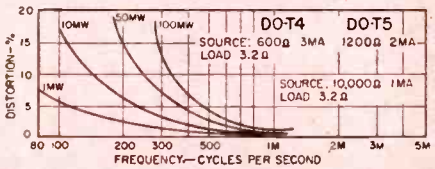
TYPICAL DO-T PERFORMANCE CURVES

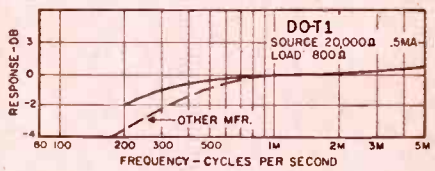
Power curves based on setting output power at 1 KC, then maintaining same input level over frequency range.

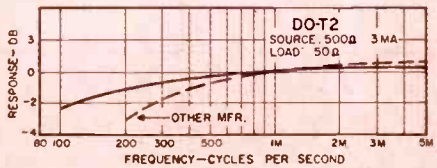


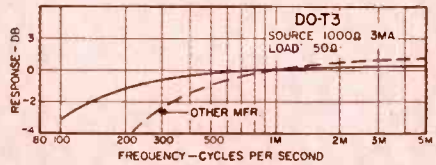


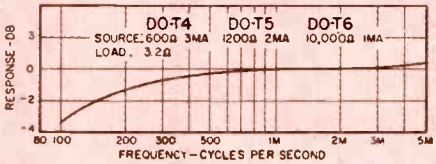












DO-T

5/16 Dia. x 1 3/32, 1/10 Oz.

High Power Rating . . . up to 100 times greater.

Excellent Response . . . twice as good.

Low Distortion . . . reduced 80%.

High Efficiency . . . up to 30% better.

Moisture Proof . . . hermetic to MIL-T-27A.

Rugged . . . completely cased.

Anchored Leads . . . will stand 10 lb. pull, plastic leads for printed circuits.

DI-T

5/16 Dia. x 1/4, 1/20 Oz.

To fully appreciate DO-T transistor transformers, the curves indicate their performance compared to that of similar size units now on the market. DI-T transformers are still smaller in size. Power rating and other characteristics are identical to DO-T, but low frequency response (3 db down point) is 30% higher in frequency. Units can be used for different impedances than those shown, keeping in mind that impedance ratio is constant. Lower source impedance will improve response and level ratings . . . higher source will reduce them. Units may be used reversed, input to secondary.

DO-T No.	MIL Type	Application	Pri. Imp.	D.C. Ma.‡ in Pri.	Sec. Imp.	Pri. Res.	Level Mw.	DI-T No.
DO-T1	TF4RX13YY	Interstage	20,000 30,000	.5 .5	800 1200	850	50	
DO-T2	TF4RX17YY	Output	500 600	3 3	50 60	60	100	DI-T2
DO-T3	TF4RX13YY	Output	1000 1200	3 3	50 60	115	100	DI-T3
DO-T4	TF4RX17YY	Output	600	3	3.2	60	100	
DO-T5	TF4RX13YY	Output	1200	2	3.2	115	100	
DO-T6	TF4RX13YY	Output	10,000	1	3.2	1000	100	
DO-T7	TF4RX16YY	Input	200,000	0	1000	8500	25	
DO-T8	TF4RX20YY	Reactor 3.5 Hys. @ 2 Ma. DC, 1 Hy @ 5 Ma. DC (DI-T8 is 2.5 Hy @ 2 Ma.)				630		DI-T8
DO-T9	TF4RX13YY	Output or driver	10,000 12,500	1 1	500 CT 600 CT	800	100	DI-T9
DO-T10	TF4RX13YY	Driver	10,000 12,500	1 1	1200 CT 1500 CT	800	100	DI-T10
DO-T11	TF4RX13YY	Driver	10,000 12,000	1 1	2000 CT 2500 CT	800	100	DI-T11
DO-T12	TF4RX17YY	Single or PP output	150 CT 200 CT	10 10	12 16	11	500	
DO-T13	TF4RX17YY	Single or PP output	300 CT 400 CT	7 7	12 16	20	500	
DO-T14	TF4RX17YY	Single or PP output	600 CT 800 CT	5 5	12 16	43	500	
DO-T15	TF4RX17YY	Single or PP output	800 CT 1070 CT	4 4	12 16	51	500	
DO-T16	TF4RX13YY	Single or PP output	1000 CT 1330 CT	3.5 3.5	12 16	71	500	
DO-T17	TF4RX13YY	Single or PP output	1500 CT 2000 CT	3 3	12 16	108	500	
DO-T18	TF4RX13YY	Single or PP output	7500 CT 10,000 CT	1 1	12 16	505	500	
DO-T19	TF4RX17YY	Output to line	300 CT	7	600	19	500	DI-T19
DO-T20	TF4RX17YY	Output or matching to line	500 CT	5.5	600	31	500	DI-T20
DO-T21	TF4RX17YY	Output to line	900 CT	4	600	53	500	
DO-T22	TF4RX13YY	Output to line	1500 CT	3	600	86	500	DI-T22
DO-T23	TF4RX13YY	Interstage	20,000 CT 30,000 CT	.5 .5	800 CT 1200 CT	850	100	DI-T23
DO-T24	TF4RX16YY	Input (usable for chopper service)	200,000 CT	0	1000 CT	8500	25	
DO-T25	TF4RX13YY	Interstage	10,000 CT 12,000 CT	1 1	1500 CT 1800 CT	800	100	
DO-T26	TF4RX20YY	Reactor 6 Hy. @ 2 Ma. DC, 1.5 Hy. @ 5 Ma. DC				2100		
DO-T27	TF4RX20YY	Reactor 1.25 Hy. @ 2 Ma. DC, .5 Hy. @ 11 Ma. DC				100		
DO-TSH	Drawn Hipermalloy shield and cover for DO-T's, provides 25 to 30 db shielding.							

‡DCMA shown is for single ended useage (under 5% distortion—100MW—1KC) . . . for push pull, DCMA can be any balanced value taken by .5W transistors (under 5% distortion—500MW—1KC)

O-T units have been designed for transistor application ly . . . not for vacuum tube service. Patents Pending

SPECIAL UNITS AVAILABLE TO YOUR SPECIFICATIONS.

UNITED TRANSFORMER CORP.

150 Varick Street, New York 13, N. Y.

PACIFIC MFG. DIVISION: 4008 W. JEFFERSON BLVD., LOS ANGELES 16, CALIF.
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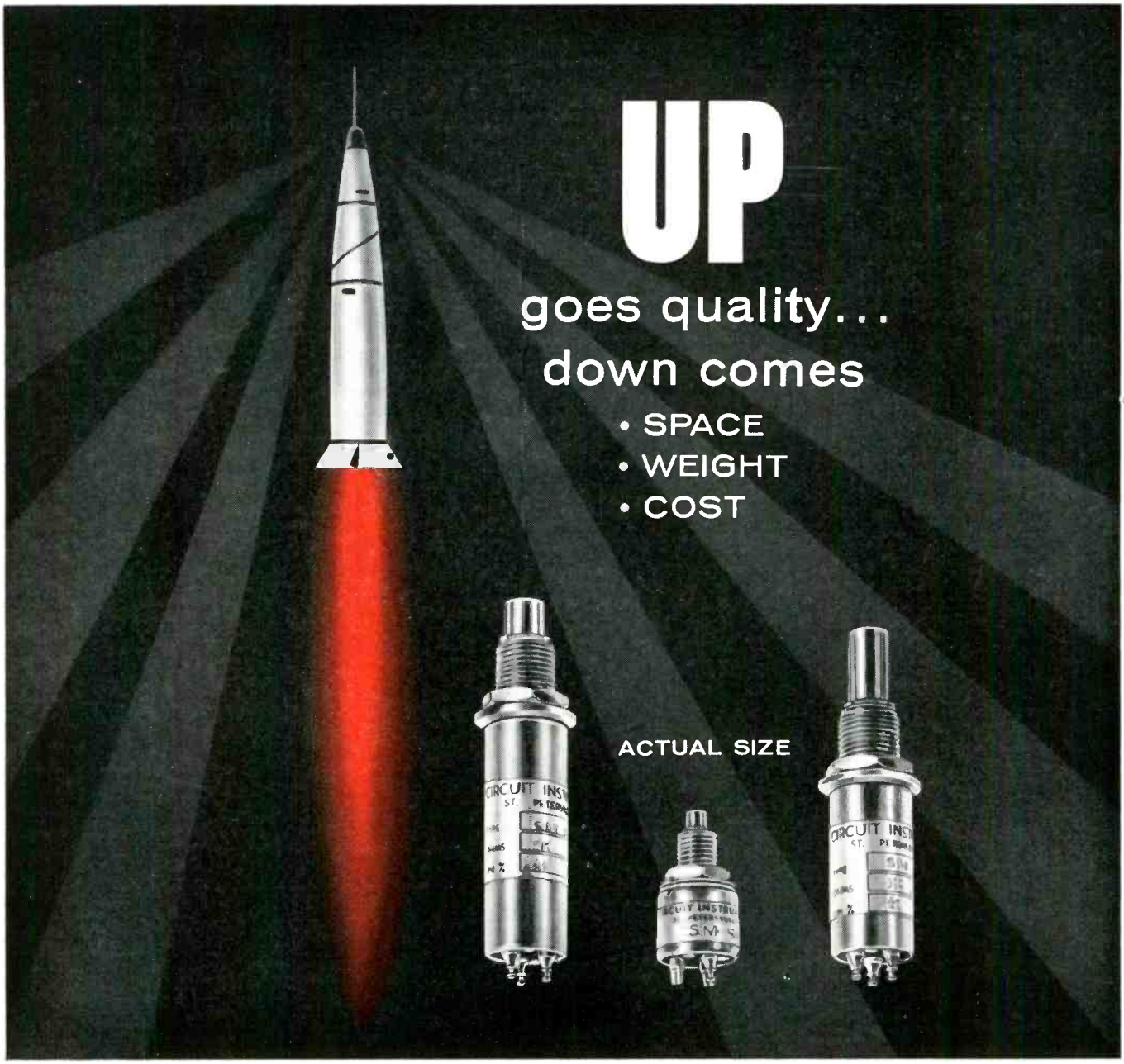
Circle 115 on Inquiry Card, page 83



CIRCUIT sub-miniature PRECISION POTENTIOMETERS

- **Large Pot Characteristics** in a small ½" diameter case
- **Resistance Range:** 50-100K ohms, 4-5000 ohms, 25-50K ohms (left to right).
- **Linearity:** (Independent) ±1%, ±5%, ±1% (left to right). Special linearities as low as .25%

Circuit sub-miniature precision potentiometers are the answer where trim pot size and large pot characteristics are required. Resolution, ruggedness and rotational life need not be sacrificed for size. Severe environmental conditions of vibration and shock won't materially affect their performance or life. High temperature and moisture-sealed versions available.

Circuit flexible production and modern facilities assure lowest possible cost. Write for complete specifications on single and multi-turn models in Bulletins A-9 and A-8 . . . or see your authorized Circuit Distributor.

IRC®

CIRCUIT INSTRUMENTS INC.
A DIVISION OF INTERNATIONAL RESISTANCE COMPANY
Dept. 356, 2801 Anvil Street
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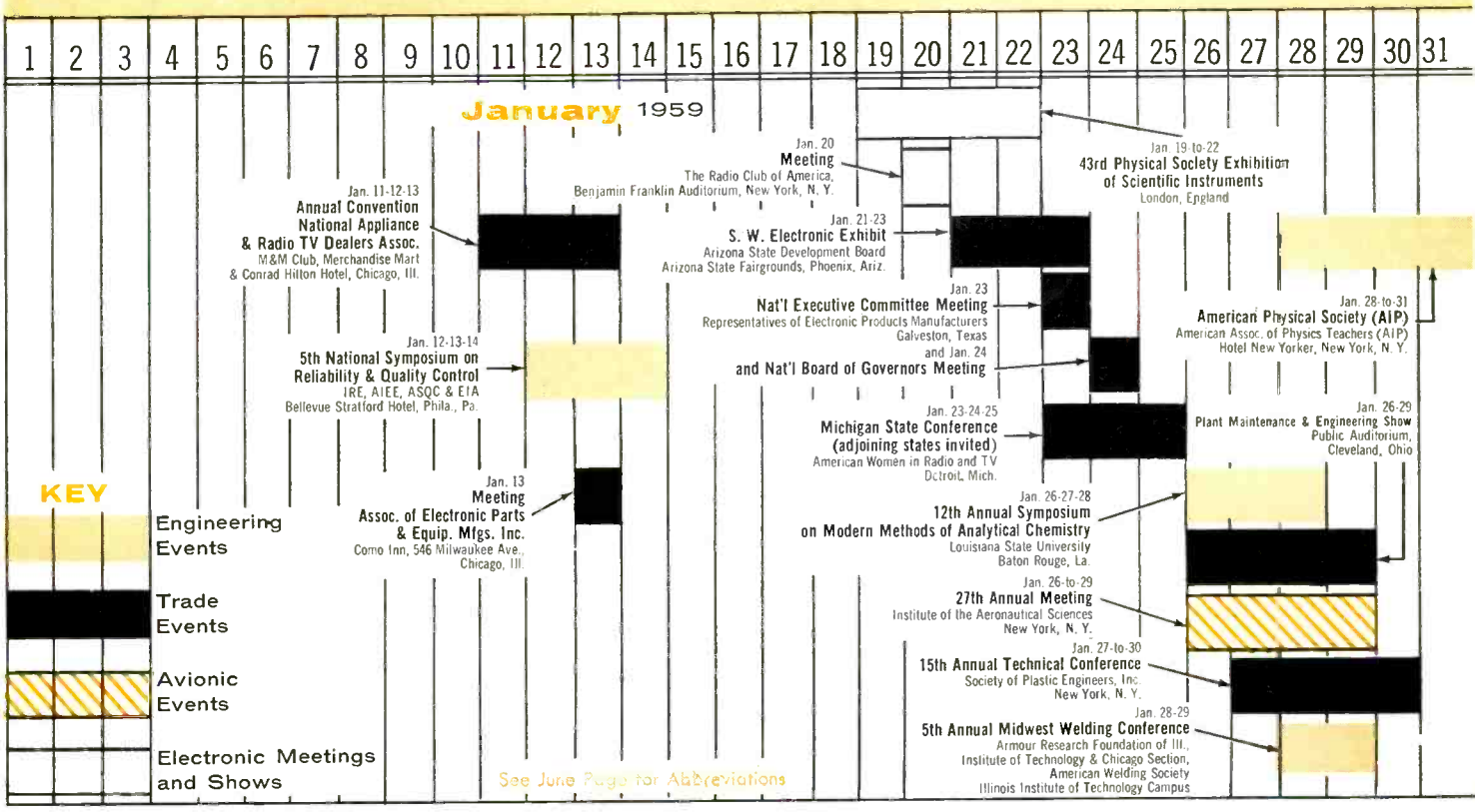
FOR ALL PRECISION POTENTIOMETER REQUIREMENTS: MINIATURE • SUB-MINIATURE • MOISTURE-SEALED • HERMETICALLY-SEALED • BALL BEARING • HIGH PRECISION • HIGH TEMPERATURE

Electronic Industries

1959 Coming Events Calendar

Portraying important electronic events for the year ahead.



Call Kittleson
for maximum efficiency
of your **ENGINEERING TIME!**

You can obtain electronic equipment to your specifications without time-consuming multiple conferences! Call on Kittleson Company, one of the West's oldest and most experienced representatives of precision electronic manufacturers.

Every man on the Kittleson Company's field staff is a mechanical or electrical engineer - with a quick grasp of essentials and objective knowledge of resources. Each is well qualified to discuss your problems at the engineering level.

When you talk to the Kittleson Company, you can come directly to the point - and as quickly receive sound recommendations based upon long experience. Three headquarters serve California, New Mexico, Arizona and Nevada. Kittleson service is as close as your telephone. Won't you call and get acquainted?

Kittleson Company *Electronic Manufacturers' Representative*

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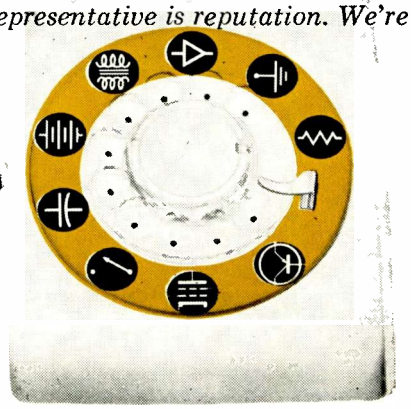
The most important line carried by any manufacturers' representative is reputation. We're proud of ours!



ELECTRONIC INDUSTRIES

Coming Events Calendar

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

February 1959

Feb. 1-to-6
Winter General Meeting
AIEE—Technical Operations Dept.
Hotel Statler, New York, N. Y.

Feb. 2-to-7
Committee Week
American Society for Testing Materials (ASTM)
Penn-Sheraton Hotel, Pittsburgh, Pa.

Feb. 2-3-4
7th Regional Technical Conference & Trade Show
IRE
University of New Mexico, Albuquerque

Feb. 5-to-8
1959 San Francisco High Fidelity Music Show
Institute of High Fidelity Mfrs. Inc
Cow Palace, San Francisco, Calif.

Feb. 3-4-5
14th SPI Reinforced Plastics Div. Conf.
SPI
Edgewater Beach Hotel, Chicago, Ill.

Feb. 12-13
Transistor & Solid State Circuits Conference
IRE, AIEE & University of Pennsylvania
University of Pennsylvania, Phila., Pa.

Feb. 15-to-19
AIME Annual Meeting—Metallurgical Society Functions
AIME—Metallurgical Society
St. Francis Hotel, San Francisco, Calif.

Feb. 16-to-19
West Coast Convention
Audio Engineering Society
Los Angeles, Calif.

Feb. 16-to-23
1959 Los Angeles High Fidelity Music Show
Institute of High Fidelity Mfrs., Inc.
Biltmore Hotel, Los Angeles, Calif.

Feb. 17
Annual Education Seminar
Assoc. of Electronic Parts & Equip. Mfgs., Inc.
Tam O'Shanter Country Club, Niles, Ill.

Feb. 17
Meeting
The Radio Club of America
Benjamin Franklin Auditorium,
New York, N. Y.

Feb. 19-20-21
Winter Meeting
National Society of Professional Engineers
Dinkler-Tutwiler Hotel, Birmingham, Ala.

Feb. 23-to-26
Symposium on Thermophysical Properties
ASME
Purdue University, Lafayette, Ind.

Feb. 24-25
State Presidents Conference
National Association of Broadcasters
Washington, D. C.

March 1959

March 1-2-3
Southeastern Regional Conference
National Assoc. of Music Merchants
Dinkler-Plaza Hotel, Atlanta, Ga.

March 3-4-5
Western Joint Computer Conference
IRE, AIEE & The Assoc. for Computing Machinery
Fairmount Hotel, San Francisco, Calif.

March 5-6
Flight Propulsion Meeting (classified)
Institute of the Aeronautical Sciences
Hotel Carter, Cleveland, Ohio

March 6-7
Meeting
American Physical Soc.
University of Texas, Austin, Tex.

March 8-to-11
Gas Turbine Power Conference & Exhibit
ASME
Netherlands-Hilton, Cincinnati, Ohio

March 8-to-12
Aviation Conference
ASME
Statler-Hilton, Los Angeles, Calif.

March 10
Annual Meeting Luncheon—
Election of Officers
Assoc. of Electronic Parts & Equip. Mfrs. Inc.
Como Inn, Chicago, Ill.

March 15-to-18
37th Annual Convention &
Broadcast Engineering Conference
National Association of Broadcasters
Chicago, Ill.

March 17
Annual Dinner Meeting
Broadcast Pioneers
Conrad Hilton Hotel, Chicago, Ill.

March 17-to-21
8th Electrical Engineer's Exhibition
London, England

March 18-19-20
Conference
Electronic Industries Assoc.
Statler Hotel, Washington, D. C.

March 22-23-24
Northwestern Regional Conference
National Assoc. of Music Merchants
Hotel Multnomah, Portland, Ore.

March 23-to-26
National Convention
IRE
Waldorf Astoria Hotel (Hdqts)
New York Coliseum (Radio Engrg. Show)—New York, N. Y.

March 23-24-25
Meeting
American Rocket Society
Daytona Beach, Fla.

March 24-25
Meeting
Institute for Printed Circuits
New York, N. Y.

March 26
15th Annual Quality Control Clinic
Rochester Soc. for Quality Control
University of Rochester, Rochester, N. Y.

March 30-31
Meeting
American Physical Society
Hotel Somerset, Cambridge, Mass.

March 31-April 2
Symposium on Millimeter Waves
Polytechnic Institute of Brooklyn, IRE,
Dept. of Defense Research Agencies
Auditorium of the Engineering Societies Bldg.,
Polytechnic Institute of Brooklyn

KEY

- Engineering Events
- Trade Events
- Avionic Events
- Electronic Meetings and Shows

See June Page for Abbreviations

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

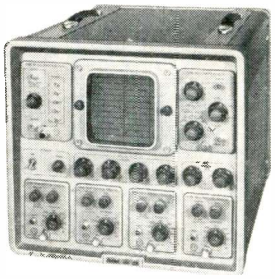
RELIABLE PRODUCTS

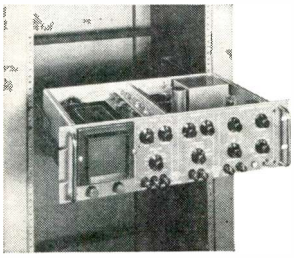
MODEL K-270
Dual-Channel Oscilloscope

A highly flexible, 5-megacycle scope using plug-in preamplifiers, sweep generators, and marker-calibrator for maximum utility. New ETC 4½" by 5½" *rectangular*, 2-gun tube.

MODEL K470
Four-Channel Oscilloscope

Similar to the K-270 but with 4-separate channels. Expands as your needs grow with optional plug-in pre-amplifiers, sweeps, and marker-calibrator. Uses new ETC 5½" *square*, 4-gun tube.



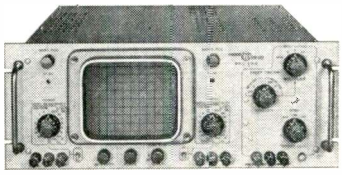


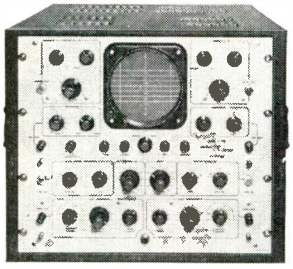
MODEL K-10-R
Rack-Mounted Oscilloscope

Using a new ETC 3½" *square* single-gun tube, this compact scope gives a raster size equal to a 5" round tube. DC to 500 kc at 10 mv/inch, direct-coupled. Transistorized calibrator.

MODEL K-11-R
High-Sensitivity Rack Scope

Features high-stability, identical X and Y amplifiers plus wide range of sweep speeds for precise measurements of voltage, time, and phase shift. Uses 4½" x 5½" *rectangular* C-R tube. Sensitivity: 1 mv/cm to 150 v/cm.



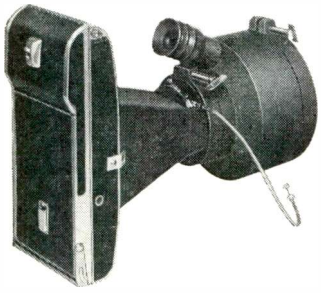


MODEL K-215
Wide-Band, 2-Channel Oscilloscope

Handling dc to 15 mc with accurately-calibrated sweep speeds, the K-215 is ideally fitted for quantitative time and amplitude measurements with accuracy comparable to indicating meters. 2-gun 5" C-R tube.

MODEL K-260
High-Sensitivity, Low-Cost 2-Channel Oscilloscope

Priced scarcely higher than most single-channel oscilloscopes, the K-260 gives truly professional 2-channel performance without switching. Identical vertical amplifiers handle dc to 500 kc with sensitivities to 200 μv/cm. Uses new 4½" x 5½" C-R tube for easy viewing.

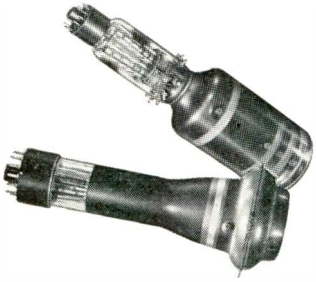


MODEL SM-200
Polaroid Land Scope Camera

Gives immediate single prints on standard Polaroid Land film. 1 to 1 image ratio for maximum size. f/1.9 lens, speeds from 1 to 1/100 second—both adjustable without removing camera from scope. Monocular viewer. Fits all 5" scopes.

MODEL SM-100
Scope Recording Camera

Accurate single-frame or moving-film recording, ½" to 12,000" per minute, using 35 mm film or paper. Binocular viewer. Versatile tripod mounting and positioning. Variable speed adjustment.



Multi-Beam & Single-Beam
CATHODE-RAY TUBES

One, three, four, five, eight and ten gun types with round, rectangular, or square faces from 3 to 12 inches. Also many special C-R tubes including Dual X-axis input, Spiral band, Radial deflection, and Primary beam commutator types. Types to critical military and industrial specifications . . . by the pioneers in multi-gun C-R tubes.

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ELECTRONIC INDUSTRIES

Coming Events Calendar

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

April 1959

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Auditorium of the Engineering Societies Bldg.
Polytechnic Institute of Brooklyn

April 2-3
Technical Conference on Physical Metallurgy of Stress Corrosion Fracture
Metallurgical Soc. of AIME
Mellon Institute, Pittsburgh, Pa.

April 2-to-30
9th Plenary Assembly, International Radio Consultative Committee
Biltmore Hotel, Los Angeles, Calif.

April 2-3-4
Meeting
Optical Soc. of America
(AIP)
Hotel New Yorker, New York, N. Y.

April 5-to-10
5th Nuclear Congress
Institute of the Aeronautical Sciences
Coordinated by EJC, ISA, ASME, IRE
Municipal Auditorium, Cleveland, Ohio

April 6-7
2nd Nat'l Symposium on Chemical & Petroleum Instrumentation
(ISA), St. Louis, Mo.

April 6-7
AFOSR 3rd Annual Astronautical Symposium
Sheraton Park Hotel, Washington, D. C.

April 6-7-8
Nat'l Open Hearth Steel and Blast Furnace Conference
Metallurgical Soc. of AIME
Jefferson Hotel, St. Louis, Mo.

April 6-to-9
16th Annual Radio Component Show
London, England

April 8-9
Railroad Conference
ASME
Sheraton, Chicago, Ill.

April 8-9-10
Southern District Meeting
AIEE
Dinkler Plaza Hotel, Atlanta, Ga.

April 12-to-16
Int'l Conf. on Fracture
AFOSR—ONR—NSF—NAS/NRC
Mass. Institute of Technology, Cambridge, Mass.

April 13-14-15
Hydraulic Conference
ASME
University of Michigan, Ann Arbor, Mich.

April 16-17-18
Southwestern IRE Conference & Exhibit
New Dallas Memorial Auditorium
& Baker Hotel, Dallas, Tex.

April 16-to-30
Engineering, Marine, Welding & Nuclear Energy Exhibition
London, England

April 18-19
Spring Directors Meeting
Nat'l Alliance of TV & Electronic Service Assoc.
Hermitage Hotel, Nashville, Tenn.

April 18-to-22
Annual Meeting
American Soc. of Tool Engineers
Schroeder Hotel, Milwaukee, Wis.

April 19-to-23
Oil & Gas Power Conference & Exhibit
ASME
Shamrock-Hilton, Houston, Tex.

April 20-21
New Techniques in Electronic Industrial Instrumentation
PGIE, PGI, AIEE
Philadelphia, Pa.

April 20-21-22
Annual Meeting
Metal Powder Core Assoc.
Metal Powder Industries Federation
Sheraton-Cadillac, Detroit, Mich.

April 20-to-24
Industrial Photographic & TV Exhibition
London, England

April 21
Round Table with Distributors, Mfrs. and Reps.
Assoc. of Electronic Parts & Equip. Mfrs.
Chicago, Ill.

April 22-23-24
East Central District Meeting
AIEE
Sheraton Mayflower, Akron, Ohio

April 22-23-24
Third Annual Technical Meeting
Institute of Environmental Engineers
LaSalle Hotel, Chicago, Ill.

April 25-to-30
Annual Meeting
Scientific Apparatus Makers Assoc
The Greenbrier, White Sulphur Springs, W. Va.

April 26-28
Southwestern Regional Conference
National Assoc. of Music Merchants
The Hilton Hotel, San Antonio, Tex.

April 27-to-30
Int'l Symposium Chem. of Extractive Metallurgy
Metallurgical Society of AIME
Penn-Sheraton Hotel, Pittsburgh, Pa.

April 29-30—May 1
Empire District Meeting
AIEE
Hotel Syracuse, Syracuse, N. Y.

April 29-to-May 3
Management—SAM Conference
ASME
Statler-Hilton, New York, N. Y.

April 29-to-May 3
Metals Engineering Conference
ASME
Sheraton-Ten Eyck, Albany, N. Y.

April 30-May 2
Meeting
American Physical Soc.
Willard & Raleigh Hotels, Washington, D. C.

April 30-to-May 3
National Convention
American Women in Radio & TV
Waldorf-Astoria Hotel, New York, N. Y.

KEY

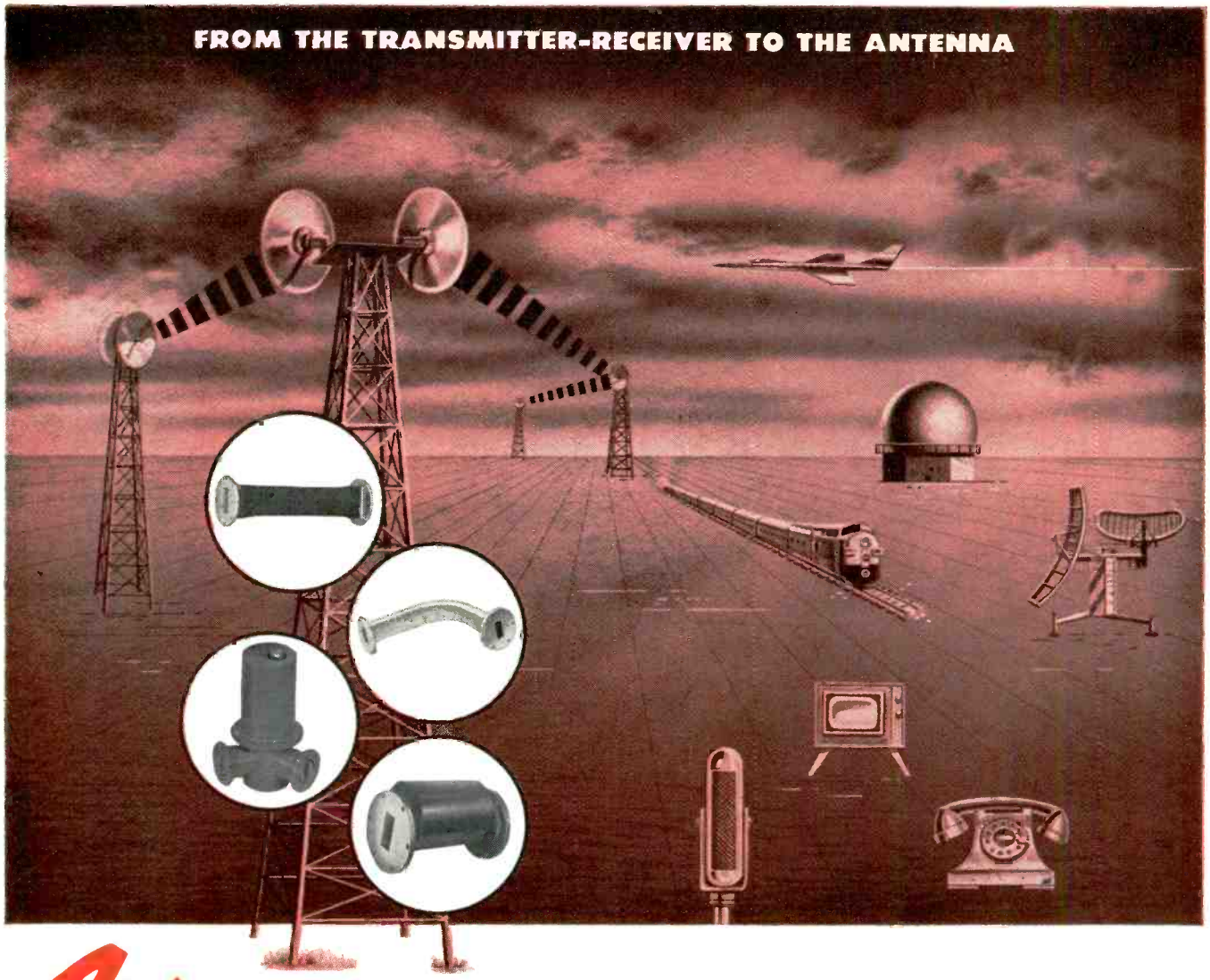
- Engineering Events
- Trade Events
- Avionic Events
- Electronic Meetings and Shows

Dates not Given:

April
Panel Discussion
Western Association of Circuit Manufacturers
Rodger Young Auditorium, Los Angeles, Calif.

See June Page for Abbreviations

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30



Airtron inc.

supplies the vital links in microwave transmission

Airtron, Inc. supplies a complete line of microwave relay waveguide components for system manufacturers and installations throughout the free world.

