ELECTRONIC INDUSTRIES

& TELE-TECH

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