Many of Airtron, Inc.'s special designs have become so widely used that today they are considered standard units — proof of Airtron, Inc.'s practical design experience which can meet the most stringent engineering requirements of the ever-growing microwave relay field.

Recognition and acceptance of Airtron, Inc.'s microwave components are predicated on the many advances that Airtron, Inc. is daily contributing; and on its having one of the most extensive microwave manufacturing facilities in the world. As proof, a new series of **high conductivity copper waveguides** (100% conductivity) recently introduced by Airtron, Inc. has opened up a new era of high efficiency performance in long line microwave relay transmission. Unique configurations in **flexible waveguide,** transmission lines, **broad band ferrite isolators,** mechanical and ferrite switches, and antenna feed horns have already become standard in their field.

Airtron, Inc. has kept pace with these developments. Since its inception over a decade ago, the company has expanded into five separate divisions, each concerning itself with a separate phase of microwave production, yet each flexible enough to be able to draw on the know-how of all the other divisions. All of Airtron, Inc.'s manufacturing plants combine the best in engineering, production and quality control.

Airtron, Inc. offers designers and manufacturers a triple service . . . the creative design engineering born of a decade of microwave specialization; practical production abilities and equipment; six, separate manufacturing plants to produce reliable and precise microwave components.

Airtron inc.

A DIVISION OF LITTON INDUSTRIES

1301 E. LINDEN AVE., LINDEN, N. J. | 200 HANOVER AVE., MORRIS PLAINS, N. J. | 5873 RODEO RD., LOS ANGELES, CALIF.

MICROWAVE AND ELECTRONIC ENGINEERS — OUTSTANDING OPPORTUNITIES WITH AIRTRON, INC.

ELECTRONIC INDUSTRIES

Coming Events Calendar

May 1959

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

April 29-30—May 1
Empire District Meeting
AIEE
Hotel Syracuse, Syracuse, N. Y.

April 29-to-May 3
Management—SAM Conference
ASME
Statler-Hilton, New York, N. Y.

April 29-to-May 3
Metals Engineering Conference
ASME
Sheraton-Ten Eyck, Albany, N. Y.

April 30-to-May 3
National Convention
American Women in Radio & TV
Waldorf-Astoria Hotel, New York, N. Y.

April 30-May 2
Meeting
American Physical Soc.
Willard & Raleigh Hotels, Washington, D. C.

May 3-to-7
Meeting
The Electrochemical Soc., Inc. & A FOSR/Chemical Div.
Sheraton Hotel (Hdqts), Philadelphia, Pa.

May 4-5
Maintenance & Plant Engrg. Conference
ASME
Edgewater Beach, Chicago, Ill.

May 4-5-6
National Aeronautical Electronics Conference (NAECON)
Dayton Section and the Professional Group on Aeronautical Navigation of the IRE & IAS

May 4-to-8
85th Semi-annual Convention including Int'l Equip. Exhib.
Soc. of Motion Picture & Television Engineers
Fontainebleau Hotel, Miami Beach, Fla.

May 4-to-7
5th Annual Flight Test Inst. Symposium
ISA
Seattle, Wash.

May 5-6-7
URSI Spring Meeting
URSI, PGAP, PGI, PGIT, PGCT
Washington, D. C.

May 5-6-7
7th Nat'l Conf. of Electro-magnetic Relays
Nat'l Assoc. of Relay Mfrs. & School of E. E. Okla. State Univ.
Oklahoma State University Campus, Stillwater, Okla.

May 6-7-8
Electronic Components Conf.
WCEMA, IRE, EIA, AIEE
Benjamin Franklin Hotel, Phila., Pa.

May 6-7-8
7th Regional Tech. Conference & Trade Show
IRE—Region 7
University of New Mexico, Albuquerque, N. Mex.

May 11-12-13
PGMTT National Symposium
IRE
Boston, Mass.

May 11-12-13
National Power Instrumentation Symposium
ISA
Kansas City, Missouri

May 11-12-13
Joint Conf. on Automatic Techniques
IRE (PGIE) AIEE, ASME
Pick-Congress Hotel, Chicago, Ill.

May 12-13-14
Production Engrg. Conf.
ASME
Statler-Hilton, Detroit, Mich.

May 14-15-16
Spring Meeting
Acoustical Soc. of America
Ottawa, Canada

May 17-18-19
5th Nat'l Symposium on Instrumental Methods of Analysis
ISA
Shamrock-Hilton, Houston, Tex.

May 17 (Tentative)
Massachusetts State Convention
The American Radio Relay League

May 18-19-20
Electronic Parts Distributors Show
Assoc. of Electronic Parts & Equip Mfg. Inc.
Conrad Hilton Hotel, Chicago, Ill.

May 19-20-21
Middle Eastern District Meeting
AIEE
Lord Baltimore Hotel, Baltimore, Md.

May 20-21-22
Annual Convention
Electronic Industries Assoc.
Sheraton Hotel, Chicago, Ill.

May 24-to-27
51st Annual Convention
Nat'l Assoc. of Electrical Distributors
Conrad Hilton Hotel, Chicago, Ill.

May 25-26-27
Meeting
American Rocket Society
Denver, Col.

May 25-26-27
13th Annual Convention
American Soc. for Quality Control
Hotel Cleveland, Cleveland, Ohio

May 25-26-27
Nat'l Telemetering Conference IAS, ISA, AIEE, ARS
Institute of the Aeronautical Sciences
Cosmopolitan Hotel, Denver, Colo.

May 25-to-28
Design Engineering Conf.
ASME
Convention Hall, Phila., Pa.

May 25-to-29
Int'l Convention on Transistors & Associated Semiconductor Devices
British Institute of Electrical Engineers
Savoy Place, London, W.C. 2, England

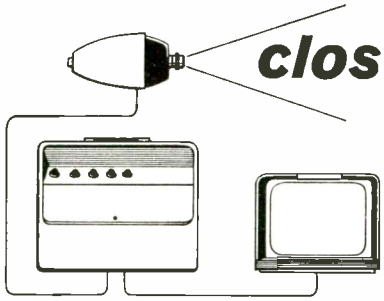
KEY

- Engineering Events
- Trade Events
- Avionic Events
- Electronic Meetings and Shows

See June Page for Abbreviations

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

NOW choose from a complete line of closed circuit TV equipment

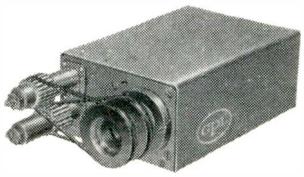


General Precision Laboratory closed circuit TV equipment is providing instantaneous visual communication for industrial, educational, institutional and military applications. Its superior performance and versatility have been proven in installations requiring observation, magnification, instruction and control functions.

To see how this valuable new tool can help you, ask for a demonstration right in your own plant.

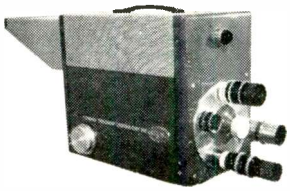
GPL cameras

PD-150 CAMERA weighs only 5 lbs., is shaped to fit into tight places. Requires no special lighting; sensitive vidicon tube picks up clear, sharp pictures at low light levels. Operates with portable, wall or rack-mounted control unit.



PD-152 RUGGEDIZED CAMERA withstands roughest treatment — shock, noise and vibration. Works undisturbed by over 175 db noise levels, 100,000 ft. altitudes, up to 100% humidity —without additional shielding.

PD-500 CAMERA is a complete single-unit system with controls built into the camera itself. This simplified, low cost, dependable unit requires only a receiver or monitor to make a self-contained closed circuit TV system.



PD-250 VIEW-FINDER CAMERA with 4-lens turret and electronic viewfinder makes it easy to follow and frame every action. Zoom-type lens, controlled from rear, can be used as part of standard lens complement. Portable or studio console control unit available.

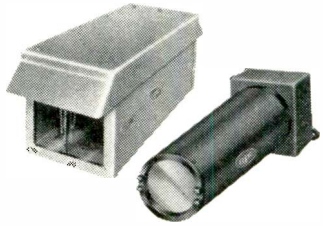
OTHER CAMERAS — Camera models also are available with remote control of iris and focus, 3-lens turret and other features.

GPL accessories

CAMERA SWITCHING UNIT PD-133 permits instantaneous, push-button selection for viewing output of up to four cameras from a single control unit. Units can be cascaded for viewing output of any number of cameras.

PAN AND TILT UNITS for indoor (I) and outdoor (r) installations permit 360° viewing and 90° tilt, remotely controlled at any practical distance. Remote control allows full camera orientation where camera is beyond reach of operator or in a hazardous location.

AUTOMATIC IRIS AND TARGET CONTROL UNIT automatically adjusts lens aperture and target voltage, compensates for light changes up to 16,000 to 1. Selects smallest possible apertures to give greatest resolution, contrast, and depth of field.

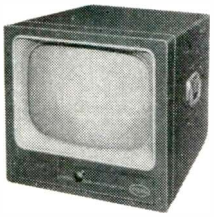


SPECIAL HOUSINGS make GPL cameras weatherproof, explosionproof, dustproof. Extremes of weather and climate cannot affect camera operation in housing (I). Fans and thermostatic heaters control inside temperature, while windshield wipers—inside and out — keep viewing window free of condensation, rain and snow.

LENSES: Any standard 16 mm "C" mount lens will fit all GPL closed circuit TV cameras. Zoom-type lenses also available.

OTHER ACCESSORIES: distribution amplifiers; 16 and 35 mm telecast projectors; film chains; EIA sync. generators; etc.

GPL display units



MONITORS: A full line of portable and rack mounted models with screen sizes from 7" up to 27". Polaroid glass available in all sizes to minimize reflections.

TV PROJECTION SYSTEM PB-611A throws bright pictures that can be viewed with equal ease by 100, or more than 1000 people. This versatile TV projector is compact, mobile and completely self-contained. Handles broadcast or closed circuit programming. It projects up to 12' by 16' pictures.

Send for detailed, complete line catalog, "How Many Jobs."

GPL — GENERAL PRECISION EQUIPMENT CORPORATION

GENERAL PRECISION LABORATORY INCORPORATED, Pleasantville, N.Y.
A subsidiary of General Precision Equipment Corporation

ELECTRONIC INDUSTRIES

Coming Events Calendar

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

June
1959

June 1-2-3
PGMTT Nat'l Symposium
IRE (PGMTT)
Harvard University, Cambridge, Mass.

June 3-4-5
Annual Convention & Exhibition
Armed Forces Communications & Electronics Assoc.
Sheraton Park Hotel, Washington, D. C.

June 4-5
3rd Nat'l Conference on Production Techniques
IRE
Villa Hotel, San Mateo, Calif.

June 8-to-11
Meeting
American Rocket Society
San Diego, Calif.

June 9
Luncheon Meeting
Assoc. of Electronic Parts & Equip. Mfg. Inc.
Como Inn, Chicago, Ill.

June 9-10-11
8th Annual Convention
Nat'l Community TV Assoc.
Mayflower Hotel, Washington, D. C.

June 9-to-21
Int'l Org. for Standardization (ISO) Triennial Meeting
Gen'l Assembly, Council and 15 Technical Committees
U.S. Member—American Standards Assoc.
Harrogate, England

June 4-5-6
First National Meeting
Congress Hotel, Chicago, Ill.
The Institute of Management Sciences

June 14-to-18
Semi-Annual Meeting
ASME
Chase-Park Plaza, St. Louis, Mo.

June 15-to-18
Summer Meeting
Institute of the Aeronautical Sciences
Ambassador Hotel, Los Angeles, Calif.

June 15-to-20
Int'l Conf. on Information Processing
UNESCO, AIEE, ACM, PGEC
UNESCO House & Palais de Exhibition, Paris, France

June 15-to-19
5th Int'l Conf. on Electrodeposition & Metal Finishing
American Electroplaters' Soc., Inc.
Artillery Armory, Oak Park, Detroit, Mich.

June 15-to-20
Symposium on Electro-Magnetic Theory
Commission VI of the Int'l Scientific Radio Union
—also Nat'l Science Foundation
University of Toronto, Toronto, Canada

June 16-17-18
Symposium
on Circuit & Information Theory (IRE)
University of California, Los Angeles, Calif.

June 17-18-19
2nd Nuclear Instrumentation Symposium
ISA
Idaho Falls, Idaho

June 17-to-20
Annual Meeting
Nat'l Soc. of Professional Engineers
Commodore Hotel, New York, N. Y.

June 18-19-20
Applied Mechanics Conference
ASME
Virginia Poly. Inst., Blacksburg, Va.

June 18-19-20
Meeting
American Physical Soc.
Milwaukee, Wis.

June 20-21-22
ARRL Nat'l Convention
American Radio Relay League
Galveston, Tex.

June 21-to-26
Summer & Pacific Meeting
AIEE
Olympic Hotel, Seattle, Wash.

June 21-to-26
Annual Meeting
American Soc. for Testing Materials
Chalfonte-Haddon Hall, Atlantic City, N. J.

June 22-to-25
Music Industry Trade Show & Convention
Nat'l Assoc. of Music Merchants
Hotel New Yorker, N.Y. Trade Show Bldg., New York, N. Y.

June 29-to-July 1
Nat'l Conv. on Military Electronics
IRE (PGMIL)
Sheraton Park Hotel, Washington, D. C.

June 24-25-26
2nd Nuclear Instrumentation Symposium
ISA
Idaho Falls, Idaho

ABBREVIATIONS

ACM	Assoc. for Computing Machinery
AEC	Atomic Energy Commission
AFOSR	Air Force Office for Scientific Research
AIEE	American Institute of Electrical Engineers
AIME	American Institute of Metallurgical Engineers
AIP	American Institute of Physics
ARRL	American Radio Relay League
ARS	American Rocket Society
ASME	American Society for Mechanical Engineers
ASQC	American Society for Quality Control
ASTM	American Society for Testing Material
EIA	Electronic Industries Assoc.
EJC	Engineers Joint Council
IAS	Institute of Aeronautical Sciences
IEC	International Electrotechnical Commission
IRE	Institute of Radio Engineers
ISA	Instrument Society of America
NAS	National Aeronautical Society
NRC	National Rocket Club
NSF	National Science Foundation
ONR	Office of Naval Research
WESCON	Western Electronic Show and Convention
URSI	International Scientific Radio Union

Professional Groups of the IRE

PGVC	Professional Group on Vehicular Communications
PBIE	Professional Group on Industrial Electronics
PGI	Professional Group on Instrumentation
PGAP	Professional Group on Antennas and Propagation
PGIT	Professional Group on Information Theory
PGCT	Professional Group on Circuit Theory
PGMTT	Professional Group on Microwave Theory & Techniques
PGEC	Professional Group on Electronic Computers
PGMIL	Professional Group on Military Electronics
PGANE	Professional Group on Aeronautical & Navigational Electronics
PGAC	Professional Group on Automatic Controls

KEY

- Engineering Events
- Trade Events
- Avionic Events
- Electronic Meetings and Shows

Dates not Given:

June (no date)
Molecular Beam Research Symposium
AROSR/physics div.—AEC—ONR—Columbia University
University of Heidelburg, Germany

June
Int'l Conf. on Medical Electronics
IRE Participating
Paris, France

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

CRYSTAL FILTERS in the 10 Kc to 30 Mc range

10 Mc Crystal Filter shown approx. 3/4 size

The accompanying table shows a partial list of standard Hycon Filters. Custom units may be engineered to your particular specifications of center frequency, bandwidth, selectivity, and impedance level. *Write for Crystal Filter Technical Bulletin.*

SYMMETRICAL BANDPASS

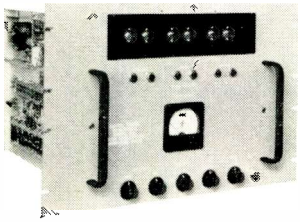
Model No.	Center Freq.	Bandwidth (6-db)	Bandwidth (60-db)	Maximum Insertion Loss	Maximum Pass-Band Variation	Impedance Ohms (Nominal)	Case Size L	W	H
100 KPA	100 Kc	50 cps	200 cps	3 db	±1/2 db	8200	3 15/16"	2 13/16"	2"
2215 KA	2215 Kc	2.8 Kc	12 Kc	3 db	±1/2 db	4000	2 9/16"	1 5/16"	1 47/64"
2215 KB	2215 Kc	250 cps	1000 cps	3 db	±1/2 db	4000	2 9/16"	1 5/16"	1 47/64"
9 MA	9 Mc	3 Kc	12 Kc	3 db	±1/2 db	1000	1 61/64"	19/32"	15/16"
10 MA	10.7 Mc	30 Kc	60 Kc	3 db	±1/2 db	2000	2 3/8 "	1"	1 1/32"
10 MB	10.7 Mc	15 Kc	30 Kc	3 db	±1/2 db	1000	2 3/8 "	1"	1 1/32"
10 ME	10.7 Mc	6 Kc	15 Kc	3 db	±1/2 db	500	2 3/8 "	1"	1 1/32"
10 MF	10.7 Mc	3.5 Kc	10 Kc	3 db	±1/2 db	300	2 3/8 "	1"	1 1/32"
13 MA	13 Mc	30 Kc	54 Kc	6 db	± 1 db	1500	3 9/16"	1"	1 1/2 "
13 MB	13 Mc	15 Kc	27 Kc	6 db	± 1 db	750	3 9/16"	1"	1 1/2 "

SINGLE SIDEBAND

Model No.	Center Freq.	Sideband	Passband	Minimum Attentuation (Unwanted)	Maximum Insertion Loss	Maximum Passband Variation	Impedance Ohms (Nominal)	Case Size L	W	H
100 KUC	100 Kc	upper	300 to 6000 cps (2 db)	60 db	10 db	±1/2 db	8200	5 3/8 "	3"	2 3/8 "
100 KLC	100 Kc	lower	300 to 6000 cps (2 db)	60 db	10 db	±1/2 db	8200	5 3/8 "	3"	2 3/8 "
3 MUA	3.2 Mc	upper	300 to 3000 cps (3 db)	40 db	3 db	± 1 db	1600	2 9/16"	1 5/16"	1 47/64"
2 MUA	2 Mc	upper	300 to 6000 cps (2 db)	60 db	3 db	±1/2 db	3900	4 3/8 "	2 3/8 "	1 7/8 "
2 MLA	2 Mc	lower	300 to 6000 cps (2 db)	60 db	3 db	±1/2 db	3900	4 3/8 "	2 3/8 "	1 7/8 "

RAPID ACCESS in Analog Data Reduction Systems

DIGITAL TIMING GENERATOR

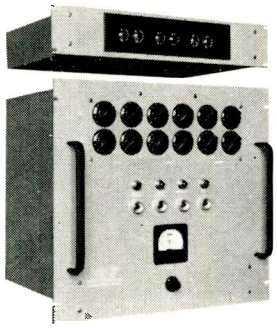


MODEL 201 for Tape Indexing generates numerically coded timing signals which are recorded on the magnetic tape throughout the data recording periods, providing a precise digital index in terms of elapsed time.

Write for Technical Bulletin TSG

MODEL 206A IS A MILITARIZED AIRBORNE VERSION OF MODEL 201.

MAGNETIC TAPE SEARCH UNIT

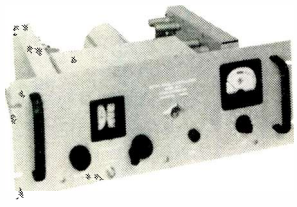


MODEL 202 for Tape Searching operates during data reduction periods. This instrument automatically locates and selects for controlled playback the tape data included between a "sequence start time" and a "sequence end time" specified by panel dial settings. Model 202 may be modified to search for timing formats other than those originated by Model 201.

ULTRA STABLE OSCILLATOR

One Megacycle Signal Source

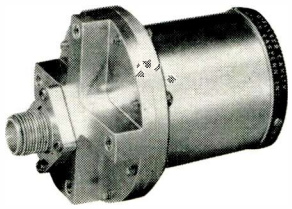
STABILITY: 1 PART IN 10^9 PER DAY



For precise time measurements or frequency control, Model 101C features include: A crystal oven without moving parts that is stabilized to better than 0.01°C. by temperature-sensitive resistance bridge, and dissipation in oscillator crystal which is stabilized at a power level of less than one microwatt. MULTIPLIERS and DIVIDERS are available for other frequency values with corresponding stability. *Write for Bulletin USO.*

HIGH POWER TELEMETERING DIPLEXERS

for Severe Environment



These instruments feed signals from 2 - 100 watt transmitters into a single missile antenna system and are designed to satisfy military requirements for use in test missiles and supersonic aircraft. Frequency Range: fixed-tuned between 215 to 250 Mc/s; Attenuation: less than 0.3 db; Size: each cavity approx. 3" x 4"; Weight of total system: 3.7 pounds, (2 diplexers + circuitry). *Write for Bulletin 1231.*

HYCON EASTERN, INC.

75 Cambridge Parkway Dept. E Cambridge 42, Mass.

ELECTRONIC INDUSTRIES

Coming Events Calendar

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

July 1959

June 29-to-July 1
Nat'l Conv. on Military Electronics
IRE (PGMIL)
Sheraton Park Hotel, Washington, D. C.

July 1-to-16
Annual Meeting
Int'l Electrotechnical Commission (IEC)
Stockholm, Sweden

July 25
Inter-Ass'n Golf Outing
Assoc. of Electronic Parts & Equip. Mfg.
Elmhurst-Country Club, Elmhurst, Ill.

July 25-to-28
Trade Show
Nat'l Audio-Visual Assoc., Inc.
Morrison Hotel, Chicago, Ill

August 1959

Aug. 9-to-12
Heat Transfer Conference
ASME
University of Connecticut
Storrs, Conn.

August 18 to-21
WESCON
West Coast Electronic Mfrs. Assoc. & 7th Region IRE
San Francisco, Calif.

Aug. 20-to-24
Annual Convention
Nat'l Alliance of TV & Electronic Service Assoc.
Congress Hotel, Chicago, Ill.

Aug. 27-28-29
Meeting
American Physical Society (AIP)
Hawaii

Aug. 31—Sept. 1-2
Conference on Semiconductors
Metallurgical Soc. of AIME
Statler Hotel, Boston, Mass.

Aug. 24-25-26
Meeting
American Rocket Society
Evanston, Ill.

September 1959

Aug. 31—Sept. 1-2
Conference on Semiconductors
Metallurgical Soc. of AIME
Statler Hotel, Boston, Mass.

Sept. 1
6th International Meeting
Institute of Management Sciences
Paris, France

Sept. 5-6
New England Div. Convention
American Radio Relay League
Hartford, Conn.

Sept. 16-17-18
Engineering Management Conference
ASME
Statler-Hilton, Los Angeles, Calif.

Sept. 20-to-23
Petroleum Mech. Engrg. Conf.
ASME
Rice, Houston, Tex.

Sept. 21-22-23
8th Annual Meeting
Standards Engineers Society
Somerset Hotel, Boston, Mass.

Sept. 21-to-25
14th Annual ISA Instrument-Automation Conference & Exhibit
ISA
Int'l Amphitheatre, Chicago, Ill.

Sept. 22-23-24
Quarterly Conference
Electronic Industries Assoc.
Plaza Hotel, New York, N. Y

Sept 23-24
Industrial Electronics Symposium
IRE-AIEE
(No place listed)

Sept 28-29-30
Nat'l Symposium on Telemetering
IRE
Civic Auditorium & Whitcomb Hotel, San Francisco, Calif

KEY

- Engineering Events
- Trade Events
- Avionic Events
- Electronic Meetings and Shows

Dates not Given:

Sept.
Power Conference
ASME
Kansas City, Mo.

Fall of 1959
Symposium on Solar House Heating
Assoc. for Applied Solar Energy

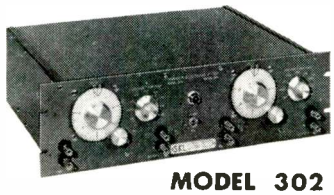
See June Page for Abbreviations

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

SKL PRECISION INSTRUMENTS
FOR YOUR MEASUREMENT PROBLEMS

• QUALITY • ACCURACY • RELIABILITY

VARIABLE ELECTRONIC FILTERS: SERIES 300



MODEL 302

MODEL 300

MODEL 308

FUNCTION		High or Low Pass Band Pass or Reject	High or Low Pass	High or Low Pass Band Pass or Reject
Cut-off Freq. Range		20 cps to 200 kc	20 cps to 200 kc	0.2 cps to 20 kc
Attenuation Rate	Per Section	18 db/octave	18 db/octave	24 db/octave
	Max.	36 db/octave	18 db/octave	48 db/octave
PASS BAND		2 cps to 4 mc	2 cps to 4 mc	2 cps to 1 mc
DIAL ACCURACY		± 3% to 20 kc ± 5% above 20 kc	± 3% to 20 kc ± 5% above 20 kc	± 5%
INSERTION LOSS		0 ± 1 db	0 ± 1 db	4.5 db ± 1 db
NOISE LEVEL		60 microvolts	60 microvolts	60 microvolts

. . . For elimination of unwanted signals in your data

. . . For studies in vibration, dynamics, telemetering, acoustics and speech

The Series 300 Variable Electronic Filters were developed to meet the problems of inflexibility and expense inherent in conventional multi-frequency filters. Where the fixed filter made for a specific application becomes useless for any other need, the SKL Variable Electronic Filter serves to fulfill broad and diversified laboratory requirements.

Continuous range of cut-off frequency and ability to produce band-pass and band-rejection characteristics with *independent* control of the upper and lower cut-off frequencies are invaluable.

WIDE-BAND CHAIN AMPLIFIERS: SERIES 200

for every application

MODEL 206

The 9 in 1 amplifier providing any combination of:

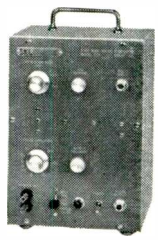
Gaussian, flat or sloping response curve

Linear, pulse or high level pulse output mode

MODEL	BANDWIDTH	GAIN	OUTPUT	IMPEDANCE	
				INPUT	OUTPUT
214B	200 cps—90 mc	30 db	125 v, pulse	180	5000
211	15 mc—110 mc	33 db	4 v, rms	50	50
202D	1 kc—210 mc	20 db	4 v, rms	200	200
212C-TV	54 mc—216 mc	20 db	3 v, peak	50 or 75	50 or 75
206	600 cps to 320 mc	18 db to 24 db	(1) 6 v, rms (2) 60 v, pulse (3) 125 v, pulse	180	200

FAST-RISE PULSE GENERATOR

THE Standard for Millimicrosecond Pulses



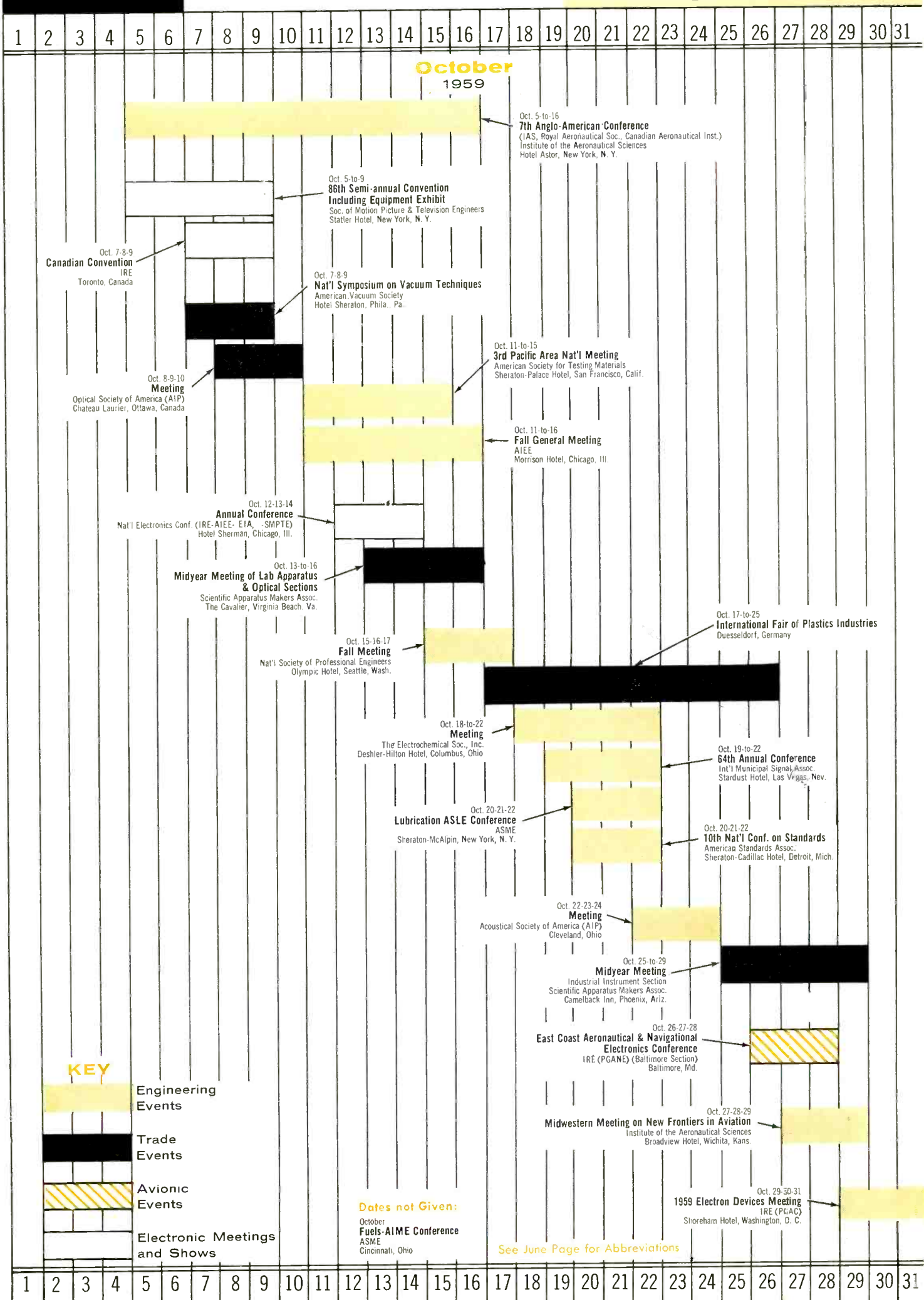
Model 503 is ideal for testing the transient response of wide band amplifiers and semiconductors. Higher voltage pulses are available through use of an external power supply.

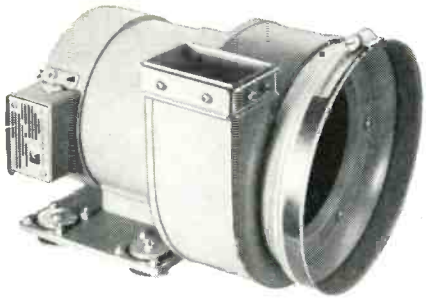
Rise time:	Less than 1 millimicrosecond
Amplitude:	0 to 150 volts
Repetition Rate:	50 to 120 cps
Pulse Width:	.06 x 10^{-10} Sec., Minimum Determined by Length of Width Cable. Max. Width not Restricted. .05 x 10^{-9} Sec., Factory Supplied
Polarity:	Either Positive or Negative
Load Impedance:	50 ohms

For further information write

SKL SPENCER-KENNEDY LABORATORIES, INC.
1320 SOLDIERS FIELD ROAD
BOSTON 35, MASS.

WIDE-BAND TELEVISION DISTRIBUTION SYSTEM: SKL manufactures complete TV distribution systems for community, apartment house and industrial use. Details upon request.


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
October
1959
Oct. 5-to-16
7th Anglo-American Conference
(IAS, Royal Aeronautical Soc., Canadian Aeronautical Inst.)
Institute of the Aeronautical Sciences
Hotel Astor, New York, N. Y.
Oct. 5-to-9
86th Semi-annual Convention
Including Equipment Exhibit
Soc. of Motion Picture & Television Engineers
Statler Hotel, New York, N. Y.
Oct. 7-8-9
Canadian Convention
IRE
Toronto, Canada
Oct. 7-8-9
Nat'l Symposium on Vacuum Techniques
American Vacuum Society
Hotel Sheraton, Phila., Pa.
Oct. 8-9-10
Meeting
Optical Society of America (AIP)
Chateau Laurier, Ottawa, Canada
Oct. 11-to-15
3rd Pacific Area Nat'l Meeting
American Society for Testing Materials
Sheraton-Palace Hotel, San Francisco, Calif.
Oct. 11-to-16
Fall General Meeting
AIEE
Morrison Hotel, Chicago, Ill.
Oct. 12-13-14
Annual Conference
Nat'l Electronics Conf. (IRE-AIEE-EIA, -SMPTE)
Hotel Sherman, Chicago, Ill.
Oct. 13-to-16
Midyear Meeting of Lab Apparatus & Optical Sections
Scientific Apparatus Makers Assoc.
The Cavalier, Virginia Beach, Va.
Oct. 15-16-17
Fall Meeting
Nat'l Society of Professional Engineers
Olympic Hotel, Seattle, Wash.
Oct. 17-to-25
International Fair of Plastics Industries
Duesseldorf, Germany
Oct. 18-to-22
Meeting
The Electrochemical Soc., Inc.
Deshler-Hilton Hotel, Columbus, Ohio
Oct. 19-to-22
64th Annual Conference
Int'l Municipal Signal Assoc.
Stardust Hotel, Las Vegas, Nev.
Oct. 20-21-22
Lubrication ASLE Conference
ASME
Sheraton-McAlpin, New York, N. Y.
Oct. 20-21-22
10th Nat'l Conf. on Standards
American Standards Assoc.
Sheraton-Cadillac Hotel, Detroit, Mich.
Oct. 22-23-24
Meeting
Acoustical Society of America (AIP)
Cleveland, Ohio
Oct. 25-to-29
Midyear Meeting
Industrial Instrument Section
Scientific Apparatus Makers Assoc.
Camelback Inn, Phoenix, Ariz.
Oct. 26-27-28
East Coast Aeronautical & Navigational Electronics Conference
IRE (PGANE) (Baltimore Section)
Baltimore, Md.
Oct. 27-28-29
Midwestern Meeting on New Frontiers in Aviation
Institute of the Aeronautical Sciences
Broadview Hotel, Wichita, Kans.
Oct. 29-30-31
1959 Electron Devices Meeting
IRE (PGAC)
Shoreham Hotel, Washington, D. C.
KEY
Engineering Events
Trade Events
Avionic Events
Electronic Meetings and Shows
Dates not Given:
October
Fuels-AIME Conference
ASME
Cincinnati, Ohio
See June Page for Abbreviations



CENTRIFUGAL BLOWERS—LOOSE SCROLL
N_S=30,000—70,000

VANEAXIAL FANS
N_S=50,000—125,000

PROPELLER FANS
N_S=100,000—400,000

Engineered to $\frac{N\sqrt{Q}}{\Delta P^{0.75}} = L_S$

Our Fans and Your Equipment Become Smaller, Quieter and Cheaper

CENTRIFUGAL BLOWERS—TIGHT SCROLL
N_S=9,000—40,000

RADIAL WHEEL BLOWERS
N_S=4,000—20,000

MULTISTAGE BLOWERS
N_S=900—9,000

ROTRON

The wide range of ROTRON FAN types enables our Application Engineers to match accurately the SPECIFIC SPEED (N_S) of our air movers with the LOAD-SPEED (L_S) characteristics of your equipment for ultimate cooling efficiency. Send for CATALOG SHEET #20201-5.

ROTRON MANUFACTURING CO., INC.
WOODSTOCK • NEW YORK

Coming Events Calendar

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

November 1959

Nov. 2-3-4
Annual Conference
Atomic Industrial Forum
Sheraton-Park, Washington, D. C.

Nov. 2-to-6
Fall Meeting
Metallurgical Society of AIME
Morrison Hotel, Chicago, Ill.

November 3-4
Annual Convention
Ultrasonic Manufacturers Association
Hotel Sheraton, Chicago, Ill.

Nov. 4-5-6
Nat'l Automatic Control Conference
IRE Professional Group on Automatic Control
—PGAS Dallas Section—ISA

Nov. 8-to-13
International Rubber Technology Conference
ASME
Washington, D. C.

Nov. 9-10-11
4th Instrumentation Conference
IRE (PGI)
Atlanta, Ga.

Nov. 9-10-11
Radio Fall Meeting
IRE— EIA
Syracuse, N. Y.

Nov. 9-to-13
Annual Meeting
Nat'l Electrical Manufacturers Association
Traymore Hotel, Atlantic City, N. J.

Nov. 16-to-20
Meeting
American Rocket Society
Washington, D. C.

Nov. 18-19-20
9th Nat'l Conference on Standards
American Standards Association
Hotel Roosevelt, N. Y.

Nov. 30-to Dec. 3
Eastern Joint Computer Conference
IRE (PGEC), AIEE, ACM
Hotel Statler, Boston, Mass

December 1959

Nov. 30-to-Dec. 3
Eastern Joint Computer Conference
IRE (PGEC), AIEE, ACM
Hotel Statler, Boston, Mass.

Dec. 2-3-4
Electric Furnace Conference
Metallurgical Soc. of AIME
Cleveland Hotel. Cleveland, Ohio

December 2-3-4
Meeting
Electronic Industries Ass'n
Statler Hilton, Los Angeles, Calif.

Dec. 17
Wright Bros. Lecture
Institute of the Aeronautical Sciences
Natural History Bldg. Auditorium.
Smithsonian Institute, Washington, D. C.

December (No date given)
PGVC Annual Meeting
IRE (PGVC)
St. Petersburg, Fla.

See June Page for Abbreviations

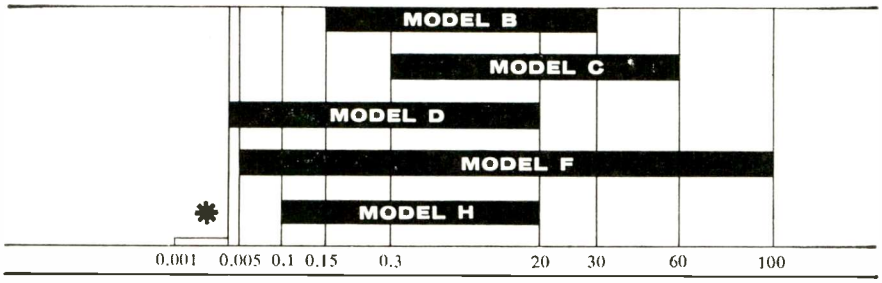
KEY

- Engineering Events
- Trade Events
- Avionic Events
- Electronic Meetings and Shows

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

New MODEL H* Servoscope®

...JOINS THE FAMILY OF SERVOSYSTEM ANALYZERS



This latest model in the Servoscope® line covers frequency ranges 0.1 to 2.0 cps and 1.0 to 20 cps.

Designed for sine wave and modulated carrier, Model H maintains high accuracy using a simplified amplifier.

Model H, like all other Servoscopes, provides phase measurement to ±1° accuracy. Frequency accuracy is ±5% OF SETTING, rather than of full scale.

Direct setting for both amplitude and frequency plus direct read-out of phase lag (exclusive feature of all Servoscopes) reduces operation of Model H to ultimate simplicity.

Suitable for standard 19" rack or bench use, the Model H is ideal for general purpose, laboratory or field service.

More widely used than any other system for analysis of control behavior, the SERVOSCOPE has demonstrated its flexibility over a broad field...covers the frequency range from 0.001 to 100 cps in five models as shown above.

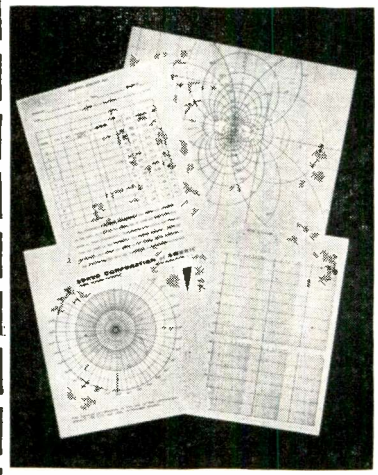
Measuring phase, transient response and gain, the Servoscope facilitates fast, accurate plotting of Nyquist, Bode or Nichols diagrams.

Write for TDS 100 which gives complete description and specifications of the Model H Servoscope.

SERVO CORPORATION OF AMERICA
20-20 JERICHO TURNPIKE, NEW HYDE PARK, L. I., N. Y.
Engineering and Manufacturing of
INFRARED • SERVO DEVICES • COMMUNICATION • NAVIGATION
systems — subsystems — instruments — components
For Industry and Defense

An Engineer Speaks Out...

Here's the EASY Way to Work Up A Nyquist, A Bode and A CPC



If you're working on servosystem test or design, you'll want to have these FREE chart forms . . . a wonderful time-saver! The coordinates are already lettered and the legend imprinted. They are transparent "masters". Almost any duplicator assures you of an immediate supply of charts at any time.

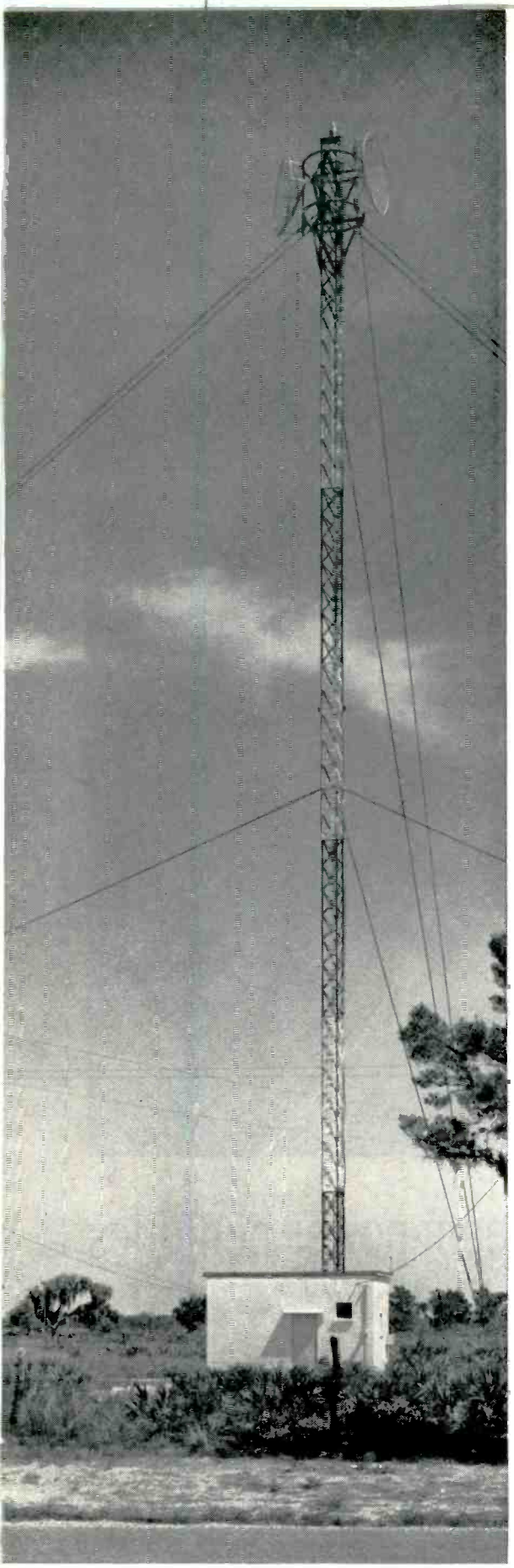
When you get the frequency, phase angle, and amplitude loci plotted on these worksheets, you've got a "standardized" permanent record of the system you are checking.

The Complex Plane Conversion Chart, Worksheet #104, should be particularly helpful. On it are plotted the loci of constant closed-loop gain (in units of voltage ratio) on the horizontally axial circles, and the constant-loop phase (in degrees) on the vertically axial circles. These loci are plotted over Cartesian coordinates, the ordinate of which represents the unreal, and the abscissa the real, component of the gain vector.

Suggestions for an uniform procedure in working up the different curves are included.

SERVO CORPORATION OF AMERICA
20-20 Jericho Turnpike, New Hyde Park, L. I., N.Y.

For your free SERVO Work Forms, call your nearest Servo Corporation representative, or write directly to Servo Corporation of America, Inc., Room E11, New Hyde Park, New York.



Guyed tower was designed and built by Blaw-Knox to meet the needs of a southern microwave system.

the towers that simplify microwave expansion

Microwave is set for a big future. More and more progressive companies choose microwave to improve service and lower operating costs. And they're looking for the towers that can keep pace with their expanding microwave plans. Here's how Blaw-Knox microwave towers provide the answer.

designed to established specifications

Blaw-Knox towers provide the positive dependability that only exacting engineering can deliver. All standard towers *meet or surpass* standards and recommendations of the Radio-Electronic-Television Manufacturers Association for safety, wind loading and quality of construction. By maintaining rigid requirements for torque and deflection, these durable towers pay off with trouble free service in the toughest weather and roughest terrain.

360 degree orientation

Even mounting a single dish antenna can cause a problem. But Blaw-Knox towers can be equipped with ring mounts to simplify precise orientation, and to permit future changes in signal path with minimum effort. Then as the system grows, two or three more dishes can be installed and orientated with less work and less cost.

Whether your installation calls for ring or fixed mounts, self-supporting or guyed towers, Blaw-Knox has the experience and the know-how to build the tower system to fulfill your present needs . . . and effectively meet your future needs.

Ring mounts simplify orientation, make future antenna installation easier and less costly.

For details on Blaw-Knox tower design, engineering and fabrication service, send for Bulletin 2538.

BLAW-KNOX

BLAW-KNOX COMPANY
Equipment Division
Pittsburgh 38, Pennsylvania

MICROWAVE TOWERS

Guyed and self-supporting towers for Microwave, AM, FM, TV, Radar, Communications . . . Transmission Towers . . . Parabolic Antennas . . . Special Structures. All custom built to meet your requirements.

Circle 56 on Inquiry Card, page 83

COMPACT

New Westinghouse series of VHF beam-power pentodes especially useful in mobile communications

Now Westinghouse introduces three improved octal-based pentodes for use as VHF amplifiers and oscillators . . . also as audio amplifiers or modulators.

Their small size does not limit their excellent performance characteristics. They have high power output, low plate and grid 2 voltages, and low driving power. They are designed for effective radio frequency ground, cool operation and long life.

WL-6146—with conventional 6.3 volt heater
WL-6159—with 26.5 volt heater
(for aircraft equipment)
WL-6883—with 12.6 volt heater
(for service with 12-volt storage battery)

Write for complete information on these three new beam-power types. Westinghouse Electric Corporation, Electronic Tube Division, Elmira, New York.

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

Why SHOULDN'T I be interested in business life insurance?

"Our future depends on the future of my husband's business."

Every businessman — owner, partner, stockholder — has a vital stake in the future of his business . . . and his family may face real hardship *unless* he has prevented possible financial disaster through sound business planning.

One of the greatest hazards can be death of an owner of the business. Ætna Life's Business Planning Service can be instrumental in protecting your family's future security when this happens.

Thoroughly trained representatives in 91 agencies from coast to coast offer you and your attorneys this essential planning service.

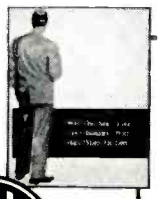
ÆTNA BUSINESS LIFE INSURANCE PLANS ARE SPECIALLY DESIGNED . . .

- To preserve **PARTNERSHIP** value when death comes to any partner.
- To preserve **SOLE PROPRIETORSHIPS** for heirs or selected employees.
- To preserve ownership values when death comes to any stockholder in a **CLOSE CORPORATION.**
- To indemnify any firm for the death of a **KEY MAN.**

Add Life to your Business with Ætna Business Life Insurance

ÆTNA LIFE
INSURANCE COMPANY

Affiliates:
ÆTNA CASUALTY AND SURETY COMPANY
STANDARD FIRE INSURANCE COMPANY
Hartford, Conn.



Ætna Life Insurance Company
Hartford 15, Connecticut

Gentlemen:

Please send me a copy of your new business life insurance booklet "Will This Man Take Your Business With Him When He Dies?"

Name_____

Address_____

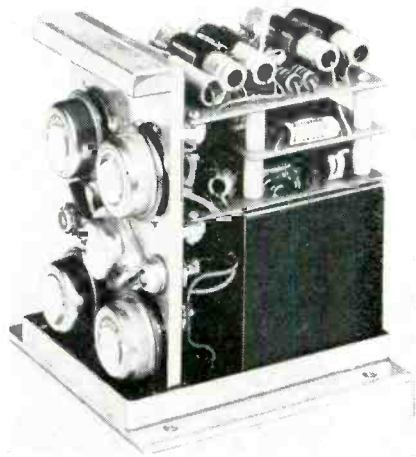
_____

Circle 92 on Inquiry Card, page 83

New Products

INVERTERS

These converter-inverters are static type power sources designed to replace motor generator and vibrator type devices for the conversion of ac or dc input voltages to ac and dc out-

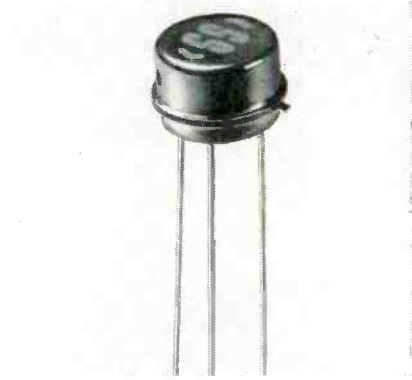


puts of different voltage levels or frequencies. The devices offer up to 5w per cubic inch output and efficiency is 80% for input voltages greater than 23 volts dc. For the series 760 and 770, output power is up to 1 kw at 0.1% regulation, and for the 780 series, output power is up to 200 w at 0.5% regulation. Spectrol Electronic Corp., San Gabriel, Calif.

Circle 187 on Inquiry Card, page 83

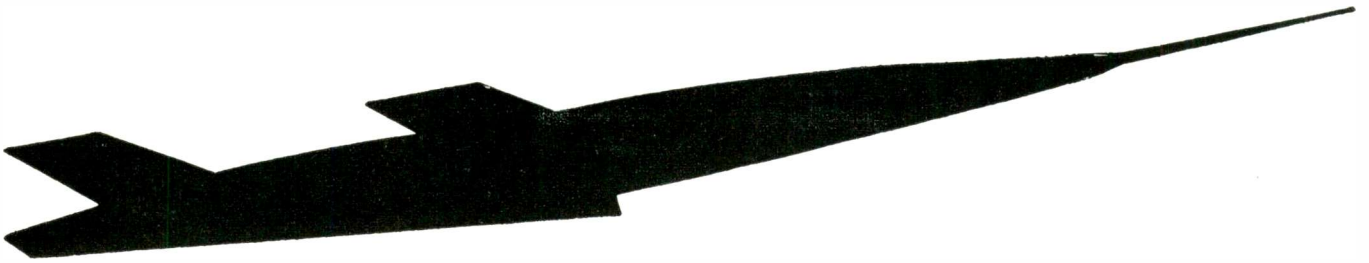
PNP TRANSISTORS

Four alloy junction transistors, the JETEC types 2N1024-25-26-27, incorporate "micro-control," a feature that holds input resistance to a uniform value (35 ohms). Collector voltages have been made higher to extend the use of these transistors. Other characteristics include low saturation re-

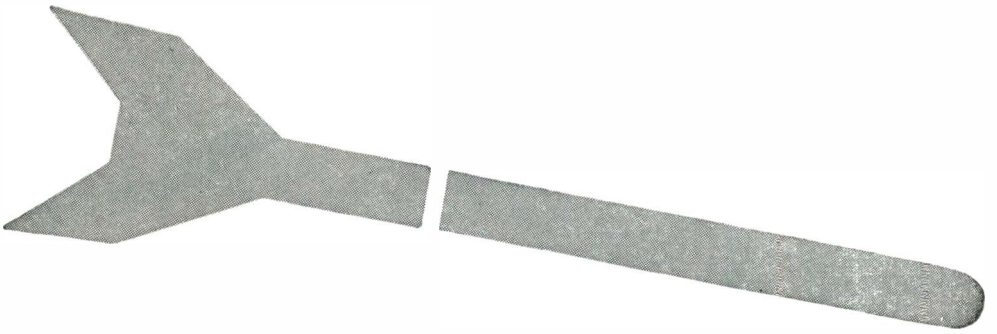


sistance, high gain, and power rating of 150 milliwatts. The transistors are for operation in the 1 to 4 megacycle range. Sperry Semiconductor Division, South Norwalk, Conn.

Circle 188 on Inquiry Card, page 83



New steels are born at Armco



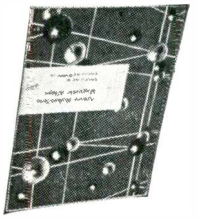
For Reliable Magnetic Components of Missile Guidance and Control Systems..... Armco Nickel-Iron Magnetic Alloys

Special magnetic properties of Armco 48 Ni and 48 Orthonik assure efficient, highly reliable components for research and defense missiles and ground control units.

ARMCO 48 NI—Characterized by very high permeability at low and moderate inductions, low hysteresis loss and extremely low coercive force, 48 Ni is especially useful for gyro and synchronous motors as well as audio transformers, relays and certain types of magnetic amplifiers. It is specially processed for laminations, wound cores or special applications, and is available in 2 to 14-mil cold-reduced strip.

ARMCO 48 ORTHONIK—This special Armco Alloy combines the advantages of a rectangular hysteresis loop with very low coercive force. Precisely controlled in manufacture, cubic-structured 48 orthonik assures consistently reliable performance in magnetic amplifiers and modulators, bi-stable elements for logic circuits and reactors for electronic computers. It is supplied in the form of cold-reduced strip in thicknesses from 1/4 to 6 mils.

Use the multiple advantages of Armco 48 Ni and 48 Orthonik to help assure maximum performance and reliability of magnetic components for aircraft and missiles as well as commercial and industrial electronic equipment. For hitherto unavailable design information on the 48% nickel alloys, write us for a copy of our new design manual "Armco Nickel-Iron Magnetic Alloys." Armco Steel Corporation, 2798 Curtis Street, Middletown, Ohio.



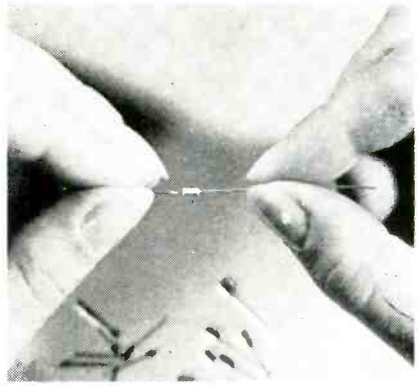
ARMCO STEEL

Armco Division • Sheffield Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products

New Products

CAPACITOR

The Type HAT sintered anode electrolytic capacitor was designed to replace tantalum wire anode capacitors of comparable ratings. The low dc leakage current of the unit lessens



drain on power supply batteries. Leads are welded for extra strength and units sealed with color coded epoxy. They may be used for by-pass coupling and filter applications requiring relatively high capacitance in a minimum of space. Available in ratings of 1 to 10 microfarads and ratings of 1 to 10 volts. P. R. Mallory & Co., Inc., 3029 E. Wash. St., Indianapolis, Indiana.

Circle 189 on Inquiry Card, page 83

TRANSISTOR TRANSFORMERS

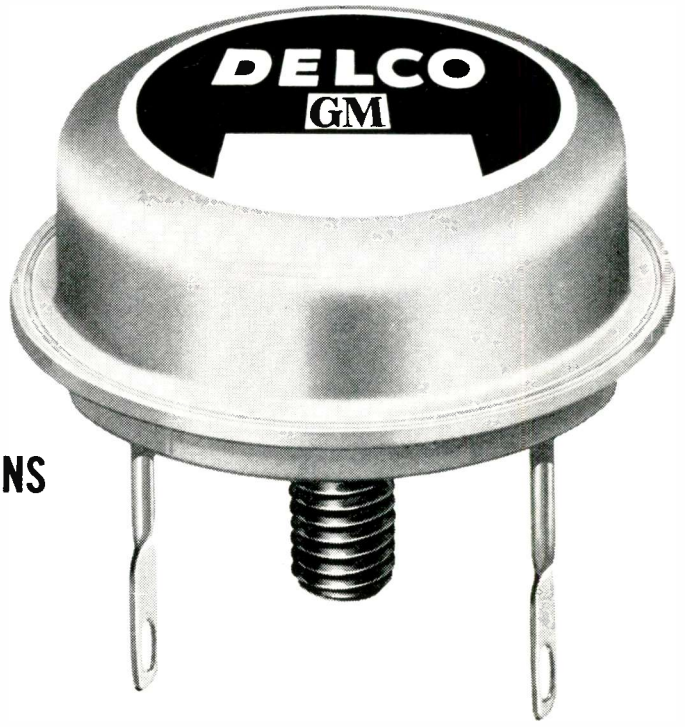
High power transitor transformers in driver and voice coil types are available. The H-280 driver transformer has a primary inpedance of 200 ohms C.T. with secondary 400 ohms split. The H-281 transformer has a 5 w. output from 48 ohms centen tapped to 16, 8, 4 ohms. The H-282 has a 10 w. output from 20 ohms center tapped to 16, 8, 4 ohms. All units are wide frequency

range suited to 30-20,000 cycles service. Units are designed to MIL-T-27A Specifications. United Transformer Corporation, 150 Varick Street, New York, N. Y.

Circle 190 on Inquiry Card, page 83

IMPROVED SWITCHING CHARACTERISTICS!

DELCO HIGH POWER TRANSISTORS OFFER UNSURPASSED PERFORMANCE FOR HIGH VOLTAGE, HIGH POWER APPLICATIONS



TYPICAL CHARACTERISTICS AT 25°C

	DT100	DT80	2N174A*	2N174
Maximum Collector Current	15	15	15	15 amps
Maximum Collector Voltage (Emitter Open)	100	80	80	80 volts
Saturation Resistance	.02	.02	.02	.02 ohms
Thermal Gradient (Junction to Mounting Base)	.8	.8	.8	.8 °C/watt
Nominal Base Current I_B (V_{EC}=2 volts, I_C=5 amps)	135	100	135	135 ma
Collector to Emitter Voltage (Min.) Shorted Base (I_C=.3 amps)	80	70	70	70 volts
Collector to Emitter Voltage Open Base (I_C=.3 amps)	70	60	60	60 volts

*Designed to meet MIL-T-19500/13A (Jan) 8 January 1958

HERE IS A LINE OF TRANSISTORS SPECIALLY DESIGNED FOR SWITCHING APPLICATIONS.

Check your switching requirements against the new characteristics of Delco High Power transistors. You will find improved collector to emitter voltage characteristics. You will find higher maximum current ratings—15 amperes. You will find that an extremely low saturation resistance has been retained.

Another important improvement is the solid pin terminal. And, as always, diode voltage ratings are at the maximum rated temperature (95°C.) and voltage.

Write today for engineering data on the *new* characteristics of *all* Delco High Power transistors.

DELCO RADIO

Division of General Motors • Kokomo, Indiana

BRANCH OFFICES

Newark, New Jersey
1180 Raymond Boulevard
Tel: Mitchell 2-6165

Santa Monica, California
726 Santa Monica Boulevard
Tel: Exbrook 3-1465

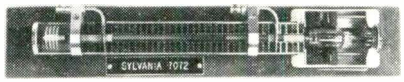
Circle 58 on Inquiry Card, page 83

New Products

TRAVELING WAVE TUBE

The Type 7072 is an amplifier capable of providing greater than 1 w CW power output across the 2 to 4 KMC frequency octave, with a 1 milliwatt input. The tube utilizes an integral periodic-permanent-magnet focusing structure to focus the electron beam. Heater requirement is 6.3 v at 1.1a. The ability to operate equally well with small signal or at saturation increases the utility of the tube. The tube is also usable as a phase shifter and phase modulator. Sylvania Electric Products Inc., 1740 Broadway, New York, N. Y.

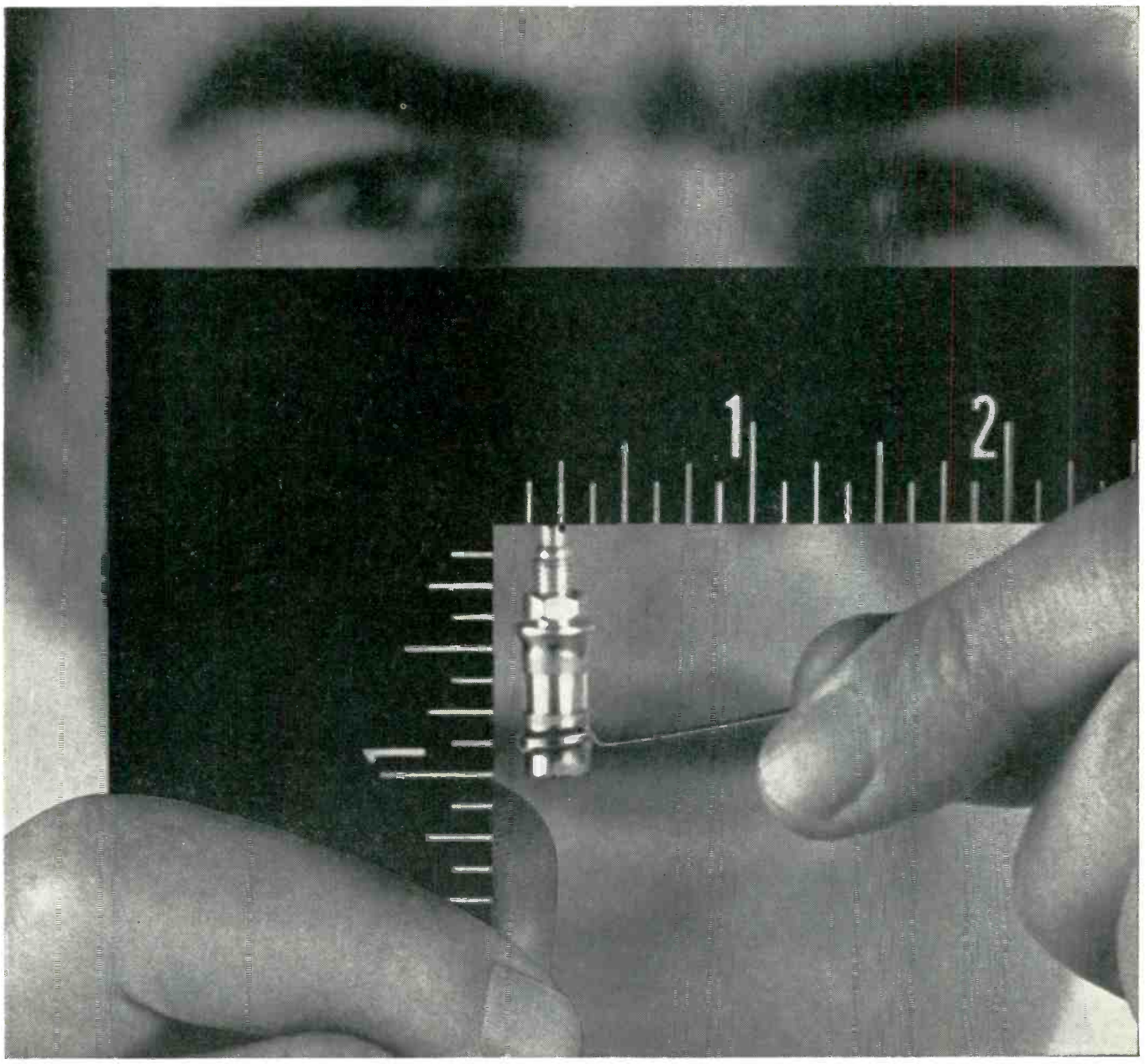
Circle 185 on Inquiry Card, page 83



MULTIPLIER PHOTOTUBE

The RCA 7264 is intended for use in scintillation counters and in the measurement of low-level light sources. Its fast response, high current gain, high peak-current capability, small spread in electron-transit time and typical pulse-height resolution of about 8% make it useful in fast coincidence scintillation counting. When operated at a supply voltage of 2000 volts, the 7264 has a median luminous sensitivity of 875 amperes per lumen and a median current amplification of 12,500,000. RCA Tube Division, Harrison, New Jersey.

Circle 186 on Inquiry Card, page 83



Another new miniature from Corning . . .

1 to 8 uufd direct traverse trimmer capacitor

Small but still precise, this new Corning direct traverse type trimmer capacitor meets military as well as civilian requirements.

Other features besides its size:

Silver plated hardware takes the noise out of tuning and protects the unit from corrosion even under extreme environments.

Mechanical stops at both ends of capacitance adjustment, with self-contained adjusting shaft.

Linear tuning with fine resolution. About 0.50 *uu*fd capacitance change per turn.

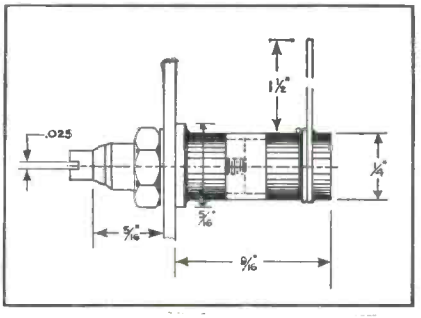
No capacitance reversals.

Glass-Invar construction.

Bushing and shaft assembly is coaxial *for low inductance, high frequency applications.*

Shock, vibration, and thermal shock resistance all excellent.

If you'd like more information, write for our new data sheet.



Corning means research in Glass

CORNING GLASS WORKS, Bradford, Pennsylvania

Electronic Components Department

(ACTUAL SIZE)

DAP

DIFFUSED ALLOY POWER TRANSISTORS

Features

Faster Switching Times 0.5-5 μ Sec
Switching Currents up to 10 amperes
Flatter Frequency Response 40 Kc
Higher Breakdown Voltage up to 120 Volts
Current Gain of 40 at 5 amperes
Standard Power Transistor Package
Lower Base Resistance, 2 ohms
Lower Saturation Resistance, 0.1 ohm

Uses

TV Horizontal Output
Hi-Fi Amplifiers
Core Drivers
High Current Switching
Power Converters
Ultrasonic Generators
Modulators

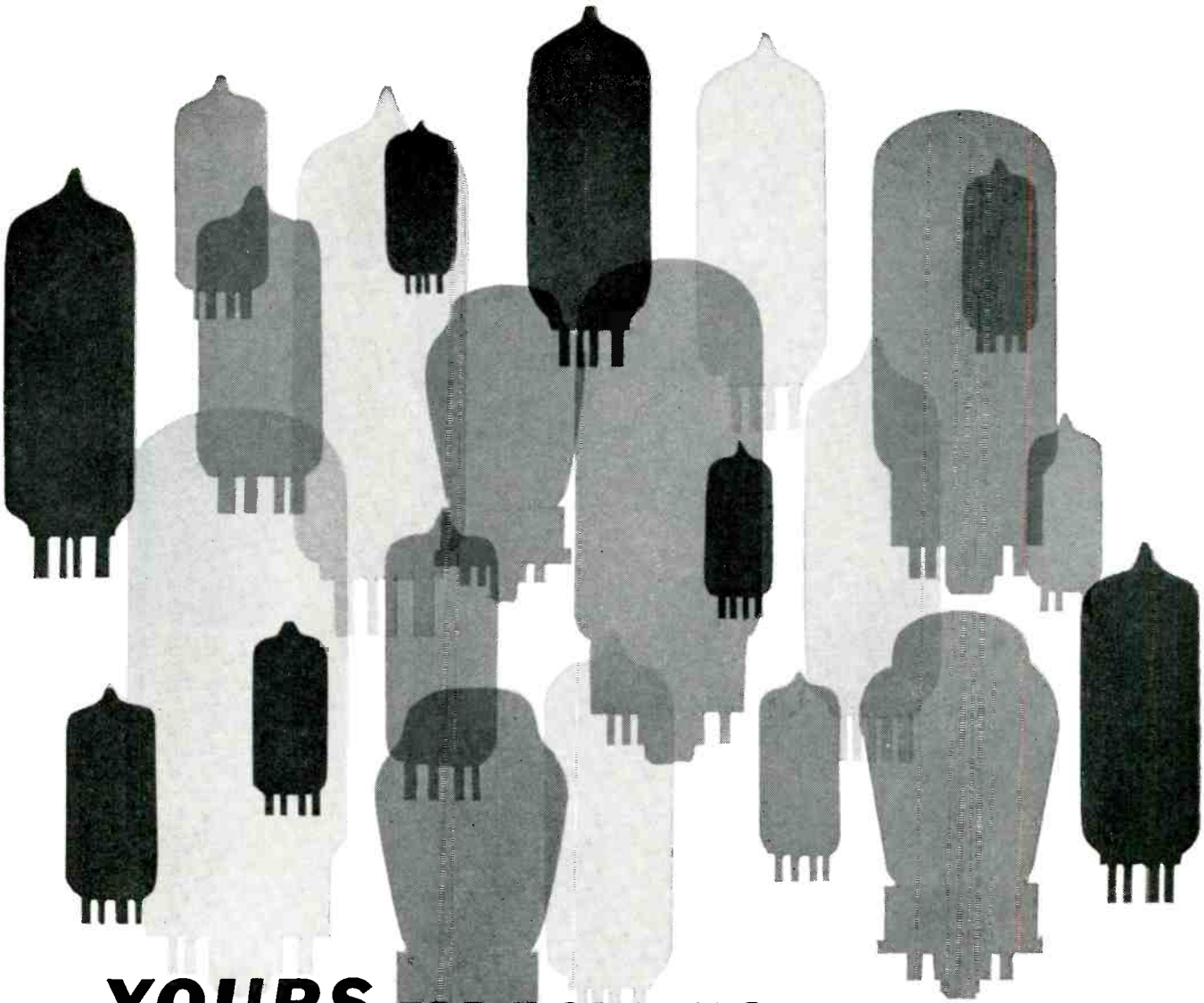
Because no other transistor offers this combination of features and uses, you will want to try out the DAP transistor in your circuits. Get full details now on new Bendix diffused alloy power transistors by writing SEMICONDUCTOR PRODUCTS, BENDIX AVIATION CORPORATION, LONG BRANCH, NEW JERSEY.

	Ratings		Typical Performance			
	Vdc	Pc (25°C)	B (Ic=5 Adc)	Vs (Ic=5 Adc)	f_α	rbb'
2N1073	40	35 W	40	0.5 Vdc	1.5 mc	2 ohms
2N1073A	80	35 W	40	0.5 Vdc	1.5 mc	2 ohms
2N1073B	120	35 W	40	0.5 Vdc	1.5 mc	2 ohms

West Coast Office: 117 E. Providencia Ave., Burbank, Calif.
Canadian Distributor:
Computing Devices of Canada, Ltd., P. O. Box 508, Ottawa 4, Ontario
Export Sales and Service:
Bendix International Division, 205 E. 42nd St., New York 17, N. Y.

Red Bank Division

Bendix AVIATION CORPORATION



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MARCH 23·24 25·26

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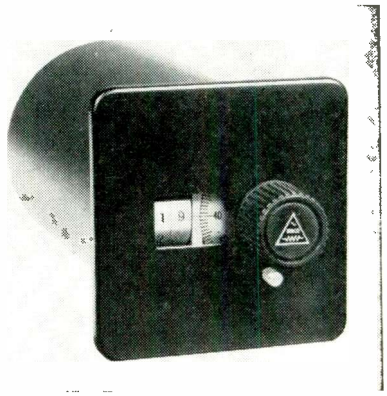
THE INSTITUTE OF RADIO ENGINEERS
1 EAST 79th STREET, NEW YORK 21, N. Y.

New Products

VOLTAGE DIVIDER

The Type 81-A provides high resolution and accurate voltage division. A single control knob operates either of two resistance decades. Three turns of the knob covers the full range. It

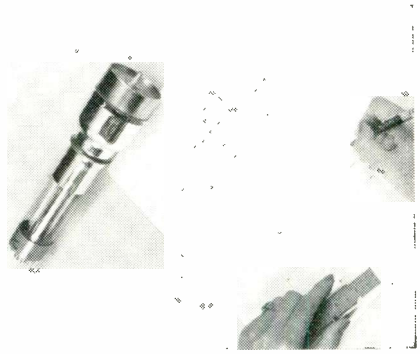


is supplied in the standard resistance value of 10,000 ohms and in other resistance values on special order. Full scale resistance accuracy is ±0.05%, linearity ±0.01%, resolution 0.002%. Power rating is 5w and the operating frequency range is dc to 10 KC. Rinco Inc., 7962 S.E. Powell Blvd., Portland, Oregon.

Circle 179 on Inquiry Card, page 83

STORAGE TUBE

This three-inch tube (WL-7225) is used for storing information in computers. The tube receives information in the form of electrical impulses, stores it, and when signalled to do so, reads back the accumulated information. Features are: ruggedness, 2.6 inch diameter of useful target, increased resolution, electron gun beam focusing to a fine spot, and a con-



venient coaxial connector for the output terminations. Erasure occurs simultaneously with the reading cycle. Westinghouse Electric Corporation, Box 2278, Pittsburgh, Penna.

Circle 180 on Inquiry Card, page 83

Unique combination of performance, size and price

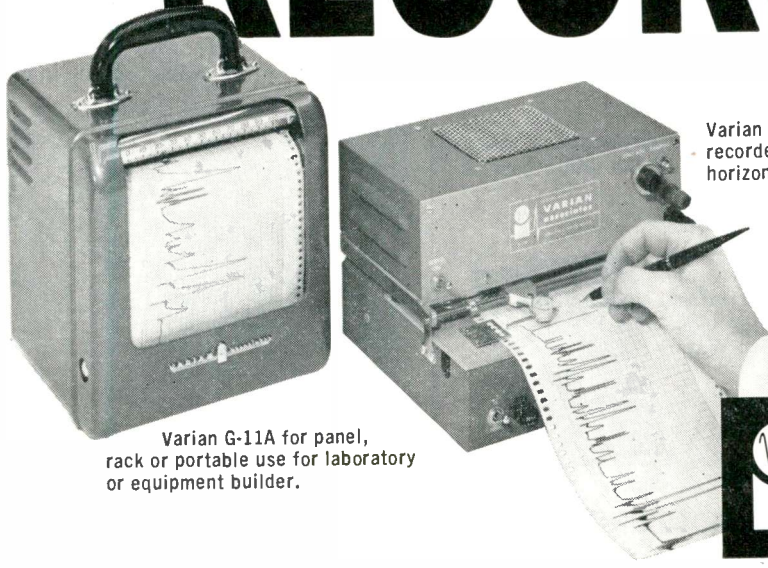
OVER 1000 TIMES AS SENSITIVE as galvanometer recorders. . . and Varian's null-balance potentiometer needs no power from the source being measured. Rugged, stable mechanism allows ink or inkless recording — easy-to-read rectilinear chart — source impedances of up to 100,000 ohms.

LESS THAN HALF AS WIDE as a standard 19-inch rack. Two Varian G-11A's mount side by side on a rack panel 10⅜ inches high. Or as a portable, the G-11A is an easy-to-handle 15 pounds. The G-10 sits on less than one square foot; its horizontal chart is handy for jotting notes.

MORE VERSATILE AND ADAPTABLE than any similar recorder — adjustable zero, adjustable span (from 9 to 100 mv on the G-11A), multiple chart speeds (up to four on the G-11A), and plug-in input chassis for different recording requirements.

PRICES THAT BEGIN AT $365 for the G-10 and **$470** for the G-11A. Because unneeded performance costs money, Varian has intentionally designed for 1% limit of error and 1-second balancing time. Thus, Varian provides needed ruggedness, dependability and operating features at moderate cost.

VARIAN STRIP CHART RECORDERS



Varian G-10 bench-top recorder for accessible, horizontal chart.

Varian G-11A for panel, rack or portable use for laboratory or equipment builder.

WRITE TODAY FOR COMPLETE SPECIFICATIONS AND STANDARD OPTIONS

VARIAN associates

INSTRUMENT DIVISION

PALO ALTO 19, CALIFORNIA

Circle 40 on Inquiry Card, page 83

New Products

DELAY RELAYS

A series of delay relays (IT, TR & STR series) for missile and other airborne applications feature instantaneous reset, compensation for temperature and voltage, and resistance

to shock and vibration. Preset time delays between 20 and 180 sec. are available. The relay is voltage compensated from 22 to 32 vdc with a nominal 28 v. rating. Temperature compensation is from −65°C to +125°C. Operating power is less than 3 w. after the timing interval and 10 w during timing. Various contact arrangements are available. Curtiss-Wright Corp., Wood-Ridge, N. J.

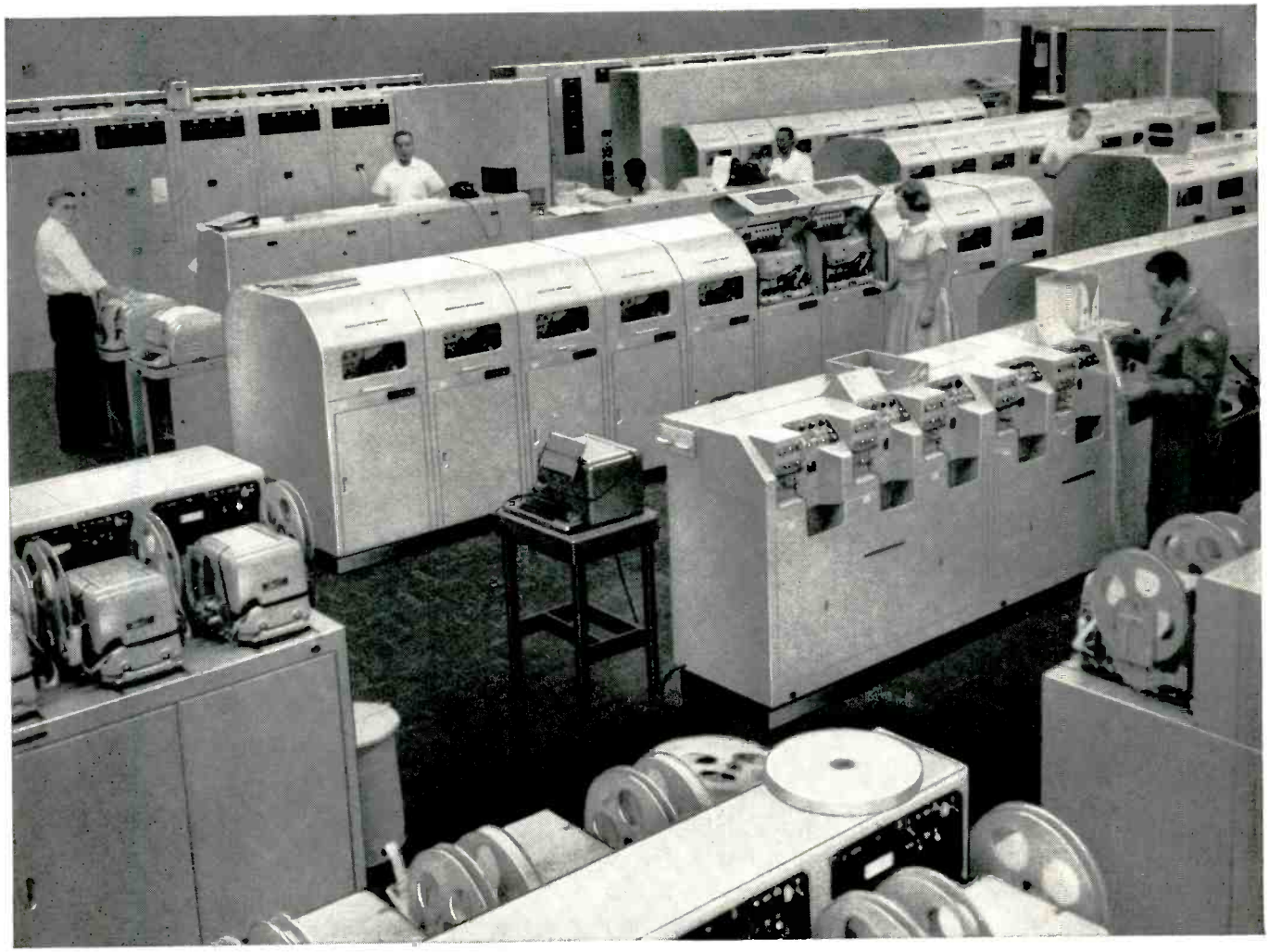
Circle 181 on Inquiry Card, page 83

MINIATURE MOTOR

The Model 2PP1, Miniature Motor, is rated at 1000 HP at 11,000 RPM. It has been qualified to MIL-M-8609 specification. The 26.5 vdc motor is 1.18 inches in diameter, 19 inches

long and weighs 3½ ounces. Life is 500 hours without a change of brushes. Western Gear Corporation, P.O. Box 182, Lynwood, California.

Circle 182 on Inquiry Card, page 83



Non-stop relay station for military messages!

Kleinschmidt equipment receives and instantly re-transmits thousands of printed communications daily at the Army's Switching Center, Davis, California.

At one of the largest installations in the U. S. Army's teletypewriter network, Kleinschmidt reperforator-transmitters, teletypewriters and related equipment, developed in cooperation with the U. S. Army Signal Corps, receive and automatically relay the vast load of military communications for the Pacific overseas area and western United States. With related switching equipment, incoming messages are scanned and re-transmitted without manual handling . . . so rapidly that the first portion of a relayed message is received at its destination before the latter part has been transmitted from point of origin!

Research and development of equipment for transmitting and receiving printed communications has been a continuing project at Kleinschmidt for almost 60 years. This unparalleled store of experience, now joined with that of Smith-Corona Inc, holds promise of immeasurable new advances in electronic communications.

KLEINSCHMIDT

DIVISION OF SMITH-CORONA MARCHANT INC., DEERFIELD, ILL.

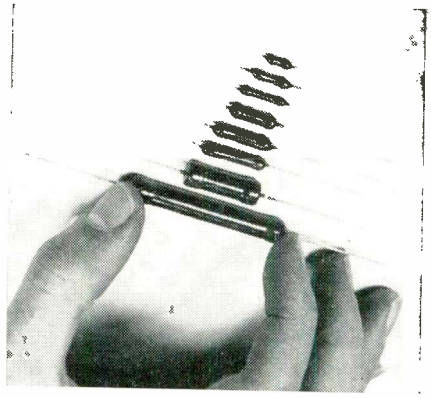
Pioneer in teleprinted communications systems and equipment since 1911

Circle 61 on Inquiry Card, page 83

New Products

CARBON FILM RESISTORS

These deposited carbon film resistors, Type DCF, are fully insulated and maintain sub-miniature size. The DCF will surpass the rigid requirements of MIL-R-10509B. The series

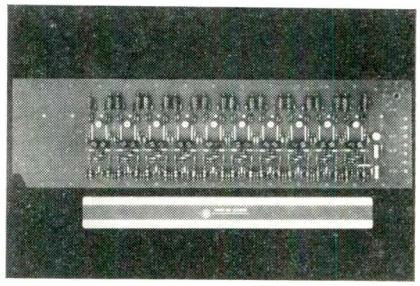


has eight sizes, with a selection of five wattage ratings: ⅛, ¼, ½, 1 and 2 watts. Resistance range is from 1 ohm to 50 megohms, depending on size and type. Standard tolerance is 1%. Typical derating is 100% power to 70°C. derating to 0% at 150°C. Dielectric strength is 1000 vac on the V-block test. All resistors have axial leads. Dale Products, Inc., Columbus, Nebraska.

Circle 191 on Inquiry Card, page 83

ELECTRONIC COMMUTATOR

A solid state high speed unit will commutate up to 1000 channels of information, supplying up to 100,000 samples per sec. It can commutate either ac or dc signals to a voltage-to digital converter or commutate the output of a digital-to voltage converter into a number of channels. If a holding circuit is required, solid state sample and hold circuits are avail-



able. Switch accuracy is a function of the full scale of the voltages being commutated. Packard-Bell Computer Corp., 1905 S. Armacost Ave., Los Angeles, Calif.

Circle 192 on Inquiry Card, page 83

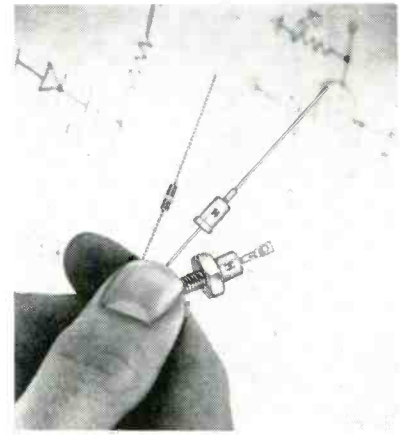
Circle 101 on Inquiry Card, page 83

Circle 102 on Inquiry Card, page 83

New Products

ZENER REGULATORS

A line of silicon diffused junction zener power voltage regulators incorporating 114 type and size combinations is available. The line consists of 38 types in each of three

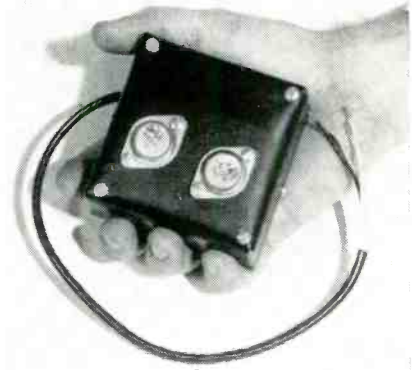


power categories (¼ w, 1 w, and 10 w). The zener voltage in each power rating ranges from 5.6 v through 200 v in 10% steps. The units are offered in a ±10% zener voltage tolerance and ±5%, up to 56 volts. Dynamic impedance ranges from 1400 ohms for 200 v —¼ watt zener regulator type, down to 1 ohm for the 5.6 v —10 w unit. Hoffman Electronics Corp., Los Angeles, Calif.

Circle 193 on Inquiry Card, page 83

POWER SUPPLY

This power supply for converting from battery to "B" voltages has no moving parts, glass tubes or vibrators. It uses printed circuits and a transistorized 2000-CPS inverter-rectifier system. The power supply is self-starting at temperatures down to —55°C; it is rated for ambient temperatures from —55°C to +71°C. Two models are available: TPS-1 which delivers 100 milliamperes at



150 v (12 v nominal input), and TPS-2 which has rated output of 200 milliamperes at 250 v (24 volts nominal input). P. R. Mallory & Co., Vibrator Division, DuQuoin, Ill.

Circle 194 on Inquiry Card, page 83

Relays

(*Continued from page 74*)

control receivers, and various other sensitive control circuits.

To date, the limited use of the magnetic amplifier operated relay has been due largely to the lack of knowledge of its availability and perhaps the reluctance to change from the old sensitive shock mounted relay to a new type of control.

But, as the avionic industry continues to increase the capabilities of our aircraft, we must provide suitable control equipment.

Table 1

	SENSITIVE RELAY	MAG. AMP. RELAY
Contact Pressure	Very low	Equivalent to any power relay
Contact gap	Small	As large as required for the load
Contact current	1 to 2 amps	5, 10, 25 amps as req'd.
Vibration resistance	Usually limited to 10 G to 55 CPS	20 G to 2000 CPS
Shock resistance	Very poor without shock mounts	The same as any power relay
Auxiliary relay	Required if more than one or two small current loads	None req'd. even for Multi ckt. hi-current loads
Reliability	Not too good due to very low contact pressure	Very good, only moving parts are at high power level
Power req'mts. of control winding	Not less than a few milliwatts	A few micro watts

* * *

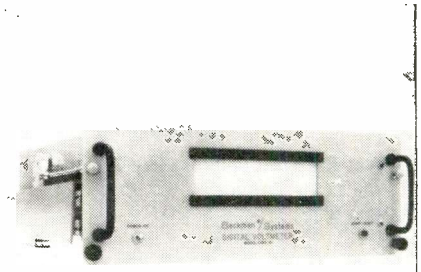
Circle 104 on Inquiry Card, page 83

Circle 105 on Inquiry Card, page 83

New Products

DIGITAL VOLTMETER

The Model 81 may be used in production testing, research measurements, telemetry, and alarm monitoring. Accuracy and resolution is 0.015% over the three ranges of

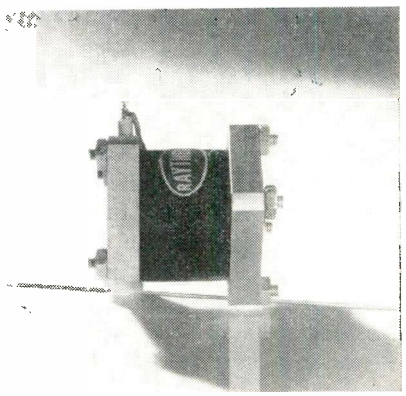


±10, ±100, ±1,000 vdc. Input impedance is 10 megohms. The voltmeter balances the input with a signal from a Digital to Analog Converter and presents the reading in the Converter. Output presentation is by dot projected visual readout and ten line decimal code, allowing the figures to show on a single plane. Beckman Instruments, Inc., 325 N. Muller Ave., Anaheim, Calif.

Circle 195 on Inquiry Card, page 83

FERRITE SWITCH

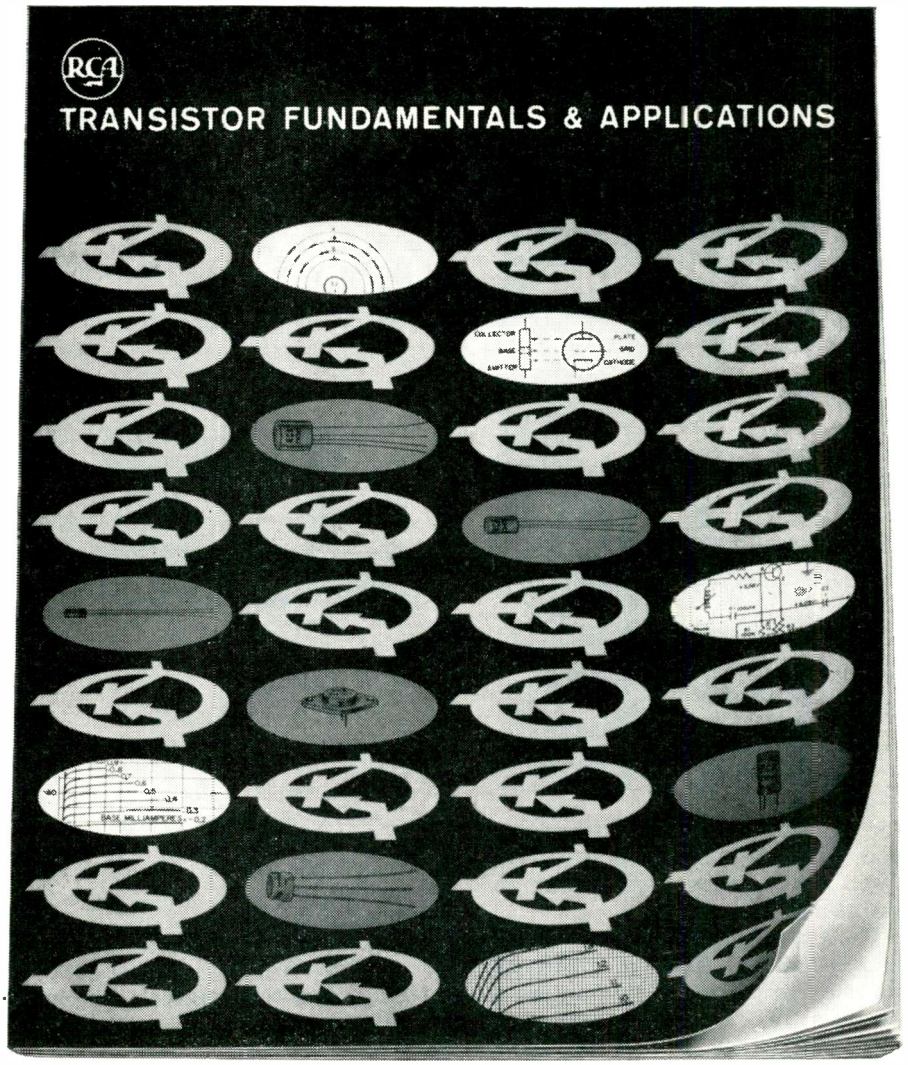
A low power X-band ferrite switch is available for on-off applications. The Model SXL1, provides a minimum isolation of 25 db with an insertion loss of 0.5 db (maximum). Multiples of this isolation can be obtained by



connecting several SXL1's in series. Weight is 15 ounces; over-all length, 1.7 inches. Raytheon Manufacturing Company, Foundry Ave., Waltham, Massachusetts.

Circle 196 on Inquiry Card, page 83

Now Available!



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Authoritative, condensed and easy-to-read, this new 48-page booklet contains pertinent diagrams, schematics, and tables of important technical data—all compiled in a simplified manner for busy engineers and executives who desire to broaden their knowledge of transistor theory and practice. Three quiz-pages consisting of questions and answers appear at the end of the booklet and serve as a valuable summary and review.

Now, *for a limited time only*, this valuable booklet will be available through your authorized RCA Semiconductor Products Distributor. See him today!

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48 pages...16 sections!

1—Introduction
2—Transistor Physics
3—The PN Junction
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5—The Point-Contact Transistor
6—Transistor Characteristics
7—Types of Transistors
8—Transistor Amplifiers
9—Methods of Coupling
10—Gain Controls
11—Power Amplifiers
12—Oscillator Circuits
13—Power Supplies
14—Practical Transistor Circuits
15—Transistor Components
16—Servicing Transistor Circuits

RADIO CORPORATION OF AMERICA
Semiconductor Products
Harrison, New Jersey

Circle 62 on Inquiry Card, page 83

New Products

DISTANCE DETECTOR

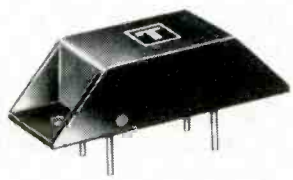
The Model D-15 is an electro-mechanical transducer which generates an output voltage as a function of distance. It is used wherever sensing of position and/or motion is required.

Applications include: indicating and control of location, dimension, contour, displacement, velocity, acceleration, vibration, impact, creep, and count. It consists of a control unit, which contains the circuitry for detection; and a sensor, which contains the pickoff element from which distance is measured. Distances are determined by bringing a conducting surface within the range of the sensor. Bently Scientific Co., 2811 7th st., Berkeley, Calif.

Circle 230 on Inquiry Card, page 83

VOLTAGE REFERENCE

Combined in a single package is a voltage reference (temperature compensated zener diode) and an amplifying transistor. This unit provides a combined temperature coefficient as low as 0.002% per degree C (−55°C to +100°C). Regulator circuits may be designed with only one transistor, one Ref-Amp, and four resistors; reducing space required, increasing reliability, and doubling loop gain. The package is engineered for chassis or printed circuit mounting in any position. Transitron Electronic Corp., Wakefield, Mass.

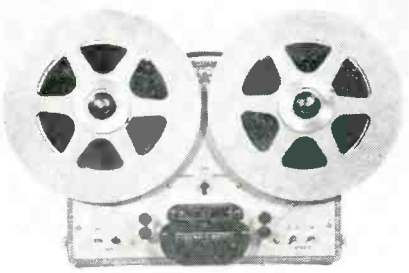


Circle 231 on Inquiry Card, page 83

New Products

TAPE PLAYER

This machine will play up to 16 hours of unrepeated time with a 14 in. reel at 3¾ ips, and 8 hours at 7½ ips with "Hi-Fi" reproduction. Featured are: Silver satin anodized aluminum construction, play light operation for long life of tape, synchronous motor, fast forward and reverse, automatic release with power failure, remote reversing controls, low wow and high quality, forced air cooling, magnetic brakes and playback preamplifiers. International Radio & Electronics Corporation, Elkhart, Indiana.



Circle 232 on Inquiry Card, page 83

DIGITAL VOLTMETER

This instrument has an accuracy of 0.1% with infinite resolution slidewire. It is a continuous null-balance, servo-driven, slidewire potentiometer with transistorized amplifier and Zener referenced power supply. The tape-slidewire is formed by bonding a resistance wire within the edge of a laminated Mylar tape. The slidewire, 144 in. long, is calibrated by comparing it to a master tape 60 ft long. Shown is the BH180B AutoTemp calibrated as a pyrometer. B & H Instrument Co., Inc., Fort Worth, Tex.

Circle 233 on Inquiry Card, page 83

New Products

ECHORASER

This device removes print-through from valuable "echo-ridden" tape recordings. It needs no power to operate. It consists of an upright chromium-plated brass bar 1½ inches by

⅜ inches by ¼ inch in size with a small energized area. The bar fits over a ¾ inch base plate permanently installed on a tape transport over which passes the moving tape. The package consists of two erasers each with a different power of energized area. Audio Devices, Incorporated, 444 Madison Avenue, New York 22, N. Y.

Circle 236 on Inquiry Card, page 83

DISTORTION METER

This distortion meter may be used for accurate measurements of residual noise and harmonic content in the audio frequency ranges, as in FCC Proof-of-Performance tests. The meter requires only 0.3 for noise and distortion measurements, and measures fundamentals from 30 to 15,000 CPS and harmonics to 45,000 CPS. For measurements of low level audio volt-

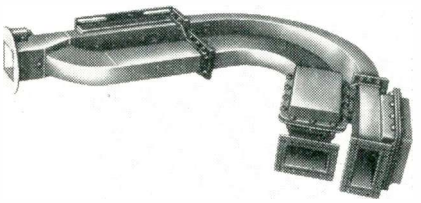
ages in determining noise and harmonic content, full scale readings of 0.3, 0.1, 0.03, 0.01, 0.003 are provided. Barker & Williamson, Inc., Bristol, Pa.

Circle 237 on Inquiry Card, page 83

New Products

DUAL FEED HORN

A dual polarized feed horn for large size waveguide having two waveguide inputs has been developed. The unique feature of this primary feed is the waveguide input, since the

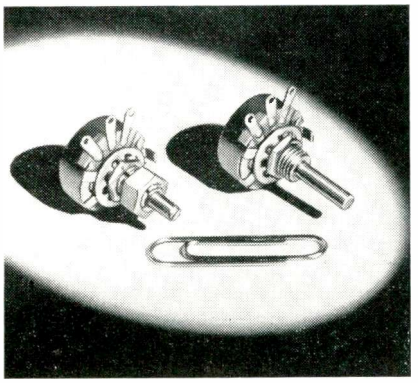


usual dual polarized horn requires a coax input. This feature has the advantage of providing the same center of radiation for both signals. Maximum power transmission is obtained in both polarizations. The horn handles 10 kw with more than 30 db decoupling between the signals. The horn has been produced in the frequencies of 1700-2400 MC, 755-985 MC and 400-560 MC, but the design is available in other frequencies. D. S. Kennedy & Co., Cohasset, Mass.

Circle 238 on Inquiry Card, page 83

VARIABLE RESISTOR

The Model 3 Radiohm, a sub-miniature variable resistor redesigned to increase its rating from ¼ to ½ w., is to be used for high temperature operation in military and commercial equipment. The ½ w. Model 3 is available in values from 25 K to 500 K, linear taper. It meets MIL-R-94B resistance change requirements, and also meets or exceeds MIL-R-94B for



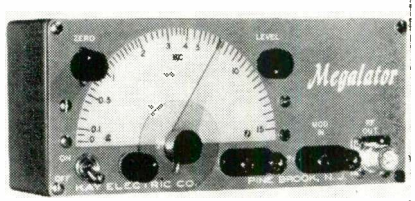
moisture resistance, thermal cycling, etc. The completely enclosed case can be sealed or potted. Centralab, A Div. of Globe-Union, Inc., 900 E. Keefe Ave., Milwaukee 1, Wis.

Circle 239 on Inquiry Card, page 83

New Products

AMPLITUDE MODULATOR

The Megalator, a battery powered, transistorized instrument, provides better than 100% amplitude modulation over both CW and FM frequency ranges, and its internal oscillator is

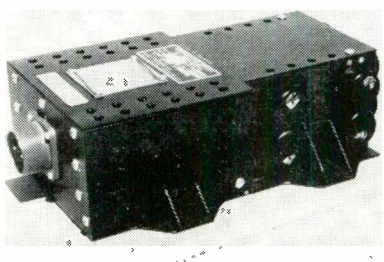


a continuously variable source of modulating frequencies from 15 CPS to 15 KC. It includes an accurate beat-frequency audio oscillator. R-F input voltage is 2.0 v RMS, input impedance is 50 ohms, and insertion loss is approx. 15 db. For the Audio Oscillator: frequency calibration accuracy is ±(1.5% + 8 CPS), harmonic distortion is 1.5%, output voltage is 1.0 v RMS at 600 ohms, and output flatness is ±0.5 db over its range. Kay Electric Co., 14 Maple Ave., Pine Brook, New Jersey.

Circle 240 on Inquiry Card, page 83

INVERTER

The Model W-1347 100 va, static inverter converts dc to ac without moving parts. The 400 CPS output frequency is regulated to ± 1 CPS; output voltage, nominally 115 v, is regulated to ±2%. It is designed to meet MIL-E-5272A. No special cooling is required. Input voltage can vary from zero to 40 vdc. without damage to the equipment. Also, the output circuit will sustain direct short circuits, and will recover to full normal operation in 10 milliseconds after short removal. Electrosolids Corp., 13745 Saticoy St., Panorama City, Calif.

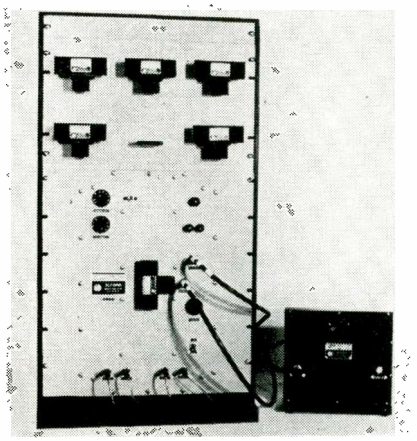


Circle 241 on Inquiry Card, page 83

New Products

IMPEDANCE PLOTTER

The AMCI Automatic Impedance Plotter is available in rack-mounted and portable units. It presents continuous data on an unknown r-f impedance at the rate of 60 points per

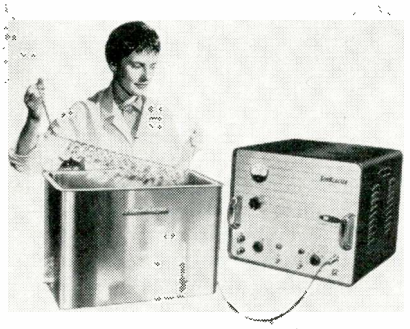


second traced on a Smith chart. The unit consists of an AMCI Hybridge, Polar Displayer and auxiliary components. It utilizes a standard r-f oscillator, regulating power supply, dc oscilloscope and/or X-Y recorder. Available frequency ranges are 2.5-250 MC, 30-400 MC and 180-1100 MC. Unknown impedance is compared with a 50 ohm Standard Load impedance. Alford Mfg. Co., 299 Atlantic Ave., Boston, Mass.

Circle 242 on Inquiry Card, page 83

ULTRASONIC CLEANER

The Series 5000 SonBlaster for ultrasonic cleaning has a 10 gal. tank with integral transducers. The generator is equipped with tank selector and load selector switches so that it can operate either one or two ultrasonic tanks alternately, or submersible transducers in tanks up to 30 gal. capacity. The SonBlaster unit is



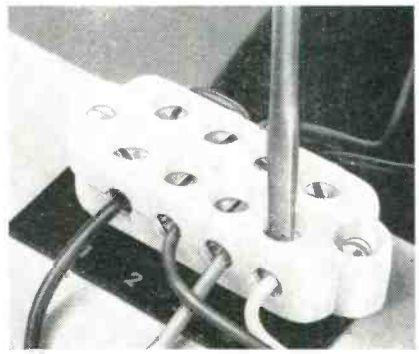
plugged into any convenient 110-115 v circuit and is actuated by the flip of a switch. Narda Ultrasonics Corp., 625 Main St., Westbury, L. I., New York.

Circle 243 on Inquiry Card, page 83

New Products

TERMINAL BLOCK

A quarter turn with a screwdriver is all it takes to connect a new type of terminal block. The Camblock makes positive connections without solder, lugs, or crimping, in a fraction of the

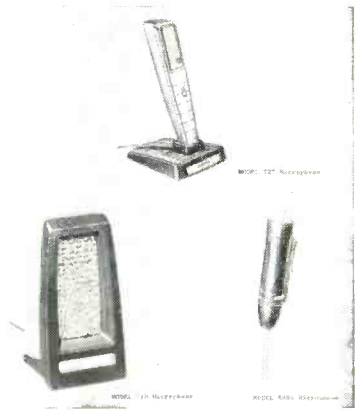


time required by older methods. Available with any number of stations from 2 through 20, these terminal blocks take wire sizes up to #18, handle up to 15 amps and withstand heat up to 220°F. Dielectric strength is 2500 v between terminals, 3000 v from terminal to base. Camblock Corp., 825 Bronx River Ave., New York, N. Y.

Circle 234 on Inquiry Card, page 83

MICROPHONES

The Model 649A Miniature Lavalier weighs two ounces and is ideal where a concealed or unobtrusive placement is desirable. The unit is nondirectional and has a frequency response of 60 to 12,000 CPS. The Model 727 Slim Ceramic has a frequency response of 60 to 8,000 CPS, it is for P. A., recording, and general use. The Model 718 Ceramic Microphone was designed as

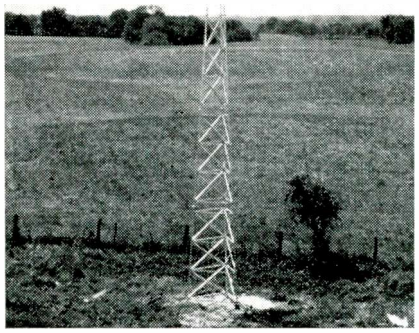


a replacement for home recording microphones. It may be used on a flat surface or held in the hand. A phono plug is provided as an accessory. Electro-Voice, Inc., Buchanan, Mich.

Circle 235 on Inquiry Card, page 83

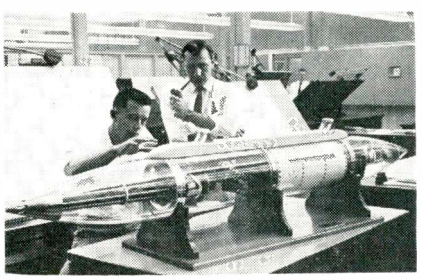
SELF-SUPPORTING TOWER

A heavy-duty tower, self supporting to a height of 130 ft, is being produced. The tower uses 13 different sections of varying size, weight, structural strength and taper. The sections can be used in making additional combinations to build self-supporting towers of variable heights and structural capacities. Available in hot-dipped, galvanized after fabrication finish. All sections are 10 ft in length. Tapered sections are shipped partially disassembled. Rohn Mfg. Co., 116 Limestone, Bellevue, Peoria, Ill.



Circle 244 on Inquiry Card, page 83

"VULCAN"

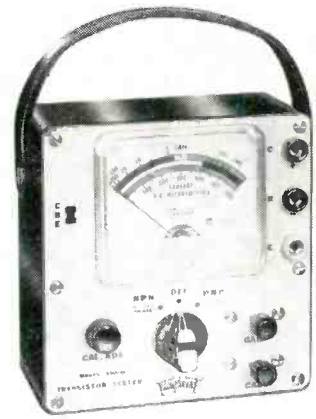


The Air Forces new 7.62 mm. Vulcan is shown in its mockup stage at GE's Missile & Space Vehicle Dept., Burlington, Vt. The new Gatling-type weapon will fire 3,000 rds/min.

New Products

TRANSISTOR TESTER

The Model 690-A provides positive leakage and gain tests for PNP and NPN type transitors. It measures DC Beta from 5 to infinity. A better indication of the degree of quality is made possible by the long GOOD portion of the scale. The tester also tests for shorts, leakage, and forward and reverse leakage of diodes. Separate "Calibrate" and "Gain" buttons elimi-



nate the possibility of errors in usage. Single switch selection of transistor types gives operational simplicity. Triplett Electrical Instrument Co., Bluffton, Ohio.

Circle 183 on Inquiry Card, page 83

RIGHT ANGLE ADAPTER

This adapter is designed for use up to 1000w of CW power, and engineered to fit the LT series cable connecters. The low residual VSWR of less than 1.1 plus its short radius of curvature makes this unit useful in hi-power transmission line systems. The Tamar #2000 is USAF approved, and carries the nomenclature number UG-1264/U. This adapter

contains a solid teflon dielectric that will perform under extremes of temperature variation, and a solid center conductor. Tamar Electronics, Culver City, Calif.

Circle 184 on Inquiry Card, page 83

News of Reps

REPS WANTED

A manufacturer of **custom r-f and i-f chokes, transformers and coils. TWT solenoids, current regulated power supplies, and actuating solenoids** seeks reps for New England, Chicago area, the Dayton-Columbus-Cincinnati area, Texas and upstate New York. (Box R12-1, Editor Electronic Industries).

The appointment of **Eichorn and Melchior, Inc.**, 749 Bryant St., San Francisco, as exclusive sales reps in Northern California and Nevada for the Lenz Electric Mfg. Co. of Chicago has been announced.

The following four new reps were appointed by Scientific-Atlanta, Inc.; **George G. Gostenhofer & Assoc.**, Waltham, Mass.; **DB Assoc.** of Syracuse and Buffalo, N. Y.; **The Gawler-Knoop Co.** with offices in Roseland, New Jersey, Wyncote, Pa., and Silver Spring, Md.; and **Phillips Electronics Industries, Ltd.**, Toronto, Canada.

Northern Associates, 704 Allen Rd., N. Syracuse, N. Y. are now reps for sales and service for transistor testing and semiconductor testing equipment manufactured by Baird-Atomic.

General Transistor Distributing Corp., subsidiary of General Transistor Corp. has appointed 3 sales rep organizations to handle sales to industrial distributors. The three firms are: **Glen M. Hathaway Electronics, Inc.**, Cambridge, Mass.; **Angus-Sloane Assoc.**, Moorestown, N. J.; and **Southern Sales Co.**, Angola, Ind.

J. D. Ryerson Assoc., Inc. have been appointed to represent Computer Measurements Corp.. N. Hollywood, Calif., for their line of high speed electronic counting, timing and frequency measuring equipment. Ryerson will cover upstate New York.

Continental - Diamond Fibre Corp. has named **George H. Shima** as their rep in the new Western Sales Division Office of the Budd Co. in Calif.

Fred Scarano and **Gerald M. Moch.** have joined to form a new electronic industrial sales firm under the name of **S & M Assoc.** Their office is located at 28-02 Broadway, Fair Lawn, N. J.

Two new Midwest sales reps have been named by Wayne Kerr Corp. They are: **R. Edward Stemm**, 5681 W. Lake St., Chicago 44, and **Lee Mark Assoc.**, P. O. Box 8467, Kansas City 14.

Metal Textile Corp., manufacturers of r-f shielding, have named the following reps: **Thomas L. Stevens Co.**, Los Angeles, Calif.; **William J. Purdy Co.**, San Francisco, Calif.; **R. Edward Stemm**, Chicago 44, Ill.; and **Jules J. Bressler**, Union City, N. J.

(*Continued on page* 166)

News of Reps

(*Continued from page* 165)

The Burroughs Corp., Detroit, has assigned **Guy L. Antrim, Jr.**, as military relations rep at Colorado Springs.

Chester Cable Corp. of Chester, N. Y., has named the following firms to act as sales agents to their expanded line of wires and cables: **C. G. Coppage**, Winter Park, Fla.; **Cooper Simon Co., Inc.**, New York City; **Edward Hoffman**, St. Paul, Minn.; and **J. Keefe Jr.**, Haddonfield, N. J.

Electro-Sales Assoc., Dabel Station, Box 143, Dayton 20, Ohio, is now rep in Southern Ohio, Kentucky and Indiana for the Bogart Mfg. Corp.

The Robert B. Nesbitt Co., of Dallas, Tex., has been appointed as sales rep for Clevite Transistor Products, a division of Clevite Corp. He will handle the company's complete line of power transistors and semiconductor diodes.

J. D. Ryerson Assoc., Inc., P. O. Box 1400, Syracuse, N. Y. will represent the "FXR" line of precision microwave and electronic test equipment, radar system components, and high-power modulators. The FXR line is manufactured by F-R Machine Works.

Epsco, Inc., Boston, Mass., has appointed the **P. J. Engineering Sales Co.**, Watertown, Mass., as its new components rep in the New England territory.

James L. Highsmith and Co., Box 1011, Charlotte, N. C., will handle the Navigation Computer Corp.'s complete line of digital data handling products in North and South Carolina and Virginia.

Pyramid Electric Co. has announced the appointment of **Hyde Sales Co.** as industrial and jobber sales rep for their line of capacitors and selenium rectifiers. Hyde Sales Co. is located at 1341 Cherokee St., Denver, Colo.

Bulova Watch Co., Electronics Div. has announced the appointment of the following firms to handle the frequency control devices: **Comtronic Assoc.**, Plainview, L. I., N. Y.; **Kelly Enterprises**, Loveland, Colo., and **F. D. Marcy Assoc.**

Egbert Engineering Assoc., Palo Alto, Calif., are now reps in the Pacific Northwest States for the Magnetic Controls Co.

Applied Physics Corp., manufacturer of Cary scientific instruments, has announced the appointment of **Atomic Assoc., Inc.**, Cambridge, Mass., as sales and service reps in the East and Midwest.

Columbine Sales and Engineering Co., Denver, Colo., has been named to represent the Electronics Div. of Iron Fireman Mfg. Co.

ANNOUNCING

an

Important Change

in response to
the many requests
for a name indicative
of the industry's fastest growing
microwave company,
F-R Machine Works, Inc.
will be known
as FXR, Inc.
This new name, our trademark, continues
to symbolize the exceptional blend
of engineering and craftsmanship
that has established
FXR as the leader
in microwave equipment
and high-power
modulators.

Contact our local
sales representative
in your area
for details.

FXR, Inc. formerly F-R MACHINE WORKS, Inc.

DESIGN • DEVELOPMENT • MANUFACTURE

PRECISION MICROWAVE EQUIPMENT
•
HIGH POWER MODULATORS
•
RADAR COMPONENTS
•
ELECTRONIC TEST EQUIPMENT

26-12 BOROUGH PLACE, WOODSIDE 77, N. Y.

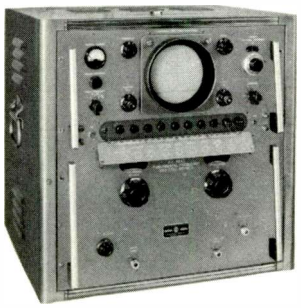
TELEPHONE: AStoria 8-2800

MICROWAVE INSTRUMENTATION

Coming Soon . . .
New printed circuit Standing Wave Amplifier.

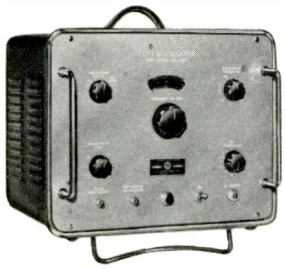
BROADBAND SPECTRUM ANALYZER, 701

Type L701A: 950 to 2000 Mc/s (Fund.)
Type S701A: 1900 to 4000 Mc/s (Fund.)
Harmonic Operation: to 16,000 Mc/s
Swept IF: 7 Kc and 50 Kc
Sweep Width: 50 Mc
RF Attenuator: 100 db Range
Video Markers



SIGNAL SOURCES, 771, 772

Type L771B: 950 to 2000 Mc/s
Type S771B: 1900 to 4000 Mc/s
Type C772A: 3950 to 8200 Mc/s
Type X772A: 7000 to 11,000 Mc/s
Output Power: 50 mw (average)
Direct Reading Frequency Dial: 1%
Internal Modulation: Pulsed, Square Wave, C.W.
Integral RF Level Set Attenuator



UNIVERSAL RATIOMETER, 811

(COMBINED RATIO METER AND STANDING WAVE AMPLIFIER)

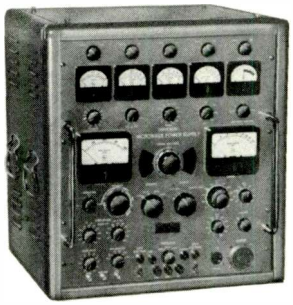
RATIO METER—1000 cps operation
VSWR Ranges: 1.02 to 1.22, 1.20 to ∞
Reflection Coefficient: .01 to .1, .1 to 1.0
Other Scales: db, Slotted Line VSWR
Standing Wave Amplifier—1000 cps operation
Range: 70 db in 10 db steps
Noise Level: .03 mv
Scales: VSWR, db, Expanded VSWR
Bolometer Bias: 4.5 and 8.75 ma
Input Impedance: 200 ohms or 200 K ohms

UNIVERSAL KLYSTRON POWER SUPPLY, 815

Beam: 200 to 2000 V, 125 ma max., 1800 to 3600 V, 100 ma or 250 W max.
Reflector: 0 to 1000 V
Control Grid: −300 to 0 to +150 V, 5 ma max.
Regulation: 0.03%
Ripple: 3 mv max.
Internal Reflector Modulation: Square Wave, Pulse, Sawtooth, Sine Wave

UNIVERSAL MICROWAVE POWER SUPPLY, 817

Helix or Beam: 0 to 1800 V, 125 ma max. 1700 to 3500 V, 100 ma or 250 W max.
Collector: 0 to 300 V, 100 ma max.
Anode: 0 to 600 V, 60 ma max.
G-1: 0 to 300 V, 5 ma max.
G-2 or Reflector: 0 to ±1200, 1 ma max.
G-3: 0 to ±750, 1 ma max.
G-4: 0 to ±500, 1 ma max.
Regulation: 0.03%. **Ripple:** 3 mv max.
Heater: 0 to 15 V D.C., Regulated.
Internal G-1 or G-2 Modulation: Sine Wave Square Wave, Pulse, Sawtooth



KLYSTRON POWER SUPPLY, 819

Beam: 300 to 1000 V, 85 ma max.
Reflector: 0 to 900 V, 20 μa max.
Control Grid: −300 to 0 to +150 V, 5 ma max.
Regulation: 1%
Ripple: 7 mv max.
Internal Reflector Modulation: Square Wave, Pulse, Sawtooth

FXR, Inc. formerly F-R MACHINE WORKS, Inc.

DESIGN • DEVELOPMENT • MANUFACTURE

26-12 BOROUGH PLACE, WOODSIDE 77, N. Y.

TELEPHONE: AStoria 8-2800

FXR

PRECISION MICROWAVE EQUIPMENT
•
HIGH POWER MODULATORS
•
RADAR COMPONENTS
•
ELECTRONIC TEST EQUIPMENT

International

ELECTRONIC SOURCES

ELECTRONIC INDUSTRIES' exclusive monthly digest of the world's top electronic engineering articles

ANTENNAS, PROPAGATION

On the Theory of a Double Block of Slot Resonators, M. F. Stel'makh. "Radiotek." Aug. 1958. 7 pp. The paper studies the propagation of electromagnetic waves in a double block of slot resonators (a double "comb"). Dispersion equations are derived, and expressions are determined for the coupling coefficients between the field and the beam for aligned and non-aligned blocks. (U.S.S.R.)

The Theory of Helical Antennas, W. Peters. "Nach. Z." August 1958. 6 pp. The characteristic properties such as beamwidth, bandwidth and matching of helical antennas for circular polarization are calculated. Various means for increasing the gain are investigated and a number of noval applications are mentioned. (Germany.)

The Construction Technique of Horn Reflector Antennas, L. Calligaris. "Alta. Freq." June-August 1958. 32 pp. (Italy.)

Some Generalized Scattering Relationships in Transhorizan Propagation, A. T. Waterman, Jr. "Proc. IRE." November 1958. 7 pp. An analysis is made of the consequences to be derived from some fairly broad assumption as to the nature of turbulent scattering and its effect on waves propagated through the troposphere. (U. S. A.)

Elements of Design of Parabolic Reflectors, Arthur S. Kramer. "El. Des." September 17, 1958. 3 pp. All energy emitted from a point source at the focus of a parabola will be reflected from the surface in rays parallel to the axis of the parabola. This characteristic makes the parabolic reflector especially useful in long-range high-frequency communication. Some basic design considerations necessary to achieve this result are presented in this article. (U. S. A.)

- Photocopies of all foreign articles are available at 50 cents per page, remitted with order. Unless otherwise indicated, articles appear in language native to country of origin.
- *Articles marked with an asterisk are available as free reprints.
- A reprint of this month's 8-page "International Electronic Sources" section is available without charge.

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Philadelphia 39, Pa.

* * *

For more information on domestic articles, contact the respective publishers directly. Names and addresses of publishers may be obtained upon request from the above address.

AUDIO

Automatic Detection of Speech, K. Steinbuch. "Nach. Z." September 1958. 10 pp. Automatic detection of spoken words may be important for the processing of information, for communications, for automatic dictation equipment and for conversation with deaf people. A summary is given of publications concerning the equipment for automatic speech detection. (Germany.)

Transmission of Speech with Quantizing in Only a Few Stages, K. Kupfmuller and W. Andrich. "Nach Z." August 1958. 4 pp. The effect of cuantizing of speech in only a few stages is investigated. The threshold values of the input voltages and of the reproduced amplitudes of the output voltages are used for the quantizing process. (Germany.)

CIRCUITS

Applications of Phase-Shift Automatic Frequency Control, A. D. Artym. "Radiotek." Aug. 1958. 10 pp. The paper studies various applications of phase-shift automatic frequency control when it is used for band-pass filtering, frequency modulation and phase detection. (U.S.S.R.)

A method for Computing the Variations in the Parameters of Nonlinear Multipole Networks, A. A. L'vovich. "Radiotek." Aug. 1958. 9

REGULARLY REVIEWED

AUSTRALIA

AWA Tech. Rev. AWA Technical Review
Proc. AIRE. Proceedings of the Institution of Radio Engineers

CANADA

Can. Elec. Eng. Canadian Electronics Engineering
El. & Comm. Electronics and Communications

ENGLAND

ATE J. ATE Journal
BBC Mono. BBC Engineering Monographs
Brit. C.&E. British Communications & Electronics
E. & R. Eng. Electronic & Radio Engineer
El. Energy. Electrical Energy
GEC J. General Electric Co. Journal
J. BIRE. Journal of the British Institution of Radio Engineers
Proc. BIEE. Proceedings of Institution of Electrical Engineers
Tech. Comm. Technical Communications

FRANCE

Ann. de Radio. Annales de Radioelectricite
Bull. Fr. El. Bulletin de la Socfete Francaise des Electriciens
Cab. & Trans. Cables & Transmission
Comp. Rend. Comptes Rendus Hebdomadaires des Seances
Onde. L'Onde Electrique
Rev. Tech. Revue Technique
Telonde. Telonde
Toute R. Toute la Radio
Vide. Le Vide

GERMANY

AEG Prog. AEG Progress
Arc. El Uber. Archiv der Elektrischen Ubertragung
El Rund. Electronische Rundschau
Freq. Frequenz
Hochfreq. Hochfrequenz-technik und Electroakustik
NTF. Nachrichtentechnische Fachberichte
Nach. Z. Nachrichtentechnische Zeitschrift
Rundfunk. Rundfunktechnische Mitteilungen
Vak. Tech. Vakuum-Technik

POLAND

Arch. Auto. i Tel. Archiwum Automatyki i Telemechaniki
Prace ITR. Prace Instytutu Tele-I Radiotechnicznego
Roz. Elek. Rozprawy Electrotechniczne

USA

Auto. Con. Automatic Control
Av. Age. Aviation Age
Av. Week. Aviation Week
Bell J. Bell Laboratories Journal
Comp. Computers and Automation
Con. Eng. Control Engineering
El. Electronics
El. Des. Electronic Design
El. Eq. Electronic Equipment
El. Ind. ELECTRONIC INDUSTRIES
El. Mfg. Electrical Manufacturing
IRE Trans. Transactions of IRE Prof. Groups
I. & A. Instruments & Automation
Insul. Insulation
M/R. Missiles and Rockets
NBS J. Journal of Research of the NBS
NRL. Report of NRL Progress
Proc. IRE. Proceedings of the Institute of Radio Engineers
Rev. Sci. Review of Scientific Instruments

USSR

Avto. i Tel. Avtomatika i Telemakhanika
Radio. Radio
Radiotek. Radiotekhnika
Rad. i Elek. Radiotekhnika i Elektronika
Iz. Acad. Bulletin of Academy of Sciences, USSR.

OTHER

Radio Rev. La Radio Revue (Belgium)
Kovo. Kovo Export (Czech)
J. ITE. Journal of the Institution of Telecommunication Engineers (India)
J. IECE. Journal of the Institute of Electrical Communication Engineers (Japan)
Phil. Tech. Philips Technical Review (Netherlands)
Eric. Rev. Ericsson Review (Sweden)
J. UIT. Journal of the International Telecommunication Union (Switzerland)

pp. The paper is devoted to deriving generalized computation formulas which make it possible to establish the relationship between parameter variations in nonlinear multipole networks and variations in the controlling voltages (or currents) which are applied to the network. A study is made of nonlinear multipole networks with any number of nonlinear elements (resistances). (U.S.S.R.)

A Low-Frequency Power Amplifier with Distortion Compensation, G. Ia. Gurovich. "Radiotek." Aug. 1958. 4 pp. The paper demonstrates the possibility in principle of fully compensating frequency, nonlinear, amplitude, phase and noise distortion, etc., in a low-frequency power amplifier without reducing its gain. This is achieved using a special circuit for coupling the tubes, which makes it possible to apply a special type of negative feedback to each stage. (U.S.S.R.)

A Circuit for Measuring Weak Signals with a Continuous Spectrum, V. S. Voiutskii and A. I. Slutskovskii. "Radiotek." Sept. 1958. 5 pp. The paper describes a circuit for measuring weak signals with a continuous spectrum; the unit eliminates the effect of intrinsic equipment noise and gain instability. The principles of the circuit are given, as well as its description and the results of an experimental test of the unit. (U.S.S.R.)

Computing the Equivalent Parameters for Evaluating the Thermal Operating Mode for Pulse Modulator Capacitors, D. E. Vakman. "Radiotek." Sept. 1958. 8 pp. The paper evaluates the conditions governing the operation of capacitors in transmission-line shaping segments and establishes the criteria which determine the practicality of the capacitors under these conditions. (U.S.S.R.)

Instrumentation Errors of a Differential Phase Shifter, V. S. Ignatov. "Radiotek." Sept. 1958. 4 pp. The paper studies a number of factors which affect the accuracy of a differential phase shifter. A quantitative evaluation is made of the errors caused by these factors; a method is given for measuring them. The paper shows that it is possible to achieve mutual compensation of certain errors in the phase shifter. (U.S.S.R.)

Efficiency-Diode Scanning Circuits, Part 2, K. G. Beauchamp. "El. Eng." September 1958. 8 pp. (England.)

Temperature Compensating Networks Design of Thermistor Bias Networks for Transistor Amplifiers, Haim D. Polishuk. "E. & R. Eng." October 1958. 5 pp. A generalized analytical design procedure is proposed for the realization of two typical temperature-compensating bias networks, employing thermistors, for class-B push-pull transistor amplifiers. A set of simple relations is derived for evaluating the network component values, and restrictions are indicated on the choice of appropriate thermistors. (England.)

Latching Counters, Part 1—Development of Four-Phase Circuit, W. P. Anderson and N. A. Godel. "E. & R. Eng." October 1958. 5 pp. Maintenance difficulties encountered with conventional scaling circuits during the development, between the years 1951 and 1956, of a large digital data transmission system led to a reconsideration of the basic principles of operation of these circuits. A new type of scaling circuit was evolved which, although being inherently more complex than the familiar Eccles-Jordan type, compensates for the additional complexity by offering increased reliability and an independence of rise time, the circuit being capable of operating at any frequency between about 500 kc/s and d.c. (England.)

Miniature Delay Lines for Millimicrosecond Pulses, Reinhold Gerharz. "E. & R. Eng." October 1958. 3 pp. Wire-wound delay lines are used as frequency-determining elements for recycling v.h.f. pulse generators. Characteristic features of the delays are the enclosure of a thin wire by metallic foils and their arrangement as a coil to save weight and space. Measurements on the devices led to the necessity of making the physical properties of the liens similar to those of coaxial cables, rather than using lumped inductive and capacitive elements, in order to keep the line losses tolerable. (England.)

The Cascading of Half Wave Bridge Magnetic Amplifiers, H. T. Carden and A. D. Cawdery. "El. Energy." Oct. 1958. 3 pp. The purpose of this article is to describe how half wave bridge magnetic amplifiers can be systematically cascaded. Design formulae are presented which apply to any H.C.R. lamination on a 400 c/s supply. A single stage is designed for maximum current gain and the method is expanded to include the logical design of a multi-stage amplifier for maximum overall current gain. The actual results obtained with an experimental amplifier are compared with the predicted current gains. (England.)

Design Curves for Simple Filters, D. J. H. Maclean. "El. Eng." Nov. 1958. 7 pp. A series of charts is presented giving the normalized element values as a function of the allowable pass band variation for Butterworth or Chebyshev behavior of the insertion loss. The values relate to LC filters of constant-k configuration working between certain resistive terminations, and can be read to an accuracy of 1 per cent. The charts are given for low-pass filters having from two to seven branches, and can be extended to high-pass, band-pass or band-stop filters by the well-known frequency transformations. (England.)

Time-Symmetric Filters, Part 2, L. R. O. Storey. "El. Eng." Nov. 1958. 6 pp. In Part 1 of this article, methods were described for simulating filters that have impulse responses that are symmetrical in time. Their application to the analysis of gliding tones is now discussed The response of a narrow-band time-symmetric filter to a gliding tone is evaluated, and is shown to consist of an oscillation bounded by a slowly-varying envelope. The shape of the envelope is governed by a single dimensionless parameter, that involves the bandwidth of the filter and the rate of variation of the instantaneous frequency of the tone. There is an optimum value of this parameter that yields the sharpest response. (England.)

The Diode Switch, Electronic Analogon of an Electromagnetic Relay, E. Buhler. "El. Rund." Aug. 1958. 3 pp. An electronic switch is described which, similar to an electromagnetic relay, has two CONTACTS electrically insulated off the driving part. Basic component of this circuit operating with switching periods of approximately 10^{-5} sec is a diode bridge fed with control voltages by rectification of high frequency ac voltages. (Germany.)

The Effect of Zero-Error and Grid-Current of DC Amplifiers on the Solution of Linear Differential Equations with Constant Coefficients, with the Electronic Analog Computer, A. Kley. "El. Rund." September 1958. 3 pp. Zero-error and grid-current of dc amplifiers produce an error voltage in the output of an operational amplifier. With integrators this error voltage consists of an error of the initial value and of a voltage increasing with time. In closed loops for the computation of linear differential equations with constant coefficients zero-error and grid-current effect errors of all initial values and of the external force function. These errors are computed in this paper. (Germany.)

Parallel Operation of Rectifiers with Anode Chokes, H. Dornheim. "El. Rund." September 1958. 4 pp. Because of differing arc characteristics and striking voltages of mercury rectifiers and other discharge tubes these cannot give even current distribution when connected in parallel, without the addition of auxiliary circut elements. (Germany.)

Some Remarks on Passive Repeaters, F. Cappuccini. "Alta. Freq." June-August 1958. 7 pp. (Italy.)

A Reactance Tube Frequency Modulator, F. Carassa. "Alta. Freq." June-August 1958. 13 pp. (Italy.)

Intermediate Frequency Triple-Tuned Coupled Circuits, G. B. Stracca. "Alta. Freq." June-August 1958. 44 pp. (Italy.)

Designing Transistor Circuits, Combinational Circuits, Part 2, Richard B. Hurley. "El. Eq." Oct. 1958. 4 pp. Using logic representation, transistor switching circuits, connected in the three basic configurations, are compared for obtaining OR and AND functions. Special points to be observed in current logic design are listed. An example of a complete logic network is illustrated. (U.S.A.)

The Mavar: A Low-Noise Microwave Amplifier, Samuel Weber. "El." September 26, 1958. 7 pp. In the quest for methods of low-noise amplification at microwave frequencies, the principles of parametric or reactance amplifiers are being exploited in increasing measure. Unlike the maser, the mavar require no cooling, is capable of wide bandwidths at substantial gain. (U.S.A.)

Broad-Band Amplifier for Radar and Scatter, J. H. Phillips and E. Maxwell. "El." September 26, 1958. 3 pp. Low-noise two-stage broadband amplifier and mixer covers 400 to 450 mc and can be designed for 200 to 300 mc or 700 to 800 mc. (U.S.A.)

Semiconductor Circuit Design Philosophy for the Central Control of an Electronic Switching System, B. J. Yokelson, et. al. "Bell J." September 1958. 36 pp. This paper discusses the philosophy of circuit design for the central control of an electronic switching system. Primary emphasis in the designs has been low cost consistent with good margins, reliability and the meeting of systems requirements. (U. S. A.)

A Low-Level, High-Accuracy, D-C Magnetic Amplifier, Blas A. Mazzeo. "El. Mfg." Nov. 1958. 5 pp. Magnetic amplifiers can be used to measure accurately and reliably d-c signal voltages from transducers such as thermocouples, strain gages, etc. Performance similar to that of chopper amplifiers can be obtained. One possible advantageous feature is complete electrical isolation between transducer and load. (U. S. A.)

A Quartz Servo Oscillator, Norman Lea. "Proc. IRE." November 1958. 7 pp. The paper deals with a 5 mc oscillator whose frequency instabilities due to vacuum tube effects are at least 100 times less than those present in the best conventional oscillators which achieve stabilization by resonant vector balance. (U. S. A.)

Nomographs for Designing Elliptic-Function Filters, Keith W. Henderson. "Proc. IRE." November 1958. The necessary formulas are given, and the procedure for evaluating them is described briefly. (U. S. A.)

COMMUNICATIONS

The Effect of Fluctuating Noise in FM Communications Systems, V. A. Smirnov. "Radiotek." Sept. 1958. 10 pp. The paper presents a new method for the theoretical investigation of the effect of fluctuating noise in FM communications systems. A series of papers has been written on this subject; however, in the majority of cases either many simplifying assumptions were made, or the analysis was sufficiently general but extremely complex. In our paper we present a sufficiently general solution of the problem which at the same time seems to us simpler than the analysis offered in previous papers. The resulting relationships can be used for practical computations. (U.S.S.R.)

The Effect of Fluctuating Noise on a Discriminator and an Automatic Frequency Control

System, A. P. Belkin. "Radiotek." Sept. 1958. 7 pp. The article studies the passage of signal plus fluctuating noise through a discriminator; a formula is derived for the DC component of the discriminator output voltage. A study is made of the effect of fluctuating noise on the discriminator characteristic in the case of a stagger-tuned discriminator. The effect of fluctuating noise on an automatic frequency control system is analyzed when the input to the system consists of a signal and fluctuating noise. (U.S.S.R.)

Computing the Intrinsic Noise of Transistorized Radio Receiver Units, V. V. Pavlov. "Radiotek." Sept. 1958. 8 pp. The paper presents a method for designing and measuring the intrinsic noise coefficient for transistorized radio receiver equipment. (U.S.S.R.)

Efficiency of Using Frequency Band in Telemetering, R. R. Vasiliev. "Avto. i Tel." Nov. 1958. 4 pp. Determination of efficiency of using telemetering channels frequency band in various modulation ways is considered. Determination is based on use of information criteria for telemetering systems evaluation. (U.S.S.R.)

About Noise Stability of Pulse-Frequency Telemetering, N. V. Pozin. "Avto. i Tel." Oct. 1958. 9 pp. Real noise stability of pulse-frequency telemetering is analyzed by means of signal discretion. As criteria of noise stability, mean error and mean-square error are assumed. Calculation formulae for noise stability evaluation are deduced. (U.S.S.R.)

A Transistorized IF Amplifier for Communication Receivers, A. S. Pett. "Proc. AIRE." July 1958. 7 pp. The design of an IF amplifier is outlined on a step by step basis and the necessary information is presented in the order in which it is required. An equivalent circuit is given and the range of values of its parameters demonstrated. (Australia.)

Recording Techniques for H.F. Direction Finding, C. W. McLeish. "E. & R. Eng." October 1958. 5 pp. The need for a means of recording direction-finding waves propagated by the ionosphere is discussed. Graphical recording systems are described which have been used on a twin-channel direction-finder for producing 'bearing indication versus time' and 'bearing indication versus signal-amplitude' records. (England.)

A Contribution to the Theorem of Adding Noise Voltages in Long Distance Communication Systems with Amplitude Modulation, H. Zuhrt. "Nach. Z." August 1958. 5 pp. Steinbuch and Marko published in 1955 a general formula in the form of a double integral for the theorem of adding third order noise voltages in case of square law and cube law phase-characteristics in repeater sections, and they evaluated this formula by graphical methods. For the purpose of supplementing this work the present paper contains a derivation for a numerical solution of the double integral for a square law phase characteristic. (Germany.)

The Protection Ratios Required for Common Channels and Adjacent Channels in Amplitude-Modulated Sound Broadcasting, Ernst Belger and Friedrich von Rautenfeld. "Rundfunk." August 1958. 6 pp. The necessary protection ratio is determined under various test conditions on the basis of the subjective appraisals of several observers. (Germany.)

Modern Production Methods of Multi-Track Magnetic Sound Recording, Ludwig Heck. "Rundfunk." August 1958. 4 pp. The author explains the difference between the classical "single-microphone" recording technique on the one hand and the requirements of musical effects, as well as the acoustical and technical means for attaining the desired effects, on the other hand. (Germany.)

Branching and Straight-Through Connections in Carrier-Frequency Telephone Networks, K. Bode and J. Steimmabl. "Nach. Z." September 1958. 6 pp. Filters for the design of straight-through and branching circuits in carrier-frequency telephone networks have been discussed. (Germany.)

An 80-Watt Frequency-Modulated Transmitting and Receiving Installation for Outside Broadcasting of Sound, H. Bohlmann and A. Rettig. "Rundfunk." October 1958. 10 pp. The paper describes a transmitting and receiving installation for sound commentaries consisting of two similar sets of apparatus. The installation uses two radio channels that are similar except for the frequency, one for the actual transmission channel and the other for the talk-back and cue channel. (Germany.)

On the Problem of Synchronizing Transmitter Frequencies, H. Ehlers and H. Thies. "Rundfunk." October 1958. 9 pp. After a survey of the purpose and development of the common-channel technique, the authors discuss the methods of synchronization at present used in the European area. A description is given of several modern installations in use in the German Federal Republic. (Germany.)

The Trans-Apennines Radio Link, G. Monti-Guarnieri. "Alta. Freq." June-August 1958. 41 pp. (Italy.)

Propagation Tests Between M. Penice and M. Venda at 1,000 MHz with Diversity Reception, P. Quarta. "Alta. Freq." June-August 1958. 8 pp. (Italy.)

Realizations and Application of Pulse Systems in Radiocommunication Networks, R. Cabessa. "Alta. Freq." June-August 1958. 11 pp. (Italy.)

Diversity Systems and Their Economic Features in Radio Link, P. Clavier. "Alta. Freq." June-August 1958. 10 pp. (Italy.)

Analysis of Millimicrosecond RF Pulse Transmission, Max P. Forrer. "Proc. IRE." November 1958. 6 pp. An analysis of millimicrosecond RF pulse transmission through uniform systems is presented. (U. S. A.)

An Experimental Switching System Using New Electronic Techniques, A. E. Joel, Jr. "Bell J." September 1958. 30 pp. First of a series of articles describing an experimental electronic telephone switching system employing a number of new techniques. These include use of a stored program, a network employing gas tube crosspoints, time-division common control and large-capacity barrier grid tube and photographic storage systems. (U. S. A.)

Telemeter System Relays Undersea Ordnance Data, M. J. Aucremanne and D. D. Woolston. "El." October 10, 1958. 4 pp. Test data during development and evaluation of underwater weapons such as mines, are transmitted to shore by a telemetering system capable of monitoring the performance of four weapons simultaneously. (U. S. A.)

COMPONENTS

Contactless Relay with Transistors, F. L. Varpakhovsky and R. A. Lipman. "Avto i Tel." Nov. 1958. 9 pp. The paper deals with a contactless relay with transistors that is constructed in correspondence with the d-c two-cascade amplifier having a deep positive feedback. The circuit operation is analyzed, main calculation formulae and experimental results are given. (U.S.S.R.)

Determination of Heating of Electromagnetic Relay Windings, M. I. Vitenberg. "Avto i Tel." Nov. 1958. 12 pp. Heating of electromagnetic relay windings is analyzed. Accepted coefficients of heat yielding of relay windings are shown to be unfit to design relays of small size. Formulae to find ratio of the mean coefficient of heat yielding to cooling surface of the winding are given. An idea of specific exceeding of winding temperature is expounded. (U.S.S.R.)

Resistance Potentiometers as Function Generators, R. W. Williams and H. Marchant. "El. Eng." October 1958. 7 pp. The generation of functions of a single variable by means of resistance potentiometers is reviewed. Three main design approaches are described—potentiometer grading, the use of linear potentiometers in special circuits and the multi-tapping technique—and detailed examples are given in illustration of these. (England.)

Pulse Testing of Magnetic Cores, J. Robert Freeman. "El. Eq." October 1958. 7 pp. An evaluation system for the pulse testing of magnetic cores includes core driving pulse generators, a drive current measuring device, a voltage response measuring device, and a driving-pulse sequential logic network. (U. S. A.)

Batteries, C. K. Morehourse, et al. "Proc. IRE." Aug. 1958. 22 pp. A review is given of the chemical compositions, structures, performance characteristics, and applications of various primary and secondary batteries. Both batteries produced presently, and those in the development stages are included. (U.S.A.)

A Very-Wide-Band Balun Transformer for VHF and UHF, T. R. O'Meara and R. L. Sydnor. "Proc. IRE." November 1958. 13 pp. A transformer is described which may be used as a phase inverter, a differential transformer, or as a balun transformer. Practical models have been built which operate over more than two decades of frequency range with bandwidths appoaching 1 kmc. (U. S. A.)

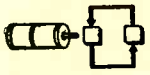
COMPUTERS

One-Cycle Shift Register, A. Ya Artukhin and V. Z. Khanin. "Avo i Tel." Oct. 1958. 11 pp. The analysis of the work of the simplest magnetic shift register circuit, its approximate calculation, the experimental designing data including the use of one core per sign are given. The influence of the length of the shift impulse on the register operation is discussed. (U. S. S. R.)

The Physical Realization of an Electronic Digital Computer Input . . . and Output, Andrew D. Booth. "El. Eng." Oct. 1958. 5 pp. The input-output equipment associated with the APEXC and M.2 computers are described and it is shown how relatively simple electromechanical devices enable high speeds of punching and reading of paper tapes to be attained. (England.)

Control Apparatus for a Serial Drum Memory, D. S. Kamat. "El. Eng." Nov. 1958. 6 pp. This article describes an apparatus that has been developed and used successfully for obtaining design data for a faster track switching device for a serial drum memory. It gives circuit and performance details of the gates, triggers, switches and other components that have been developed. The apparatus is intended for further use for study of other computer functions. (England.)

End-Fired Memory Uses Ferrite Plates, V. L. Newhouse et al. "El." October 10, 1958. 4 pp. Magnetic flux is induced around holes in ferrite plates to store and switch digital information. (U. S. A.)



CONTROLS

On Existence of a Cycle Beyond Absolute Stability Conditions of a Three-Dimensional System, B. V. Shirokorad. "Avto i Tel." Oct. 1958. 15 pp. Beyond absolute stability conditions (under Lurje—Letov (1)) of a closed-loop system with neutral object and regulator having non-linear velocity of controls resetting there always exists a non-trivial (periodical, in particular) stable regime. Physical interpretations of the system are given. (U. S. S. R.)

International ELECTRONIC SOURCES

Determination of Periodic Behaviour of Automatic Control Systems Having Non-Linear Part with Piece-Linear Characteristic, L. A. Gusev. "Avto i Tel." Oct. 1958. 14 pp. The paper deals with determination of periodic behaviour of control systems having an arbitrary piece-linear characteristic. The said periodic behaviour is determined as a complete Fourier series without neglecting harmonics. The problem is reduced to solving simultaneous transcendental equations that determine motion time in each part of the non-linear characteristic. Some problems of using computers to solve period equations are considered. (U. S. S. R.)

Logarithmic Method of Plotting a Real Frequency Response of Automatic Control System, V. A. Atsukovsky. "Avto i Tel." Nov. 1958. 4 pp. Graphic method of plotting real frequency response of a control system is proposed. The method is not cumbersome and permits to find real roots of any order linear algebraic equations. (U. S. S. R.)

About Reservation Units Number, V. G. Druzhinin. "Avto i Tel." Nov. 1958. 4 pp. The problem of finding optimal number of reservation units in automatic control system is considered. (U. S. S. R.)

About Equivalency of Pulse and Continuous Control Systems, V. A. Rubtsov. "Avto i Tel." Oct. 1958. 8 pp. Insufficiency of generally used equivalency criterion of pulse and continuous control systems is proved. Sufficient conditions for equivalency of closed loop control systems are determined. (U. S. S. R.)

Probability of Element Injury of Automatic Control Systems, S. M. Kuznetsov. "Avto i Tel." Nov. 1958. 14 pp. Probable change of electric elements parameters of automatic control system when affected by random disturbances is analyzed. Resulted deviation of parameters due to complex disturbances is determined. Approximate equation describing injury probability and probable lifetime of elements at stationary disturbances is deduced. (U. S. S. R.)

Method of Operation of Electromechanical Analog-Multipliers, K. Zeilinger. "El. Rund." Sept. 1958. 2 pp. Electromechanical components with servo motors sometimes show advantages for the multiplication of two variable magnitudes. Method of operation and construction of these servomultipliers are described and their precision is discussed. (Germany.)

Magnetic Amplifiers for Process Control, Horace E. Darling. "El. Des." Oct. 29, 1958. 3 pp. A guide to the most useful magnetic amplifiers for industrial electronic applications. A discussion of these amplifiers, and a presentation of the four basic cores in general use—their advantages, their disadvantages, and their problems. (U. S. A.)

GENERAL

On Systems of Units for Electrical and Magnetic Quantities, L. B. Slopian. "Radiotek." Sept. 1958. 9 pp. The MKSA system of units which is widely used in radio engineering and electrical engineering is based on formulas which involve two major defects: 1) formulas expressing the Ampere and Coulomb Laws are written in a physically unjustifiable form; 2) certain other formulas contain the absolute velocity v rather than the ratio v/c. The first defect can easily be removed by replacing the MKSA system by the MKSC system; this is achieved by fixing the quantity ε_0 rather than the quantity μ_0. The elimination of the second defect requires a basic change in the units of all magnetic quantities and is hardly practicable. The basic scientific system of electromagnetic units must be regarded as the CGS (Gaussian) system. In radio engineering and electrical engineering it is desirable to use the MKSC system. (U. S. S. R.)

Pulse Servosystems Including Two Pulse Elements with Unequal Repetition Periods, Fan Chun-Wui. "Avto i Tel." Oct. 1958. 14 pp. Pulse servosystems including two pulse elements with unequal repetition periods are considered. Their equations and transfer functions are determined. Dependence of the system stability on inequality of pulse-repetition periods is analyzed. As to stability rate increasing, the condition $T_1 = T_2$ is proved to be not the best one for a general case. (U. S. S. R.)

Universal Pneumatic Multiplication-Division Unit and Device for Automatic Square Rooting, Yu. I. Ivlichev and E. M. Nadzhafov. "Avto i Tel." Nov. 1958. 13 pp. Block diagrams of a universal pneumatic multiplication-division unit and of a device for automatic square rooting are given. Equations describing operation of universal units are deduced. Accuracy of unit operation is evaluated. Experimental results are exposed. (U. S. S. R.)

A Versatile Stimulator, R. H. Kay, et al. "El. Eng." Oct. 1958. 4 pp. A versatile stimulator for neurophysiological research is described consisting of three basic units (England.)

Survey of World Nuclear Markets, T. H. H. Skeet. "El. Energy." Oct. 1958. 6 pp. The development of technique and manufacturing resources in the countries with a nuclear power industry is reviewed, and an assessment is made of prospects for the sale of equipment internally and abroad over a period of some 20 years. (England.)

Application of Mass-Spectrometry in Vacuum-Technology, H. Hintenberger and E. Dornenburg. "Vak. Tech." Sept. 1958. 10 pp. The aim of this article is to summarize the work done so far in this field and also to point to the possibilities of the new procedure which so far does not seem to have been utilized fully. (Germany.)

Automatic Input for Business Data-Processing Systems, K. R. Eldredge, et al. "Nach. Z." Aug. 1958. 5 pp. The numbers and symbols on the document are printed in magnetic ink in conventional form and size. Documents with suitable format arrangements can be fed directly to the computer input with the techniques described and machine reading can be accomplished at rates exceeding 5,000 characters per second. (Germany.)

Electron Gun Operates High-Speed Printer, Joseph T. McNaney. "El." Sept. 26, 1958. 4 pp. Electronic printer converts pulse-code data from shaped-beam crt into printed records on ordinary untreated paper at the rate of one million characters per minute. (U. S. A.)

The Space Environment — A Preliminary Study, R. A. DiTaranto and J. J. Lamb. "El. Mfg." Oct. 1958. 13 pp. Analysis of natural environments in space (above 75,000 ft.) as they affect future equipment design. Anticipated values are established for atmospheric composition, pressure, solar radiation, ozone, dissociated gases, aurorae, ionized gases, solid particles and the earth's magnetic field. (U. S. A.)

Video Microplanimeter Detects Bone Disease, Ottiwell W. Jones, III, et al. "El." Oct. 24, 1958. 3 pp. Electronic scanner using television flying-spot microscope measures tiny tissue areas of spongy human bone in locating common but difficult to diagnose disease. Densograin gives percentage of marrow in a differential area. (U. S. A.)

Techniques of Cooling Electronic Equipment, James P. Welsh. "El Mfg." Nov. 1958. 8 pp. This basic article on cooling theory and temperature measurement is the first of two to be presented. Included here are methods and techniques of temperature measurement and control. The second article will show practical methods for cooling specific electronic parts and systems. (U. S. A.)

Sputnik I's Last Days in Orbit, J. D. Kraus and E. E. Dreese. "Proc. IRE." Sept. 1958. 8 pp. Observations during the last days of Sputnik I's orbiting are presented. These observations were made at The Ohio State University Radio Observatory using a simple CW reflection technique. The data suggest that the breakup of an artificial satellite upon its reentry into the denser atmosphere is a complex phenomenon in which a sequential series of events may occur over a period of days. (U.S.A.)

Regenerative Divider Drives Precision Clock, D. P. Henderson. "El." Aug. 1, 1958. 3 pp. A precision crystal-controlled 1-MC source is converted to 1-KC clock power by two-factor and five-factor regenerative frequency dividers, cascaded to give division by 1,000. (U.S.A.)

Determining Arrival Time of Radioactive Fallout, Ross W. Farmer and Oscar Reiner, Jr. "El." Aug. 1, 1958. 3 pp. Standard electric automobile clock operates until fallout at levels greater than 2 milliroentgens per hour arrives. (U.S.A.)

On the Determination of the Electrodes Required to Produce a Given Electric Field Distribution Along a Prescribed Curve, Peter T. Kirstein. "Proc. IRE." 7 pp. October 1958. A method is derived for determining the potentials in a space-charge-free region, with given potentials and electric fields on a prescribed curve. (U.S.A.)

An Error-Correcting Encoder and Decoder of High Efficiency, J. H. Green, Jr. and R. L. SanSoucie. "Proc. IRE." October 1958. 4 pp. A report is given on a group effort which has demonstrated the applicability of regenerative shift register sequences to error-correcting codes. (U.S.A.)

Distribution of Leakage Flux Around a TWT-Focusing Magnet—A Graphic Analysis, M. S. Glass. "Proc. IRE." October 1958. 6 pp. Formulas and graphs are presented which describe the distribution of leakage flux around a tubular permanent magnet. The importance of this information derives from the fact that the external leakage flux from the magnets used for straight-field focusing of traveling wave tubes frequently interferes with the operation of other equipment in the vicinity. (U.S.A.)

ELF—A New Electroluminescent Display, E. A. Sack. "Proc. IRE." October 1958. 6 pp. The ELF screen is a new, flat electroluminescent display which combines very desirable brightness and halftone characteristics with flexible storage capabilities and high scanning speeds. There is no theoretical limitation on the area of the screen. (U.S.A.)

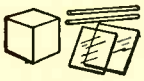
Electronic Organ Uses Neon Tone Generators, Richard H. Dorf. "El." August 29, 1958. 6 pp. Twelve neon tone generators mounted on six printed circuits supply 12 notes of the chromatic scale. Each tone generator has four pairs of neon tubes in series, each pair shunted by two series capacitors. With the signal taken from common point between capacitors, sufficient isolation exists to prevent feedback and spurious tones in output. Formant voicing system is provided in analog form. Switching circuits permit duplexing of voices on either manual. (U.S.A.)

Solid-State Panel Amplifies X-Rays, B. Kazan. "El." September 12, 1958. 4 pp. Only a single power supply is needed to initiate X-ray amplification by a thin panel containing photoconductive and electroluminescent phosphor materials. High contrast aids perception of details. Long persistance permits close-range viewing with X-rays off. (U.S.A.)

INFORMATION

Coder and Decoder in Pulse-Code Telemetering Systems, Ya. A. Kupershmidt. "Avto. i Tel." September 1958. 13 pp. The paper deals with a systematized survey of conversion of voltage and current into binary pulse code and the

method of conversion of pulse code into voltage and current. Various ways of conversion are compared as to their validity for pulse-code telemetering systems. Areas of using normal binary code, sign-changeable binary code and reflected one are pointed out. (U.S.S.R.)



MATERIALS

A Temperature Sensitive Ceramic Reactance Element, C. V. Ganapathy, et. al. "J. ITE." June 1958. 7 pp. This paper attempts to show that the new ceramic composition developed at the National Physical Laboratory, Radio Components Development Section, has properties which are very similar to thermistors and it can be described in almost identical terms except that, with these, the change is that of a capacitive reactance with temperature instead of a change of resistance with temperature. (India, in Engilsh.)

Ferrites and Their Applications in Microwave, J. Deutsch. "Nach. Z." Sept. 1958. 10 pp. The scientific basis of gyromagnetic resonance in ferrites and its applications are discussed. The principles and the design of reciprocal and non-reciprocal microwave circuit elements are explained. (Germany.)

Effect of Crystal Growth Variable on Electrical and Structural Properties of Germanium, F. D. Rosi. "RCA." Sept. 1958. 39 pp. (U. S. A.)

Gaseous Dielectric Materials — Applications and Test Methods, M. L. Manning and E. D. Padgett. "El. Mfg." Oct. 1958. 5 pp. The range of equipment applications for gaseous (dry) dielectrics, including transformers, airborne electronics and radar, has been widened owing to the development of new electronegative gases with increased breakdown voltage characteristics and the availability of improved test cells and test methods. (U. S. A.)

International Developments in Insulation Standards, J. F. Dexter. "El. Mfg." Oct. 1958. 4 pp. Activities of the Technical Committee on Electrical Insulation at 1958 International Electrotechnical Commission meetings highlight new test procedures, including measurement of dielectric constant, dielectric loss, and thermal stability of magnet wire. European acceptance of a 120 C (Class E) category was emphasized. (U. S. A.)

Plastics in Synchro Housing Design and Production, Alvin S. Weiss. "El. Mfg." Nov. 1958. 5 pp. Case history of the development of a cast epoxy plastics-housed synchro. Included are the advantages of such a design, the materials used and the method of manufacture. (U. S. A.)

Transfluxor Controlled Electroluminescent Display Panels, J. A. Rajchman, et al. "Proc. IRE." Nov. 1958. 17 pp. Two important developments of recent years, the transfluxor and the electroluminescent cell, have been united to bring about a major step forward in the evolution of solid-state display devices of the type that are actuated by electrical signals rather than by X-rays or light. (U. S. A.)

Materials Used in Radio and Electronic Engineering, 5. Magnetic Materials, "J. BIRE." August 1958. 16 pp. (England.)

Silicone Insulation Adds Reliability, D. F. Christensen and C. G. Currin. "El. Des." September 3, 1958. 3 pp. Components and materials that retain their initial characteristics over wide ranges in temperature and other environmental conditions are necessary to assure system reliability. Silicones, discussed in this article, fulfill many of these requirements. (U.S.A.)

Plastics for the Electronics Industry, Ralph L. Mondano. "El. Des." September 3, 1958. 5 pp. Basic economics have forced industry and government to unite in many joint study programs to find suitable materials to meet environmental conditions such as temperature, speed, shock, radiation, etc. The electronics industry is one such industry, and its material problems are many. This article concentrates on plastics in the electronics industry. (U.S.A.)

Plastics as Microwave Dielectrics, William R. Cuming. "El. Des." September 3, 1958. 4 pp. Filling in the gap between extremes is a whole series of materials of adjusted electrical properties useful to the microwave design engineer. A selection is presented in this article. (U.S.A.)

MEASURE & TESTING

On the Theory of Stroboscopic Oscillographing, V. A. Vol. "Radiotek." Aug. 1958. 8 pp. The paper makes an attempt to delineate the theoretical bases of the stroboscopic method of oscillographing. On the basis of the derived relationships, computations are made for the frequency responses of various types of stroboscopic oscilloscopes. (U. S. S. R.)

Computation of Complex Pulse Systems from a Specified Transient Response, S. N. Krize. "Radiotek." Sept. 1958. 3 pp. The paper presents a method of computing the parameters of pulse systems from the transient response; the method assures a maximum ratio between the steady-state transfer coefficient and the rise time of the leading edge of the pulse. (U. S. S. R.)

Phase-Shift at Microwave Frequencies. Measurements on Waveguide Components, M. H. N. Potok. "E. & R. Eng." Oct. 1958. 5 pp. Phase-shift through waveguide arbitrary lossless networks can be measured by the application of the nodal shift method. Measurements on filters in the 4-kMc/s range agree well with calculations. (England.)

A Drip Rate Recorder for Intravenous Solutions, A. W. Melville. "El Eng." Oct. 1958. 2 pp. An instrument is described which will record continuously the repetition rate of recurring pulses with the range of 5 to 80 pulses per minute. The response time for a sudden rate change corresponds to 3 pulse periods irrespective of rate and it will therefore indicate a changing rate with much greater accuracy than a conventional resistance capacitance integrator. The calibration is satisfactorily linear. (England.)

An Amplitude/Frequency Response Display Using a Ratio Method, Part 2, H. L. Mansford. "El. Eng." October 1958. 3 pp. (England.)

An Amplifier-Detector for Schering Bridge Measurements at Power Frequency, E. F. Hasler. "El. Energy." Oct. 1958. 6 pp. The requirements for this instrument, which include an automatic equivalent of the Wagner earth, are discussed in relation to published designs. Details are presented of the circuit and performance of the tuned detector produced to meet these requirements. in which control of gain is automatic over the bridge unbalance voltage range of 34V to 104V. (England.)

The Differential Transformer as a Sensitive Measuring Device, J. H. Heath. "El. Eng." Nov. 1958. 4 pp. In the measurement of physical quantities such as strain acceleration etc., it is necessary to convert the mechanical movement into an electrical signal in order that use can be made of electronic amplifiers. This article is the result of a study made into a very sensitive measuring apparatus using a differential transducer as a head and in which phase changes associated with the transducer output voltages have little effect upon the measuring system. (England.)

On Measuring Frequency-Level Fluctuations, Ernst Belger. "Rundfunk." August 1958. 2 pp. The most important proposals as yet known for the measurement of frequency level fluctuations are discussed. It is shown that the peak value measurement offers considerable practical advantages compared with root-mean-square measurement. A graph is given showing the subjective evaluation of fluctuations as far as the frequency is concerned. This graph is a compromise between several proposals. (Germany.)

New Measuring Equipment For Teleprinter Installations, G. Keller and D. V. Sanden. "Nach. Z." Aug. 1958. 6 pp. A distortionless signal generator operates without contacts. A test transmitter for use in exchanges transmits automatically various test texts. A signal distorter transmits irregularly distorted signals. (Germany.)

A Contribution for Ascertaining Errors in the Measurement of the Moment of Torsion and Power by Resistive Strain Gauges, G. Thiele. "El. Rund." Aug. 1958. 5 pp. The method of resistive strain gauge has been proved for equipment to supervise bigger motors e. a. because of its high precision and clarity. Error possibilities in such an equipment, systematical as well as casual, are dealt with and their influence on overall precision is discussed. (Germany.)

Transistor Receivers for Measuring Purposes, H. J. Albrecht. "El. Rund." Sept. 1958. 2 pp. This paper deals with aspects to be considered in the design of transistor receivers for measuring purposes. Problems of stabilization and temperature compensation, respectively, are discussed for all stages, i. e.: rf amplifier, rectifier, and final stage. (Germany.)

Modular Units for Automatic Test Systems, Harold B. Rose. "Auto. Con." Oct. 1958. 5 pp. A major goal of development programs is creation of systems containing enough flexibility to permit their use on wide variety of missiles with only a minimum of modification. (U. S. A.)

Measuring Microwave Interference, Part 1. Robert Saul. "El. Des." Oct. 15, 1958. 4 pp. Here is a procedure for measuring interference in the 1000 mc to 10,000 mc range. It will help determine the susceptibility of microwave devices to this interference. (U. S. A.)

Electrical Breakdown of Microwave Components, G. K. Hart et. al. "El. Des." Oct. 15, 1958. 4 pp. (U. S. A.)

Waveguide Coils Make Compact Delay Lines, R. R. Palmisano and A. Sherman. "El." Oct. 24, 1958. 2 pp. Production testing of microwave electronic equipment is simplified with compact delay line made from a number of tightly wound waveguide coils. (U. S. A.)

Designing for Industrial Electronic Equipment Reliability, W. H. Lesser. "El. Des." Oct. 29, 1958. 4 pp. The author shows how, with a division of responsibility, all parts of an organization can contribute to reliable equipment performance. This approach has been tested and found to work admirably. (U. S. A.)

Radio Noise Measurement, Howard J. Tyzzer. "El. Mfg." Nov. 1958. 3 pp. Conducted and radiated interference measurements, instrument characteristics and response standards are reported for a series of radio noise meters. (U. S. A.)

RADAR, NAVIGATION

Transient Process and Steady State in Automatic Range Scope, F. M. Kilin. "Avto i Tel." Oct. 1958. 16 pp. Transient process and steady state in automatic range scope

are considered, provided operation specific peculiarities are taken into account. The peculiarities mentioned include discontinuous processes in some range scope parts, variability of circuit parameters that change in accordance with received pulses. (U. S. S. R.)

Decca Doppler and Airborne Navigation, T. Gray and M. J. Moran. "Brit. C. & E." Oct. 1958. 8 pp. This article presents a qualitative description of the Doppler element of the Decca Integrated Airborne Navigation System (D.I.A.N.) A brief survey of the entry of Decca into the airborne civil Doppler field and the case for pictorial presentation are given. The general principles which govern the design of a Doppler sensor are discussed followed by a detailed technical description of the Decca Doppler sensor, indicating the technical considerations involved in selecting the various parameters. Finally, the D.I.A.N. concept is introduced providing details of the computer serving the Flight Log and indicating future developments possible with the system. (England.)

Further Progress In The Work Relating To Bandwidth Compression For Radar PPI Pictures, H. Meinke and A. Rihaczek. "Nach. Z." Aug. 1958. 7 pp. A method for the compression of the bandwidth required for the transmission of radar PPI pictures is described. The scanning velocity in a line store for the radar signals is varied in such a way that short pulses and short interpulse periods are expanded at the expense of long picture elements. (Germany.)

How To Select Airborne Electronic Equipment Coolants, Richard E. Shafer and Thomas J. Herron. "El. Des." Oct. 1, 1958. 2 pp. Here are a number of useful curves that can help the design engineer to select the proper cooling system for airborne electronic equipment. Examples of how to use the curves are shown with each curve. (U. S. A.)

Incoherent Scattering of Radio Waves by Free Electrons with Applications to Space Exploration by Radar, W. E. Gordon. "Proc. IRE." Nov. 1958. 6 pp. Extremely weak, and hence previously unconsidered, incoherent scattering of radio waves by free electrons in and above the earth's ionosphere can, in fact, produce a detectable radar echo if a powerful enough radar is used. This could probe the earth's surroundings out to a distance of 4000 miles, exploring several important phenomena such as electron density and temperature at various heights, streams of charged particles coming from outer space, and the ring current (if it exists) around the earth. (U. S. A.)

SEMICONDUCTORS

A Four-Pole Analysis for Transistors, B. J. Alcock. "El. Eng." Oct. 1958. 3 pp. An algebraically convenient analysis for four pole networks is presented, based upon determinant techniques; it is applied to transistor circuits and introduces two new comprehensive parameters for the transistor. (England.)

An Electrical Multiplier Utilizing the Hall Effect in Indium Arsenide, R. P. Chasmar. "El. Eng." Nov. 1958. 4 pp. The advantages pertaining to the use of semi-conducting indium arsenide as the basis of an electrical multiplier are discussed. A particular merit is the low value of the temperature coefficient of the Hall constant (0.06%°C between —40°C and +100°C. The design of Hall plates is considered and certain figures of merit are proposed. (England.)

The Effect of a Magnetic Field on Point-Contact Transistors, K. K. Bose. "El. Eng." Nov. 1958. 3 pp. When a magnetic field is applied to a point-contact transistor at right-angles to the plane of the emitter and collector, interesting observations have been made of the alterations of all the characteristics of the transistor, both static and dynamic. The changes which take place in the operational characteristics of the transistor are positive or negative with respect to the normal values, according to the polarity of the applied field. (England.)

Transistor Trends and Developments, H. S. Blanks. "Proc. AIRE." July 1958. 4 pp. Transistor production in the U. S. A. is expected to reach 60 million units this year, with 40% being used in the entertainment field. Present day transistors operate at up to 85 watts and 500 mc/s, but new types such as the mesa and spacistor are expected to raise these limits. (Australia.)

Application of Negative Temperature Coefficient Resistors to Temperature Stabilization of Transistor Circuits, Colin Wright. "Proc. AIRE." July 1958. 3 pp. A practical two-step method of stabilizing transistor circuits with negative temperature coefficient resistors is described. Firstly the required characteristics of the temperature sensitive circuit are determined. Secondly the circuit is designed to have approximately the established characteristics. (Australia.)

Transistor Monostable Multivibrator for use with Counting Registers, R. E. Atchison. "Proc. AIRE." July 1958. 4 pp. The use of monostable multivibrators using transistors for the operation of counting relays is considered. A suitable design is given in which the pulse width can be readily controlled and is relatively independent of variations of transistor parameters. (Australia.)

Power Transistors, N. H. Fletcher. "Proc. AIRE." July 1958. 5 pp. The factors which limit the power handling capacity of ordinary transistors are examined and it is shown how these limitations can be overcome. By making use of the geometrical freedom afforded by the alloy junction process, transistors can be constructed to handle powers in the kilowatt range. (Australia.)

Techniques of Transistor Production, R. N. Wheaton. "Proc. AIRE." July 1958. 12 pp. Requirements of a transistor suitable for high-frequency operation are discussed and fabrication methods reviewed. Alloying and diffusion techniques, destined to play an important role in future transistor production, are treated in detail. Several devices made by these techniques are described and their performances indicated. (Australia.)

An Oscilloscope Accessory for the Display of Transistor Characteristic Curves, R. E. Aitchison. "Proc. AIRE." July 1958. 4 pp. A method is described for the display of transistor characteristic curves on an oscilloscope. A full wave rectified voltage is applied between the collector and emitter. A constant current is supplied to the base, the value alternating between two values in synchronism with the two phases of the collector supply, one for each half of the rectified sine wave. (Australia.)

Simplified Transistor Characteristic Measurement, J. R. Goldthorp. "Proc. AIRE." July 1958. 3 pp. This paper examines the relative importance of characteristics and parameters to be measured for reliable evaluation of a transistor and shows not only how these may be measured but the manner in which the measuring circuits may be correlated to yield simple practical designs to cater for low power transistors with collector dissipations of the 25 m W order, and power transistors up to 100W DC input. (Australia.)

Analogous Transistor System Design and Nodal Methods of Construction with Applications to Research Equipment and Prototype Evaluation, R. F. Treharne. "Proc. AIRE." July 1958. 29 pp. Analogous design and nodal methods of construction allow valve engineers to take up the design of transistor circuits quickly and to employ methods of construction which are quick and economical. The best man to apply transistors for a given purpose is a valve expert in that field. A block diagram which is physically realizable in valves is usually physically realizable using transistors. Nevertheless circuits which are quite unrelated to valve circuitry will eventually be used where appropriate. (Australia.)

Design Curves for Stabilizing Transistors With Thermistors, T. R. Nisbet. "El. Des." Sept. 17, 1958. 4 pp. A handy means of rapidly selecting thermistor values for transistor temperature stabilization. (U. S. A.)

TELEVISION

A Generator Of Triangular Video Pulses, Iu. N. Prozorovskii. "Radiotek," Aug. 1958. 3 pp. A method is proposed for generating triangular video pulses using a two-terminal shaping network. One such network treated as an example is a section of transmission line which delays the signal by an amount less than the duration of the leading edge of the voltage or current pulse applied to the generator. The paper describes the design of a generator which produces triangular video pulses with a duration of 3 to 19 millimicrosec (at a level of 0.5). (U. S. S. R.)

Group-Delay Correction for Residual-Sideband Transmission in Television, Herbert Hopf "Rundfunk." Aug. 1958. 4 pp. The article gives a review of the method at present used in the German Federal Republic for correcting the delay distortion in television transmitters. (Germany.)

Experiments Concerning the Adaptation of the NTSC Colour-TV System To The European 625-Line Standards, J. Davidse. "Nach Z." Sept. 1958. 7 pp. The paper deals with the problems arising from the adaptation of the NTSC-system to the European 625-line standards as far as the frequency of the chrominance carrier, the choice of the colour information and the bandwidth of these signals are concerned. (Germany.)

The Physical Basis Of The Appraisal Of Picture Quality, Werner Kroebel. "Rundfunk." Oct. 1958. 12 pp. The comprehensive paper shows that the subjective appraisal of quality has a physical basis. It lies in the mass of the recognisable picture detail which a reproducing or transmitting system is capable of resolving. The subjective picture quality may therefore be replaced by a parameter which may be indicated physically. (Germany.)

A Transistor Video Amplifier With Keyed Clamping, Blanking and Adjustable Black Level Setting, Hans Anders. "Rundfunk." October 1958. 10 pp. The paper describes a transistor video amplifier which may be used as main amplifier in television cameras and film scanners when a reference level exists during the line fly-back. It begins with an outline of the problems arising in the design of transistor broadband amplifiers and goes on to discuss the particularities of the d. c. restauration in a transistor stage and describes the circuit used. (Germany.)

$$\Delta G = \Delta G/en_i\mu_p\mathcal{L}$$

THEORY

On The Kotel'nikov Theorem, A. A. Kharkevich. "Radiotek" Aug. 1958. 8 pp. The paper is a survey of several of the newest papers written on the Kotel'nikov Theorem. In summarizing, the author states that our contemporary understanding of the sense of the Kotel'nikov Theorem has substantially changed from the initial one. It is now applied to random processes with an unbounded spectrum, whereas initially it was formulated for determinate functions with regorously

bounded spectra; it is treated as an approximate (and not accurate) postulate which permits us to do the following: 1) to derive an approximate expression for the process in the form of a series with delay functions, or 2) to derive an approximate estimate for the number of samplings of a random vector on the basis of the specified accuracy in determining E-entropy. (U.S.S.R.)

On The Problem Of Applying The Kotel' nikov Theorem To Time Functions With Unbounded Spectra, I. T. Turbovich. "Radiotek," Aug. 1958. 2 pp. The paper studies the problem of a practical formulation of an approximate Kotel'nikov series for time functions with unbounded spectra. (U.S.S.R.)

TRANSMISSION

Certain Problems Of Synthesizing Nonuniform Transmission Lines, A. L. Fel'dshtein. "Radiotek," Aug. 1958. 11 pp. Based on relationships derived in a first approximation, certain types of nonuniform transmission lines are synthesized. Two types of examples are studied: 1) syntheses according to a specified frequency response, and 2) synthesis according to a specified equivalent LCR circuit. (U.S.S.R.)

Certain Special Features of Coaxial Irised Waveguides, G. I. Zhileiko. "Radiotek," Aug. 1958. 6 pp. The paper studies functions which determine the magnitude of the power flux in coaxial irised waveguides. A comparison is made between various types of coaxial waveguides from the point of view of the magnitude of the power flux. (U.S.S.R.)

Surface Waves Of The E-Type In A Circular Waveguide, L. N. Loshakov, "Radiotek," Sept. 1958. 5 pp. The paper studies axially symmetrical surface waves of the type E which can be propagated in a circular waveguide whose inside surface is covered with a dielectric layer. (U. S. S. R.)

The Effect Of Small Deformations Of The Cross-Section On The Opeating Mode Of A Waveguide, V. Ia. Smorgonskii "Radiotek," Sept. 1958. 3 pp. (U.S.S.R.)

Waveguide Manufacturing Techniques, T. Beardow. "Brit. C. & E." October 1958. 7 pp. (England.)

Measurement of Phase Difference Through a Long Power Transmission Line, G. Zito. "Alta. Freq." June-August 1958. 24 pp. (Italy.)

On the Evaluation of the Transmission Quality of Frequency Modulation Multichannel Telephone Radio Links, I. Medici. "Alta. Freq." June-August 1958. 17 pp. (Italy.)

TUBES

Some Novel Circuits Employing Cold-Cathode Tubes, Part I, R. S. Sidorowica. "El. Eng." Nov. 1958. 6 pp. The circuits described are based on three types of cold-cathode tube: (1) a stable subminiature diode, type XC12, (2) a subminiature triode, type XC 18, having a current rating of 1.0mA, and (3) a miniature 7.5mA triode, type XC23. (England.)

The Constant Current Magnetron 7091, W. Schmidt. "El. Rund." September 1958. 6 pp. The pesent article deals with the constant current magnetron for 2400 mc/s with an output of 2500 W. Preferably this magnetron is intended for the use in microwave generators for dielectric heating of provisions and industrial products. (Germany.)

PATENTS

Complete copies of the selected patents described below may be obtained for $.25 each from the Commissioner of Patents, Washington 25, D. C.

Demodulator, #2,846,578. Inv. S. Tarantur. Assigned Admiral Corporation. Issued August 5, 1958. The plate of a first triode is directly connected to the cathode of a second triode. A signal to be synchronously detected is fed to the grid of the second triode, while a continuous wave of a frequency equal to the carrier of the signal and of a predetermined phase relative to the carrier wave is applied to the grid of the first triode. The first triode becomes conductive or nonconductive in response to the polarity of the applied continuous wave.

Electric Oscillator Circuit, #2,846,579. Inv. E. Wolfendale. Assigned North American Philips Company, Inc. Issued August 5, 1958. A first series-resonant circuit is connected to the collector electrode of a transistor having an emitter-collector amplification factor of less than unity. A second series-resonant circuit is coupled to the base of this transistor. The two inductors of the resonant circuits are inductively coupled to provide regenerative feedback to the base electrode.

Pulse Gap Detector, #2,847,565. Inv. G. L. Clapper. Assigned International Business Machines Corporation. Issued August 12, 1958. A capacitor is charged through a resistor and discharged recurrently in response to input pulses. A flip-flop circuit provides an output signal when, and only when, the capacitor voltage exceeds a predetermined level when the interval between successive discharging pulses exceeds a predetermined time interval. The output signal affects the capacitor-charging voltage.

Relaxation Oscillator Circuit, #2,847,569. Inv. M. B. Finkelstein. Assigned Radio Corporation of America. Issued August 12, 1958. A transformer is connected for regenerative feedback between the collector and base of a transistor to provide a stable state of low current conduction with zero emitter current and a stable state of high current conduction with constant emitter current.

Direct View Electrical Storage Tube and Erasing System Therefor, #32,847,610. Inv. H. Borkan. Assigned Radio Corporation of America. Issued August 12, 1958. An electron-permeable screen is positioned closely to the fluorescent screen for storing a desired electrical charge pattern. A plurality of electron permeable coplanar conductive units, insulated from each other, is in contact with one surface of the permeable screen. Each unit is individually capable of controlling the electron flow.

Color - Correction System, #2,848,528. Inv. H. J. Woll. Assigned Radio Corporation of America. Issued August 19, 1958. A brightness signal and a color saturation signal are developed, both signals being derived from all color component signals. A signal representative of the black of the subject to be displayed is produced in response to the brightness and saturation signals.

Data Processor, #2,848,532. Inv. R. L. Weida. Assigned Underwood Corporation. Issued August 19, 1958. The signals of a code group are inspected to determine whether the code group belongs to the disallowed group included at the beginning and at the end of a sequence of code groups. Separate indicating means for the code groups, designed as comparators, indicating the beginning and the end of a sequence are provided, both indicators operating a common flip-flow.

Electronic Ring Circuit, #2,848,608. Inv. R. E. Nienburg. Assigned International Business Machines Corporation. Issued August 19, 1958. Each ring-circuit stage includes a flip-flop and a passive network having two parallel branches. One branch is coupled to a first flip-flop input circuit, the other branch to an input circuit of the adjacent succeeding flip-flop. The input pulses are coupled to all passive networks and so are the output pulses.

Phase Stabilization of R. F. Amplifiers and Oscillator Circuits, #2,848,611. Inv. R. J. Bousek. Assigned Collins Radio Corporation. Issued August 19, 1958. A frequency-stabilizing element is connected to one electrode of a phase-shift controlled oscillator. A first resonant circuit is contained in the tube output and a second dummy resonant circuit of the same resonant frequency is inductively coupled to the first resonant circuit, the coupling being variable, whereby the reflective impedance is varied. A capacitive shield between the two resonant circuits shields them capacitively while not interfering with the magnetic coupling.

Transistor Ring Counter, #2,848,628. Inv. E. R. Altshul. Assigned Hazeltine Research, Inc. Issued August 19, 1958. N cascade-coupled transistor counter stages can be simultaneously conditioned to their nonindicating state. An astable pulse generator is operatively coupled between the last and the first stages and effective to trigger a succeeding stage into an indicating stage when a preceding stage is triggered into its nonindicating state, thereby to develop at the output circuit periodic output pulses having a frequency equal to 1/N of the control pulses.

Anode Structure, #2,848,636. Inv. R. L. Norton. Assigned Penta Laboratories, Inc. Issued August 19, 1958. This is a thin-walled extended-area anode for a triode. It comprises a metallic endless corrugated strip and a wire mesh secured to and in electrical contact with the innermost points of the corrugations in the strip.

Counting Circuit Using Multiple Position Beam Switching Tubes, #2,848,646. Inv. S. Fan and R. A. Cola. Assigned Burroughs Corporation. Issued August 19, 1958. The cathode and anode of a separate electron tube are connected in series with an electrode of each beam switching tube utilizing crossed electrostatic and magnetic fields. A pulse shaping network connects one target electrode of each beam switching tube to the input of one electron tube, which electron tube is effective to momentarily change the electrostatic field intensity of the successive beam switching tube.

Transistor Gating Circuit, #2,848,653. Inv. L. W. Hussey. Assigned Bell Telephone Laboratories, Inc. Issued August 19, 1958. The current-regulating switch comprises two transistors of opposite conductivity type connected in series. A switching circuit supplies control potentials to the bases of the two transistors. A gas tube is connected in tandem with one collector whereby a regulated current is supplied to the gas tube in response to the switching operation.

Microwave Switching Circuit, #2,848,688. Inv. J. T. Frazer. Assigned General Precision Laboratory Incorporated. Issued August 19, 1958. Two collinear waveguide short slot hybrid junctions are positioned in axial alignment. Each junction includes a coupling space. A ferrite element is mounted in the coupling space of one junction and a magnetic field is applied to the element, the magnetic field extending perpendicular to the narrow waveguide walls.

Tuning System for Television Receivers, #2,849,529. Inv. L. W. Parker. Issued August 26, 1958. The audio signal and the i.f. picture carrier of a received T. V. signal are both applied to the grid of a tube for amplification. Sound producing means are coupled to the tube output. A frequency-selective tuning indicator is also coupled to the tube, the frequency-selective indicator being responsive to the magnitude of the amplified i.f. picture carrier.

International ELECTRONIC SOURCES

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.

Development of Sandwich Construction Inorganic Radomes, Part 1, T. M. Giles, N. Tallan, P. S. Hessinger and J. O. Everhart, Ohio State Univ. Research Foundation for Wright ADC. Aug. 1957. 59 pages. (PB 131408, OTS) $1.50. The aim of this project was development of a ceramic sandwich radome which would resist high operational skin temperatures of future aircraft and missiles. High wollastonite materials were used and several promising bodies were obtained. Two techniques, mechanical and fire bloating, were used to produce low-density ceramic core materials. The mechanical process yielded rather reproducible results with very uniform pores and pore distribution in the foam. Small conical shapes were formed and several finished cores were obtained. The process seemed promising for forming moderate-sized radome shapes. The fire-bloating process was conducted only on very small-sized samples. It appeared, however, that it might be useful in producing the ceramic equivalent of a foamed-in-place core. Very high strength for a given foam density was obtained with this technique.

Hydrostatic Pressing of Alumina Radomes, W. D. Anderson, Gladding, McBean & Co. for Wright ADC. Nov. 1957. 21 pages. (PB 131565, OTS) 75 cents. This project was concerned with development of an alumina body containing more than 93 percent alumina fabricated by hydrostatic pressing into a half-wave solid-wall ceramic radome approximately six inches in diameter and 18 inches high. Techniques were devised for molding, pressing, machining, and firing a radome shape practical for ultimate production. Equipment and handling techniques necessary to process the radome at the various stages of production also were developed. The method was shown to be practical, and perhaps could be used for fabrication of larger shapes.

Project Vanguard Report No. 23: Minitrack Report No. 3, Receiver System, V. R. Simas and C. A. Bartholomew, Naval Research Laboratory. Dec. 1957. 31 pages. (PB 131390, OTS) $1. The Minitrack system of radio angle tracking operates on the interferometer principle, providing the direction cosines of a satellite's position vector with respect to the tracking stations at any given instant during a transit. The receiving equipment amplifies signals obtained from the satellite's 108-Mc signal source via interferometer antenna pairs. A unique double-local-oscillator principle is used to translate this intelligence to a frequency adaptable to phase measurement. This report describes the five units comprising a single rf channel. They are a pair of front ends, a signal adder, a combined i-f amplifier, a special local oscillator, and a calibration source.

Project Vanguard Report No. 24: Minitrack Report No. 4, The Satellite Telemetry Receiver System, V. R. Simas, Naval Research Laboratory. Jan. 1958. 17 pages. (PB 131396, OTS) 50 cents. Scientific information from the Vanguard artificial earth satellite is transmitted to telemetry systems described in this volume. The telemetry receiver, one at each Minitrack tracking station, amplifies the received signals and converts the information to a form which permits demodulation and subsequent analysis. The receiver is a double-conversion type with crystal-controlled local oscillations. Three pre-detection bandwidths are available. These provide a means of increasing the output signal-to-noise ratio for experiments in which the information bandwidth is less than the maximum. Grounded-grid preamplifier circuitry is used to achieve stability and a low noise figure.

Upper Atmosphere Research Report No. XXXII: History of the Upper-Air Rocket-Research Program at the Naval Research Laboratory, 1946-57, J. W. Townsend, Jr., H. Friedman and R. Tousey, Naval Research Laboratory. Feb. 1958. 52 pages. (PB 131521, OTS) $1.50. This illustrated volume reviews NRL's program of basic research in the physics of the upper atmosphere (above 20 miles) by means of high-altitude sounding rockets. From 1946, when the continuing program began, to 1957, 104 rockets carrying upper-air research experiments were flown and instrumented. Notable initial measurements of high-altitude physical parameters were collected and a number of practical applications were developed during the work. The report includes discussions of basic research in pressure, temperature, density, and winds; gas and ion composition; solar radiation; electron density and other ionosphere parameters; day and night airglow; cosmic radiation; and auroral particles, meteors, magnetic field of the earth, earth photography, and conductivity. A bibliography lists some 300 scientific papers which appeared in the open literature during the period.

Terminal System Effectiveness as a Function of the Method Used by Controllers to Obtain Altitude Information, L. M. Schipper, J. S. Kidd, M. Shelly and A. F. Smode, Ohio State Univ. for Wright ADC. June 1957. 26 pages. (PB 131605, OTS) 75 cents. Experienced controllers were required to control simulated aircraft from entry points 50 miles out to the GCA gate. Variables were the presence or absence of a continuous visual display of altitude on a 17 by 12-inch cathode ray tube, and mean aircraft entry rate. Intervals between aircraft entry were random, but averaged 90 seconds and 50 seconds. Principal findings were that the presence of a continuous altitude display did not materially affect system performance, except that the controller made significantly fewer requests for altitude information from the pilot. All measures of system performance were affected by the entry rate variable. It was concluded that an auxiliary continuous display of altitude would not improve system performance, except when communication availability is low or when monitoring or supervision is desired. The research was part of a continuing study of human engineering aspects of radar air traffic control.

An Electronic Target Simulator for Use with Operational Radar Surveillance Systems, G. A. Harter and P. Gain, Ohio State Univ. for Wright ADC. May 1957. 39 pages. (PB 131604, OTS) $1. An operational target simulation (OTS) system for simulating targets and mixing them with "live" targets on operational plan position indicator-type radar displays is described. The system employs target generating procedures used successfully in earlier OSU radar system research. It makes possible a relatively simple and highly reliable method of placing simulated targets on radar displays used in various operational units. Each target can be controlled independently to simulate the flight of aircraft under control from a ground station. Three designs for the OTS are discussed. All contain an electronic target generator and additional circuitry required to convert the rectangular coordinate output signals of the target generators to polar-coordinate signals compatible with the video-type intelligence required for operational radar displays. The designs differ in the method used for transformation of this information from rectangular to polar form.

Development of a Stable High Sensitivity Multiplier Phototube, D. A. Bly, Radio Corporation of America for Wright ADC. Oct. 1957. 33 pages. (PB 131561, OTS) $1. The multiplier phototube developed during this project is said to have many individual features and a combination of characteristics which are new in a production-type phototube. It exhibited cathode sensitivity over 100 μa/1, stable output over four hours of continuous operation, rugged anti-vibration construction, moderate gain, low dark current, high collection efficiency, and uniformity over large areas of the cathode. The tube is particularly recommended for detection of a weak signal against a high background.

A Study of the Effects Produced by Asymmetries in the Two-Helix Backward-Wave Amplifier, W. H. Watson, Univ. of Calif. for Wright ADC. July 1957. 50 pages. (PB 131412, OTS) $1.25. Unusual gains had been measured in two-helix traveling-wave tubes operated with one helix on the fundamental and the other helix on the minus-one space harmonic. Measurements and calculations were made to determine whether asymmetries in the tube could be a cause of this apparent coupling between the two space harmonics. It was concluded that the gains were caused by a small misalignment of the electron beam and the helix. The effect of misalignment could become even more important for tubes with helices smaller in diameter than one-half inch, it was suggested. This might prove to be an important limitation for tubes designed to operate through the cross-over point.

Integrated Instruments: A Roll and Turn Indicator, H. E. Bamford, Jr. and M. L. Ritchie, Univ. of Illinois for Wright ADC. May 1957. 23 pages. (PB 131439, OTS) 75 cents. This study was one of a series devoted to development of effective standby instrumentation for directional control of an aircraft after failure of the attitude indicator. Performance of pilots in simulated flight demonstrated an improvement in direction control when an integrated roll and turn indicator was substituted for the standard turn indicator. This finding is discussed in relation to a simplified model of the experimental man-machine system. It was concluded that the command effectiveness of a feedback display is increased by the distinct indication of control-induced components of the system output, and by the anticipatory indication of the feedback signal. Interpretability of an instrument display is increased by the distinct indication of each aspect of the condition displayed.

Some Aspects of Crystal Performance in a New Microwave Receiver, G. E. Hambleton, Evans Signal Laboratory for Signal Corps Engineering Laboratories. June 1956. 38 pages. (PB 131335, OTS) $1. A new design of microwave receiver is described whose chief feature is the elimination of the l-f noise generated by the input tubes of a video amplifier at low modulation frequencies. With the same modulation frequency demands, which are essentially aimed at pulse fidelity in microwave pulse reception, the new receiver was expected to give a 12 db increase in sensitivity over a crystal video type. One of a number of applications indicated was measurement of VSWR with a c-w signal in the line. Receiver miniaturization, although not attempted, appeared feasible.

Automatic Data Reduction System—Amplitude-Distribution and Correlation Analyses. A. Shapiro, Naval Research Laboratory. Dec. 1957. 11 pages. (PB 131395, OTS) 50 cents. A useful description of many forms of radio and radar data can be obtained from amplitude-distribution and correlation analyses. This volume described a data reduction system which performs these analyses automatically, using data recorded on film as input. A film reader converts the recorded data to digital voltages which are totaled in a 30-level amplitude distribution. In correlation analysis, the output of the film reader is modified by the input-output characteristic of the receiving and recording system and transferred to a special-purpose computer which performs autocorrelations or crosscorrelations.

ENGINEERS – EE, ME, PHYSICISTS

A CHALLENGE

AND

A PROMISE

The Challenge is Diversity

When one organization offers consistent engineering challenge in areas ranging all the way from Audio through RF and Microwave regions, to IR – you can begin to visualize the stimulating professional climate that is generated and regenerated here.

It takes a versatile engineer who can move freely across his discipline, exposing himself to unfamiliar problems and exploring new ideas with colleagues in the advanced areas of electronics.

The Promise is Stability

The experienced engineer will recognize that long-term stability is implicit in Light Military's wide-ranging diversity. This characteristic is further enhanced by the large company resources of General Electric. Yet G. E.'s policy of decentralization sets the Department free to get the job done – with on-the-spot management to make vital decisions quickly and effectively.

AND FOR YOUR FAMILY Utica is a modern, growing city, located in New York State's famous Mohawk Valley. Close at hand are skiing, hunting, hockey, fishing, swimming, boating, golf, tennis. City and suburban housing of all types, well-staffed schools and excellent stores round out a picture of full family living in an invigorating 4-seasons climate.

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Phone_____

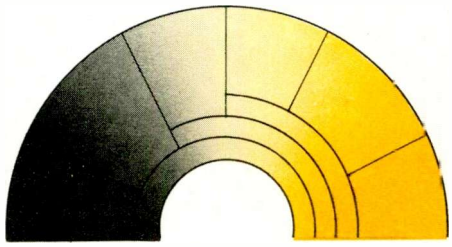
Degree (s)_____

Year (s) Received_____

I am particularly interested in the following technical areas:_____

_____

(U.S. citizenship required)



A Record of Continuous Engineering Achievement Underscores the Potential for Rapid Professional Growth

Recent projects that have won recognition for both the Department and its engineers include:

AIRBORNE COMBAT INFORMATION CENTER This integrated system covers functions previously performed from land-based or ship-based CIC's. After target position, heading and speed have been established by the system's powerful search radar, intercept courses are plotted and radioed directly to the appropriate defense forces.

AIRBORNE ECM Although details of the equipment are still classified, Light Military's highly miniaturized system represents a considerable advance in flexibility and reliability over earlier systems. A new program for development of an intelligent Airborne ECM Intercept System – *not only capable of detecting, but defeating enemy radar devices* – is now underway.

AIRBORNE NAVIGATION SYSTEM This 150-pound system is of the Doppler/Inertial/Computer type, and does not depend upon any form of ground information or control.

MAJOR PRODUCT GROUPINGS AT LIGHT MILITARY INCLUDE:

Airborne Data Link
Airborne Early Warning and Control Systems
Airborne Electronic Warfare and Electronic Defense Systems
Airborne Fire Control and Bombing Equipment
Airborne Navigation Systems and Equipments
Aircraft Defensive Armament Systems
Automatic Test Equipment
Communications Systems
Digital and Analog Computers
Missile Systems and Missile-Borne Guidance and Control Equipment
Terminal Control Systems and Fuzes
Undersea Warfare Systems

PROFESSIONAL OPPORTUNITIES

Reporting late developments affecting the employment picture in the Electronic Industries

Design Engineers • Development Engineers • Administrative Engineers • Engineering Writers
Physicists • Mathematicians • Electronic Instructors • Field Engineers • Production Engineers

American Educators To Tour Red Schools

To study the much-discussed engineering schools of Russia, eight American engineering educators are completing plans for an Exchange Mission on Engineering Education to the Soviet Union.

They hope to see engineering classrooms and laboratories and meet teachers and students throughout Russia, including Siberia, and to bring back curricula, syllabi, textbooks, and other material pertaining to Russian engineering education not now in the United States. The proposed itinerary includes institutions in Moscow, Kharkov, Novosibirsk, Tomsk, Stalinsk and Frunze. The group anticipates being in Russia for most of November.

In return, a group of Russian engineering educators is expected to tour schools in this country, but detailed plans have not yet been completed.

The exchange, originally suggested by the Soviet Union, is a project of the American Society for Engineering Education, cooperating with the East-West Contacts Staff of the Department of State.

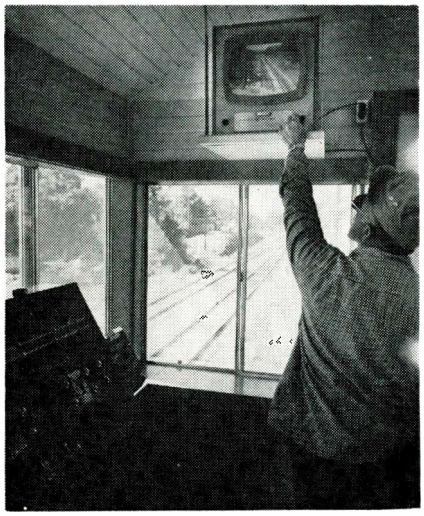
'Technorama' Underscores Technician Shortage

A one-day "Electronics Technorama" held at the Penn Technical Institute of Pittsburgh, focused attention on the need for technicians, as well as engineers, in the United States.

From three to five technicians are needed to provide back-up support for each engineer.

Special exhibits and speakers were provided by the United States Steel Corp., The U. S. Naval Research Laboratory, J. W. Fecker, Inc., the International Business Machines and the Instrument Society of America. The Penn Technical Students used mock classes.

RAILROAD TELEVISION



Crossing tender for the D & H Railroad, Cohoes, N. Y., adjusts G.E. closed-circuit TV monitor which gives him a picture of switching engines approaching the main line.

Seminars on Technical Writing in NY and LA

A number of one-day seminars are being conducted by the Industrial Education Institute on "Clear Technical Writing."

Designed for men whose jobs include writing on technical subjects, the seminars will be conducted by Robert Gunning, outstanding authority on writing and readability techniques. They will present proven formulae for organizing thoughts and getting them on paper more easily, quickly nd understandingly.

The dates and locations of the seminars are:

New York City, Park Sheraton Hotel, Dec. 11, 1958.

Los Angeles, Hotel Sheraton-West, Jan. 13, 1959.

San Francisco, Hotel Sheraton-Palace, Jan. 15, 1959.

FOR MORE INFORMATION . . . on positions described in this section fill out the convenient inquiry card, page 85.

R & D to Spur Plant, Equipment Expansion

Spending on product and processes research, greatly accelerated by industry since 1954, will result in the introduction of new products on a large scale beginning in the early 1960's according to Victor Roterus, Director, Office of Area Development, U. S. Department of Commerce, in a speech before the Washington Board of Trade. The expected sharp rise will not come earlier because it takes seven years (on the average) to develop a new product and establish a market for it.

As more new products are readied for large-scale marketing, the need will arise for expanding and modernizing present manufacturing plants and building some new facilities. By the early 1960's the facility expansions and new plants which will be needed to manufacture the new products now under research are expected to account for a major share of all capital spending. This means that in a few years most capital expenditures will be for new product type industries rather than for the old established product industries. This also means that the obsolescence of existing plants, 50% of which, a recent survey shows, were built during or before World War I, will be hastened and replacements in old or new locations will be in order.

Four trends in industrial development were pointed out: the severe competition for new plants in states and local communities, a growing importance of business climate and community amenities in plant location decisions, and the growing tendency for industry to locate its expansions in market areas where they do not now have a plant.

Man-Machine Relationships a Growing Field for **OPERATIONS RESEARCH**

Mathematicians, Physicists and Engineers with experience or strong interest in Operations Research on large-scale automated systems will be interested in the major expansion program at System Development Corporation.

SDC's projects are concerned primarily with man-machine relationships in automated systems in a number of fields, including air operations. The application of new and advanced digital computer techniques is particularly important in optimizing these man-machine relationships. SDC activities constitute one of the largest Operations Research efforts in the history of this growing field.

Senior positions are among those open. Areas of activity include: Mathematics, Systems Analysis, Forecasts, Cost Analysis, Operational Gaming, Design Analysis, Performance Evaluation.

Those who have professional questions or desire additional information are invited to write Dr. William Karush, Head of the SDC Operations Research Group. Address System Development Corporation, 2420 Colorado Avenue, Santa Monica, California.

"A Theorem in Convex Programming." A paper by Dr. Karush is available upon request. Address inquiries to Dr. William Karush at System Development Corporation.

SDC

SYSTEM DEVELOPMENT CORPORATION
Santa Monica, California

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Circle 502 on "Opportunities" Inquiry Card, page 85

Wall Street Looks At The Electronic Industry . . .

What yardsticks does the security analyst use to measure financial health of a company? How do electronic firms differ from other industries? In changing jobs what are the significant items in a firm's financial statement that best indicate the quality of management? How much R&D is "healthy"?

By CASPER M. BOWER,
Investment Analyst,
Utilities & Industries Management Corp.
425 Park Ave.,
New York 22, N. Y.

Part One of Two Parts

THE electronic industry, within a relatively few years, has sprouted from a single seed of generally understood basic technical terms and product lines into a plant structure whose branches in turn are generating seedlings for a variety of new sciences, products, and abstruse nomenclature.

And, we analysts—as non-scientists—must collect, analyze, translate and finally evaluate with a high degree of perspicacity the expanding scientific horizon and its associated technical terms in relation to a corporation's future earnings. And, the industry's management is one of the principal sources for this basic information.

These functions, as you will agree, are critical responsibilities. For it is the aggregate of the publicized judgments of security analysts and their forecasts for future earnings which contribute to the ever changing price level for corporate securities.

It is for these latter reasons that later I will offer to electronic company managements some reporting procedures which may assist security analysts, stockholders, and in fact, employees in evaluating a company's fiscal-year performance, the company's place in the broadening spectrum of military and commercial markets, and finally, its sales and earnings forecast for the year ahead.

As a prologue to my subject, I consider it expedient to discuss briefly and comment on:

First—the security analyst's principal corporate measuring tools which consist of comparative operating ratios, efficiency percentages, and trade statistics;

Second—the methods of applying these yardsticks of corporate and management analysis to specific security recommendations; and

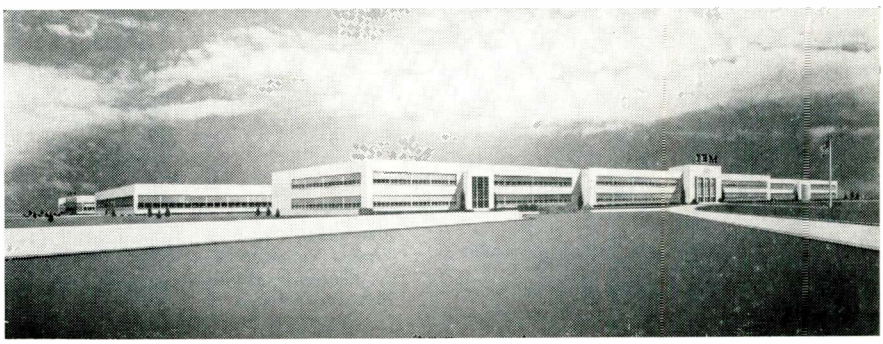
Third—the fact that management appraisal conclusions, depending as they do on the analyst's final summarization of his data, part of which are statistics and part empirical, are far from an exact science. Therefore, final judgments are subjected to challenge by contemporary analysts. The latter point was neatly packaged by Edward H. Collins, the profound economic and business writer for the *New York Times*, who commented recently as follows:

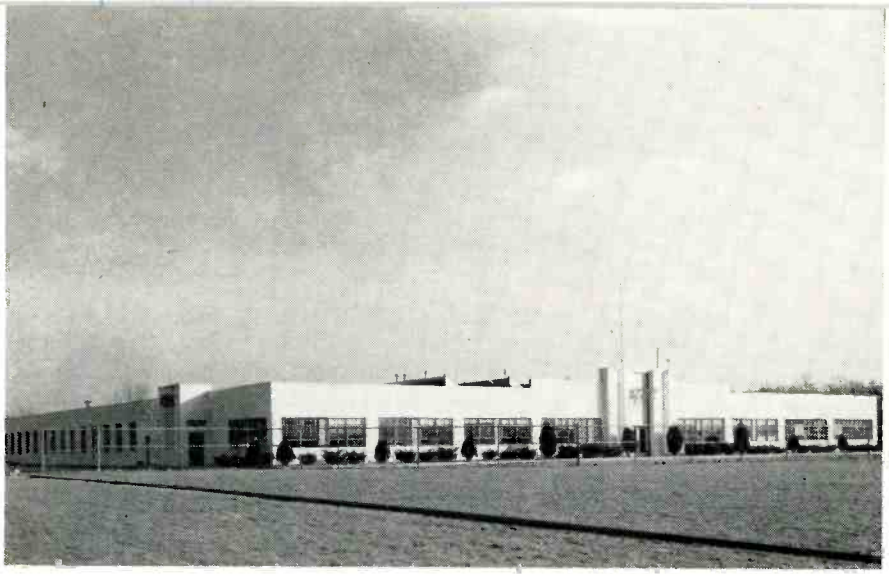
"But the mere possession of such an armory of statistics carries no guaranty that the conclusions drawn therefrom will be valid ones, or that they will coincide with the findings of other economic analysts."

Mr. Collins' remarks which, in a sense, evaluate the analyst's evaluating tools highlight the fact that whereas measuring tools used by other fields of industrial endeavor provide the investigator with the means to obtain concrete and specific conclusions, those available to the corporate security analysts are primarily vanes of direction—nothing more.

And peering at investment philosophy through the public's eyes,

IBM plant, Kingston, N. Y.—"Management appraisal is an important yardstick."





Radio Materials Corp.—merged with P. R. Mallory.

Wall Street . . . *(Continued)*

the objectives of the average stockholder when the chips are down, are capital appreciation and dividend income growth. These twin targets of capital growth and income are acutely sensitive to a spectrum of forces cutting across the vagaries of economics, weather and human emotions. In no sense do they lend themselves to any precise mathematical, physical, chemical law or formulae.

And now to our tool crib—The most frequently used tools for semi-serious company investigation are price earnings ratios, pretax net income as a percentage to sales, current ratio which shows the extent by which current assets exceed current debt and book values.

None of these ratios or percentages when applied to a single company is necessarily conclusive. Actually, to be effective, they must be compared with the identical ratios of other competing companies.

For corporate examinations which may lead to the supply of new working capital to corporations or mergers—many other internal operating ratios are employed to assay fiscal stability and managerial efficiency. But, rather than discuss each one—and many are not germane to this discussion—I prefer to utilize my time to examine those of immediate interest.

Price Earnings Ratio

My first choice—and for what I consider to be good reason, having in mind *public responsibility*—is that of the price earnings ratio. I deliberately elect this one because the present security price level for a majority of electronic company shares presents a most provoking investment conundrum—yet unresolved. Price earnings ratio is the relationship between the current security price level and current as well as estimated near-term earnings.

This ratio, as I have said, is an important broad spectrum ratio and always has been. Yet, one of your industry's corporate presidents, for example, suggests that this yardstick is not presently applicable in evaluating electronic companies. His words were, and I quote:

"I would like to refer again to the use of price earnings ratio as a measurement of the soundness of investment in electronic companies . . . Many financial analyses from blue-chip investment and brokerage firms recommend to their clients to sell or buy electronic stocks on some arbitrary mathematical basis such as a price earnings ratio. I know one or two electronic stocks that are showing no earnings and a few that are priced at thirty times earnings, which as an investment—and I do not mean short-term speculation—are far better than a great many others whose market price is only six, eight, or 10 times earnings . . ."

We shall see.

Historically, investors pay a given number of dollars a share of stock for each one dollar of present or forecast earnings applicable to these shares. Usually, the emphasis is on the future rather than the present earnings. These present or future figures are the basis for the price times earnings ratio. If investors believe a company will earn $1.00 a share for a given year, they pay ratios ranging from as low as $4.00 to as high as $30.00 a share and sometimes even more for these $1.00 earnings. We say, therefore, the present market price is selling at four or thirty times earnings.

The price earnings ratio varies industry by industry. The shares of railroad, public utility, food, drug, and chemical companies, for example, all sell at different price earnings ratios, which also vary under the impact of changing economic conditions.

During prosperous times, price earnings ratios tend to rise, reflecting investor expectations that next year's earnings will be still higher than the present. And, as may be expected, during recession periods that ratios decline. But, more on this subject later.

Pre-Tax Net Income

Pre-tax net income as a percent-

Leeds & Northrup's new plant, North Wales, Pa., a well-established electronic firm expanding with the industry.

age to sales is a very important comparative tool. It represents a company's net earnings after all of its expenses are paid but before federal income taxes.

It permits us, therefore, to measure a corporation's efficiency and compare the company's efficiency rating with that of competitors.

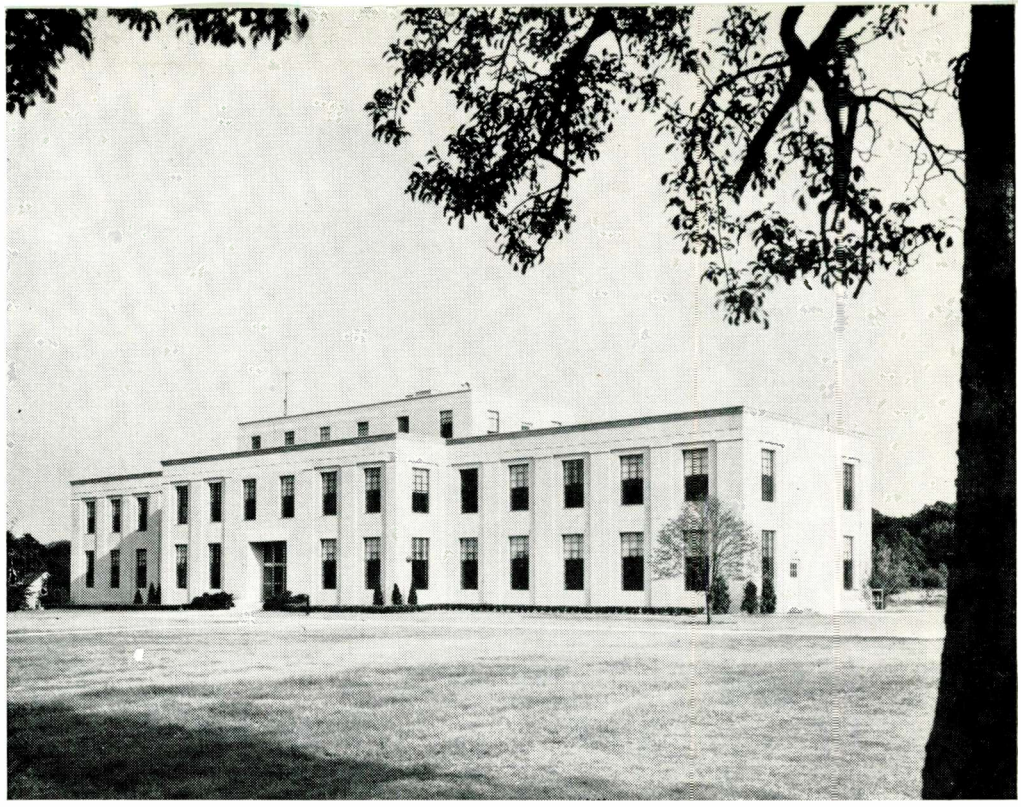
In fact, were you to consider changing your position, you might, as an additional guide but certainly not final, compare the present and past efficiency ratios of your company with those of the company you plan to join.

Bear in mind, however, that oftentimes a corporation may have had some unusual or non-recurring expenses during the year, or it may employ different accounting methods for certain of its expenses. This would affect this efficiency ratio. A disputative example of the latter is that of continuous or single product research and development costs, which you are aware, are a heavy drain on cash and oftentimes non-income producing for years, if at all.

Some companies follow the practice of charging all of these expenses within the year in which they occur. Others, on advice of their accountants, or because of management policy or other considerations, may charge only a portion of these expenses within the year and they, in the language of the Certified Public Accountant. capitalize or prorate the balance of these costs over a specific period of years.

You can appreciate, therefore, that companies, heavily involved in research and development expenses for their own commercial products and the sequential costs for breadboard circuitry, product design, prototypes, packing, production, marketing and selling — all prerequisites for introducing new products — can report substantially different pre-tax net income, depending on the accounting practices employed.

Our investigators, in checking final pre-tax net income, therefore examine a company's various operating expense components; make corporate comparisons; check for unusual accounting treatment for reserves, taxes, research and development charges; and read carefully the CPA certification of the company's quarterly and annual reports to stockholders; then come up with comparative pre-tax net.



Sylvania's R&D Labs., Bayside, N. Y. "Management views differ widely on methods to evaluate the efficiency and productivity of their research and development programs."

Net Income

Net income or net earnings, of course, are those which remain after provisions for payment of federal income taxes. And this remaining sum, divided by the number of shares of common stock outstanding, provides the basis for "earnings per share"—the variable yardstick for stock market appraisal.

A company's current ratio which indicates the relationship between current assets and current liabilities—hence working capital—is, of course, of critical importance, particularly for those companies heavily involved in government contracts and which may depend substantially on progress payments for salaries and materials and other current expenses.

Many electronic managements were made painfully aware of this ratio within the past year when the government decided to economize by stretching out completion dates of contracts which slowed up progress payments. This economy wave could again engulf the Pentagon under the pressure of steeply rising costs of defense about which I have subsequent remarks to make.

Our analysts cannot be satisfied alone with the ratio itself because the components of current assets must also be diagnostically examined. Oftentimes, inventories in form of raw material, work in progress, and accounts receivable, particularly those due on government contracts, and so forth, comprise a sizeable portion of current assets. And, if these items are unexpectedly slow in liquidation, the company might be face to face with a shortage in cash to meet payroll and current bills outstanding.

Book Values

Book values represent a company's total assets available to the common stock after provision is made to pay all debt and other prior claims. This figure is important for serious investment investigation, particularly if a merger is in the making. Managements, in considering a consolidation, must carefully examine each other's net tangible assets as well as earning power in determining equitable exchange of shares. Of course, technical skills of staff—a most vital asset—unfortunately do not appear in any form in the balance sheet. In your industry mergers occur quite frequently and there are strong technical, financial, and economic undercurrents, which in my

(*Continued on page* 192)

GE's Operation "Check-Up"

New General Electric Flight-Test hangar at Edwards AFB houses technical and engineering services for aircraft maintenance, instrumentation, data reduction, operations control, quality control, advanced design, etc. Planes shown include the Vought Regulus II Missile, North American F-86, Boeing B-47, Lockheed F-104, Grumman F11F-1F, Douglas XF4D, and the McDonnell F-101.

...at EDWARDS AFB!

At flight test centers like this, General Electric technical and engineering services quickly gather and interpret experimental flight data to guide design toward peak performance for the engine-airplane combination.

Operation "Check-Up" enables the men at General Electric's Jet Engine Department to design, develop and improve jet engines like the J47, the J79, and the new J93—engines which write history.

Headlines like "Speed Record Added to Feats of F-104"—"CJ-805 to Power Convair's New Jetliner"—"Starfighter Sets New Altitude Mark"—"New Air Force Bomber, Fighter Will Shoot for Mach 3" reaffirm the sky-mastery of GE jet power—the mastery established by J47-powered Sabrejets over Korea.

Progress Is Our Most Important Product

GENERAL ELECTRIC

JET ENGINE DEPARTMENT CINCINNATI 15, OHIO

Industry News

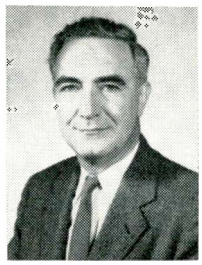
Electronics International Co., a division of International Electronic Research, has appointed **J. R. Foster**, Sales Manager. He was formerly District Sales Manager at Hycon Electronic Instrument sales.

Recent General Electric Co. appointments include: **Edwin L. Davis** as Regional Commercial Engineer-Receiving Tube Dept., **H. A. Mayer** as District Sales Manager Receiving Tubes and **R. W. Morefield** as Manager-Merchandise Sales.

George R. Lippert has joined the Victoreen Instrument Co. as Director of Technical Services. Mr. Lippert was formerly associated with I-L-S Instrument Corp., Cleveland.

Commodore A. J. Spriggs, U. S. Navy Ret., Vice President of Packard Bell Electronics Corp., has been named Adviser to the Director of the Electronics Div., Business and Defense Services Administration, U. S. Dept. of Comm.

A. J. Spriggs



G. E. Valley

Dr. G. E. Valley is the new Director of Development Planning at Melpar, Inc. He was previously Professor of Physics at M.I.T., and Associate Director of Lincoln Lab.

Admiral S. Murray, USN (ret.), has joined the Aerophysics Development Div. of Curtiss-Wright Corp., as assistant to the General Manager.

J. Spayth is now Manager of the Data Processing Dept., Avion Div., ACF Industries, Inc. He joined Avion from the Crosley Div. of AVCO Mfg. Corp.

Arthur W. Vance has been named Head of the newly-formed Information Processing Research Dept. at Hughes Aircraft Co. He was formerly Chief Engineer of the Astro-Electronic Products Div. at RCA.

James A. Hannan has been appointed Manager of the International Div. of Centralab. Hannan had previously been Sales Manager of Centralab's Mechanical Electronic Products Div.

Harry Reese is serving as Manager, Atomic Energy Services, RCA Service Co. He was formerly Assistant Manager, Nuclear Power Dept., Curtiss-Wright Co.

(*Continued on page* 186)

Industry News

(*Continued from page* 185)

E. J. Tanner is now Controller at Allen B. Du Mont Labs., Inc. He was formerly General Accounting Manager and later Assistant Controller.

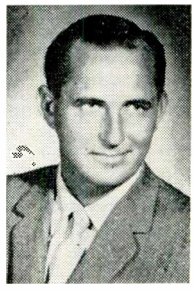
Two new appointments at Stromberg-Carlson have been announced: **James E. Howell** is Assistant Chief Installer, Telecommunication Division and **E. S. Turner** is District Representative at the Colorado Springs office.

Kenneth C. Moritz has been named Sales Manager of the Semiconductor Div. for Raytheon Mfg. Co. He formerly was Export Sales Manager for Philco's government and industrial products.

Ralph B. Reade is Manager of the newly-formed Communications Div. of the Airborne Systems Group of Hughes Aircraft Co.

Michael Zangrillo is now Sales Manager at Dilectrix Corp. He was Director of Technical Services of Hitemp Wires Inc.

M. Zangrillo



C. V. Dickman

Charles V. Dickman is national Sales Manager for Fleetwood products—Conrac, Inc. He was formerly with Zenith Radio Corp.

J. H. Lamothe becomes Vice President-Operations at D. S. Kennedy & Co. Lamothe was formerly Executive Vice President and General Manager of Wheeler Reflector Co.

John W. Beavans is controller for the Berkeley Div. of Beckman Instruments, Inc. He formerly was Division Controller for the metal products division of Ball Brothers, Inc.

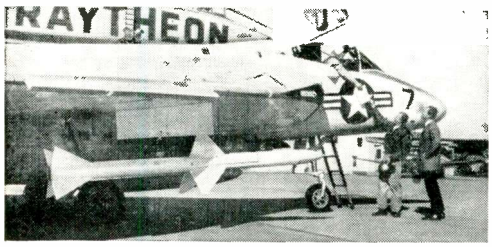
Lee D. Webster has been elected Vice President and Secretary-Treasurer of Ling Electronics, Inc. Webster was financial analyst for Dresser Industries, Inc.

C. R. Robertson, recently named Sales Manager at Weller Electric Corp., has been elected Vice President-Sales.

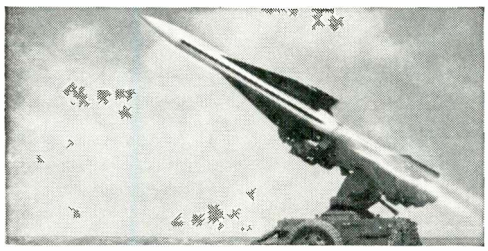
Charles W. Rosner has been appointed Sales Manager of the newly established Industrial Equipment Div. of Atronic Products, Inc. He has served with the Air Force & Leeds and Northrop.

(*Continued on page* 189)

Raytheon Missile Projects



SPARROW III—the Navy's tenacious, lightning-fast, air-to-air missile—is intended for extensive use by Navy fighter aircraft in fleet air defense. Sparrow III is a Raytheon prime contract.



HAWK—the Army's defense against low-altitude attackers—carries out its destruction in the blind zone of conventional radars. Hawk development and production is under Raytheon prime contract.

TARTAR—A substantial contract for vital electronic controls for this Navy destroyer-launched missile is held by Raytheon. This equipment—a tracking radar and associated units—enables it to "lock on", cling to target's path, despite evasive tactics.

ADVANCED PROJECTS in aeronautical structures as well as missile guidance and control are now underway in Raytheon laboratories. New facilities are continually being added for this work.

PRELIMINARY NEW DESIGNS of tomorrow's missiles will result from the advanced work being done by today's missile engineers. Raytheon plays an important role in this area.

Raytheon diversification offers

JOB STABILITY FOR CREATIVE MISSILEMEN

Here is an opportunity to free yourself of worry about a job that's here today, gone tomorrow.

Diversified assignments—only possible in a company with Raytheon's wide range of missile activities—means security not found in one- or two-project companies. You apply your creative energies to the many projects you work on, and they in turn are your "insurance" against falling into a rut.

Individual recognition comes quickly from Raytheon's young, engineer-management—men who are keenly aware of the engineer's needs and contributions to missile progress.

Dynamic Raytheon growth—the fruit of this management's progressive policies—is best illustrated by the fact that Raytheon is already the only electronics company with two prime missile contracts—Navy Sparrow III and Army Hawk.

The next step is up to you. Why not get frank answers and helpful information on the type of job suited to your background and talents, its location, salary and other important details. Write, wire or telephone collect: The number is CRestview 4-7100 in Bedford, Massachusetts. Please ask for J. Clive Enos.

RAYTHEON OPPORTUNITIES NOW OPEN IN:

WEAPONS SYSTEM ANALYSIS • CONTROL SYSTEMS • PACKAGING • MICROWAVE • RADAR • SPECIFICATIONS • MISSILE AERODYNAMICS • WIND TUNNEL TESTING • AERODYNAMIC HEATING • ROCKET ENGINEERING • VIBRATION MEASUREMENT and DATA REDUCTION

RAYTHEON MANUFACTURING COMPANY
Missile Systems Division, Bedford, Mass.

RAYTHEON *MISSILE SYSTEMS DIVISION*
Excellence in Electronics

Circle 507 on "Opportunities" Inquiry Card, page 85

ROY T. HURLEY

Portrait by Bachrach

"More than 11,000 of our 19,000 employees are now buying U.S. Savings Bonds Regularly"

"We are delighted to see the steady increase in the number of our people who are buying U.S. Savings Bonds through the payroll plan. More than 59% of our employees are now enrolled.

"To enjoy the benefits of peace and freedom, we must provide for our own personal financial security and, at the same time, create the power for peace through support of an adequate defense program. Systematic savings through the Savings Bond program will keep us ahead of any potential aggressor and help insure the soundness of an economic system which encourages and permits each of us to look forward to a bright, secure future."

ROY T. HURLEY, ***Chairman and President, Curtiss-Wright Corporation***

Today there are more Payroll savers than ever before in peacetime. If employee participation in *your* Payroll Savings Plan is less than 50% . . . or if *your* employees now do not have the opportunity to build for their future through the systematic purchase of U.S. Savings Bonds, give your State Director an opportunity to help. Look him up in your phone book. Or write: Savings Bonds Division, U.S. Treasury Dept., Washington, D. C.

Electronic Industries

THE U. S. GOVERNMENT DOES NOT PAY FOR THIS ADVERTISEMENT. THE TREASURY DEPARTMENT THANKS, FOR THEIR PATRIOTISM, THE ADVERTISING COUNCIL AND THE DONOR ABOVE

Industry News

(*Continued from page* 186)

Dr. Benjamin J. Patton and **Mrs. Dorothy Hoffman** have been appointed Project Leaders for the Semiconductor Research and Film Research Programs respectively for International Resistance Co.

W. F. Hoeppner has joined International Standard Electric Corp., ITT subsidiary, as Comptroller of the Ace High project, a communications system being installed by ITT for SHAPE in the NATO countries.

W. G. Coe is now Pacific Division Manager at Mycalex Corp. of America. He was a Sales Engineer for the western district office of Applied Science Corp. of Princeton.

Edward P. Fleischer is now Assistant to the President, Consolidated Electrodynamics Corp. Fleischer has been Manager of Systems and Procedures at CEC.

Peter Stefan will now serve as Manager Mechanical Alloys for the Wilbur B. Driver Co. of Newark, N. J.

Meyer Leifer has been appointed Manager of Special Tube Operations for Sylvania Electric Products Inc. He has recently held managerial posts for Sylvania on the West Coast.

M. Leifer

F. J. Van Poppelen

F. J. Van Poppelen is now Sales Manager at Motorola's Semiconductor Div. He was formerly with General Electric Co. where he was District Sales Manager, Semiconductor Dept.—New England District.

Donald J. Stewart, formerly with the Naval Ordnance Test Station, China Lake, Calif., has been named to the new position of Technical Assistant to the Vice President at Hoffman Lab. Div., Hoffman Electronics Corp.

Alfred B. Rossip, formerly Sales Manager at General Transistor Corp., is now President of Electronics Fabricators, Inc. Mitchel Samuels has assumed the position of Vice President in charge of sales.

Ronald J. R. Kallman has been named to the new position of Western Regional Manager for Tansac computer systems by Philco Corp. He was formerly with the Burroughs Corp. Electrodata Div.

Electronic Industries'

ANNUAL INDEX—1958

The annual index of ELECTRONIC INDUSTRIES has been arranged by subjects for easy reference to related topics. The first figure indicates the month in which the article appeared; the second figure indicates the page number.

COMMUNICATION SYSTEMS

COMPONENTS, CHASSIS ELEMENTS

COMPUTERS

CONVENTIONS AND MEETINGS

CUES FOR BROADCASTERS

Circuits

Maintenance, Testing

Miscellaneous

Recorders, Playbacks

Remote

Turntables

EDITORIALS

GENERAL

INSTRUMENTS, MEASUREMENTS, TEST METHODS

MICROWAVE

Wall Street

(*Continued from page* 83)

judgement will accelerate the rate of these corporate combines. This offers a challenge to electronic company managements and investment bankers to arrange mergers—soundly conceived and properly financed. Oddly enough, the role of the investment banker in last year's rash of mergers has been small. The majority of corporate weddings seemingly have been company inspired and company executed.

While this has proven successful so far, I believe that, as existing firms grow larger—in terms of systems contracts, and technical personnel, the medium sized firm must also seek to combine which makes it practically mandatory for the low firm on the totem pole to scurry around for a partner or so.

In this climate, it would appear that impartial, seasoned management advice and financial guidance are an absolute requirement which will save more than one company, its stockholders and employees from the grief of improper matchmaking.

But, to return to book values.

Here too, is a problem — electronic companies have little in the way of net assets or book value.

And again, another electronic executive considers book value appraisal another tool of dubious value. He observed, in speaking of book values, and I quote:

" . . . But not one of those electronic companies lived up to expectations, even though each was selected on the basis of the highest book value per share and the lowest price earning ratio. . . . "

These are the basic tools. And, as you can judge by my interjected remarks, not one is a basis for absolute conviction. Debatable variables exist in each and final interpretation and sequential company appraisal depend, as I remarked at the beginning of this talk, on a combination of experience, observation, and deductive reasoning.

So much for our tools, and now to the subject matter at hand—the application of these tools to the Electronic Industry.

(*Continued next month*)

ELECTRONIC INDUSTRIES Advertisers—December 1958

Annual Directory *(Continued)*

WHILE NERO FIDDLED

One windy Tuesday in Rome during the reign of the infamous Nero, a new mobile radar unit, on its way for delivery to the emperor's legions outside the city, suddenly caught fire. A tube blew, the sparks flew, the horses bolted, and soon all Rome was ablaze.*

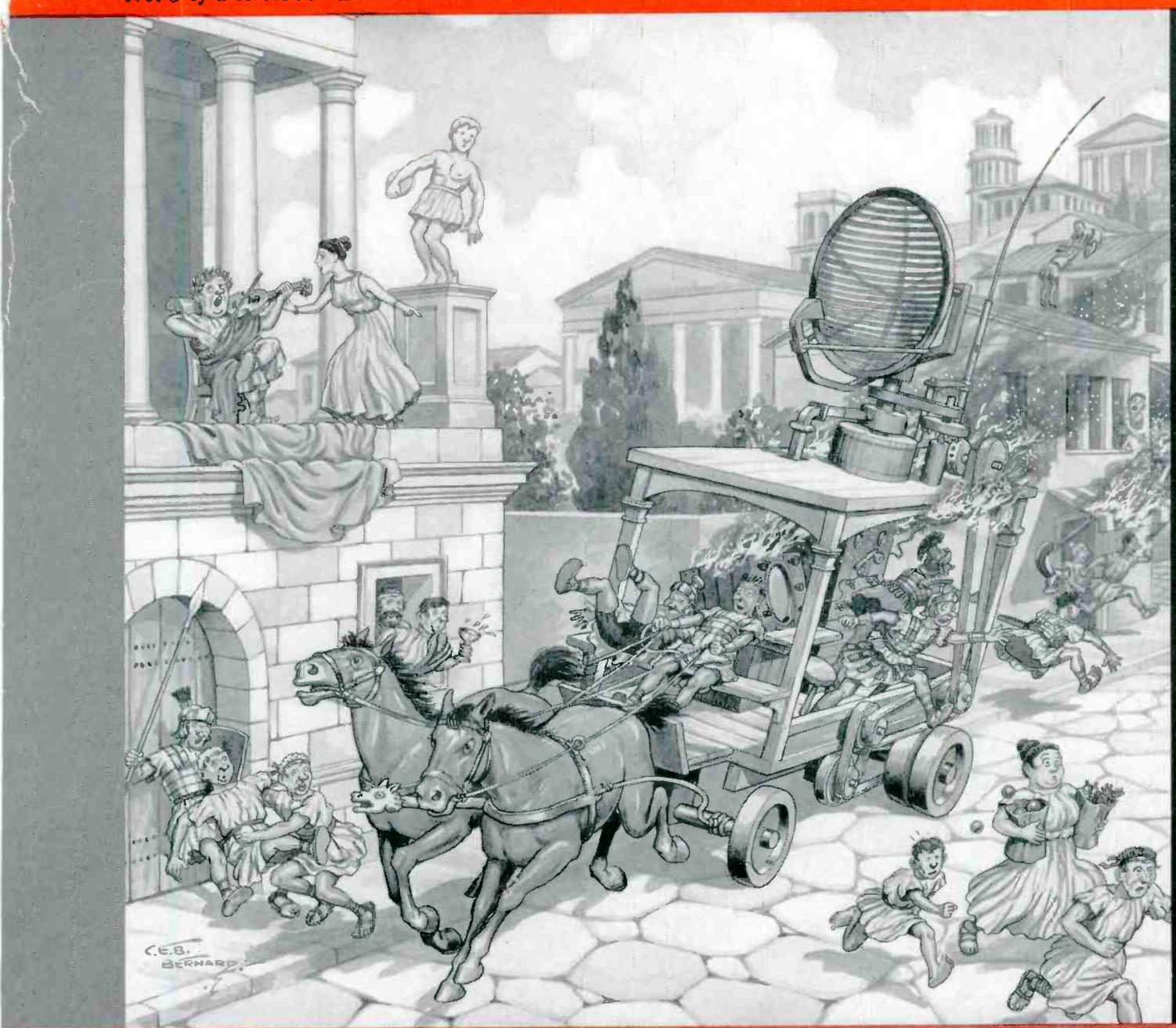
Nero was furious. He had the members of the ill fated crew brought before him. "I'll make the punishment fit the crime!" he roared. While he thought about it, he picked up his violin and began to play. Since he was the vilest of violinists, the feelings of his listeners may better be imagined than described. He scraped his way through 'Keep the Rome Fires Burning' and 'Smoke Gets in Your Eyes.' At last he paused, confronting his trembling listeners.

"I'm going to have you all boiled in oil!" he boomed.

"THANK GOODNESS!" one of the doomed wretches exclaimed fervently as they were being led away. "For a minute I thought he was going to play 'Smoke Gets in Your Eyes' again!"

The obvious moral: *It doesn't pay to go horsing around with inferior tubes.*

No. 6 of a series . . . **BOMAC LOOKS AT RADAR THROUGH THE AGES**



* *Bomac makes the finest microwave tubes and components this side of the Coliseum*

WRITE FOR FREE SIX PAGE FOLDER

Bomac LABORATORIES, INC.
Salem Road, Beverly, Massachusetts

Leaders in the design, development and manufacture of TR, ATR, Pre-TR tubes; shutters; reference cavities; hydrogen thyratrons; silicon diodes; magnetrons; klystrons; duplexers; pressurizing windows; noise source tubes; high frequency triode oscillators; surge protectors.

Offices in major cities—Chicago • Kansas City • Los Angeles • Dallas • Dayton • Washington • Seattle • San Francisco • Canada: R-O-R Associates Limited, 1470 Don Mills Road, Don Mills, Ontario • Export: Maurice I. Parisier, 741-745 Washington St., N.Y.C. 14, N.Y.

Circle 2 on Inquiry Card, page 83

Announcing new

RCA SILICON RECTIFIERS

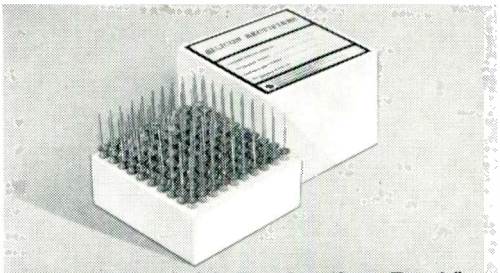
RCA is now in mass production of silicon rectifiers of the diffused-junction type for use in electronic applications. The two types now available are the initial units of a broad line intended for power supplies of entertainment, industrial, and military equipment.

These RCA Silicon Rectifiers Offer You:

- Low Cost—specifically priced for entertainment applications.
- Electrical Uniformity—precision controlled diffusion process forms superior junctions.
- Welded Hermetic Seal—each unit individually pressure-tested to provide complete protection against moisture and contamination.
- Rugged Construction—industrial-type "top-hat" design with axial leads for soldering-in applications; may also be mounted in standard fuse clip.

TYPE	MAXIMUM RATINGS			* CHARACTERISTICS		APPLICATION
	Peak *Inverse Volts	RMS Supply Volts	DC Forward Ma	Max. Reverse Current at Indicated Peak Inverse Volts	Max. Instantaneous Forward Voltage at Indicated Instantaneous Forward Current	
1N1763	400	140	500	100 μa at 400 volts	3 volts at 15 amperes	Black-and-white TV, radios, phonographs and other electronic equipment operating direct from power line
1N1764	500	175	500	100 μa at 500 volts	3 volts at 15 amperes	Color TV, radios, phonographs and other electronic equipment operating from the power line through a step-up transformer

*At ambient temperature of 25°C



New RCA "100 Production Pack" saves time and motion. Package is specially designed for quick, convenient, operator handling. Saves inventory-control time; simplifies the "count".

For sales information, contact your RCA Field Representative at any of these offices:

EAST: 744 Broad Street, Newark, N. J., HUmboldt 5-3900
NORTHEAST: 64 "A" Street, Needham Heights 94, Mass., HIllcrest 4-7200
EAST CENTRAL: 714 New Center Bldg., Detroit 2, Mich., TRinity 5-5600
GOV'T: 224 N. Wilkinson St., Dayton, Ohio, BAldwin 6-2366
WEST: 6355 E. Washington Blvd., Los Angeles 22, Calif., RAymond 3-8361
1625 "K" St., N. W., Washington, D.C., DIstrict 7-1260
CENTRAL: Suite 1154, Merchandise Mart Plaza, Chicago 54, Ill., WHitehall 4-2900

RCA Silicon Rectifiers are also available at your local authorized RCA Distributor!

New Designer's Data-Sheets Ready Now! Write RCA Commercial Engineering, Section L-50 NN Somerville, New Jersey.

RADIO CORPORATION OF AMERICA
Semiconductor and Materials Division
Somerville, New Jersey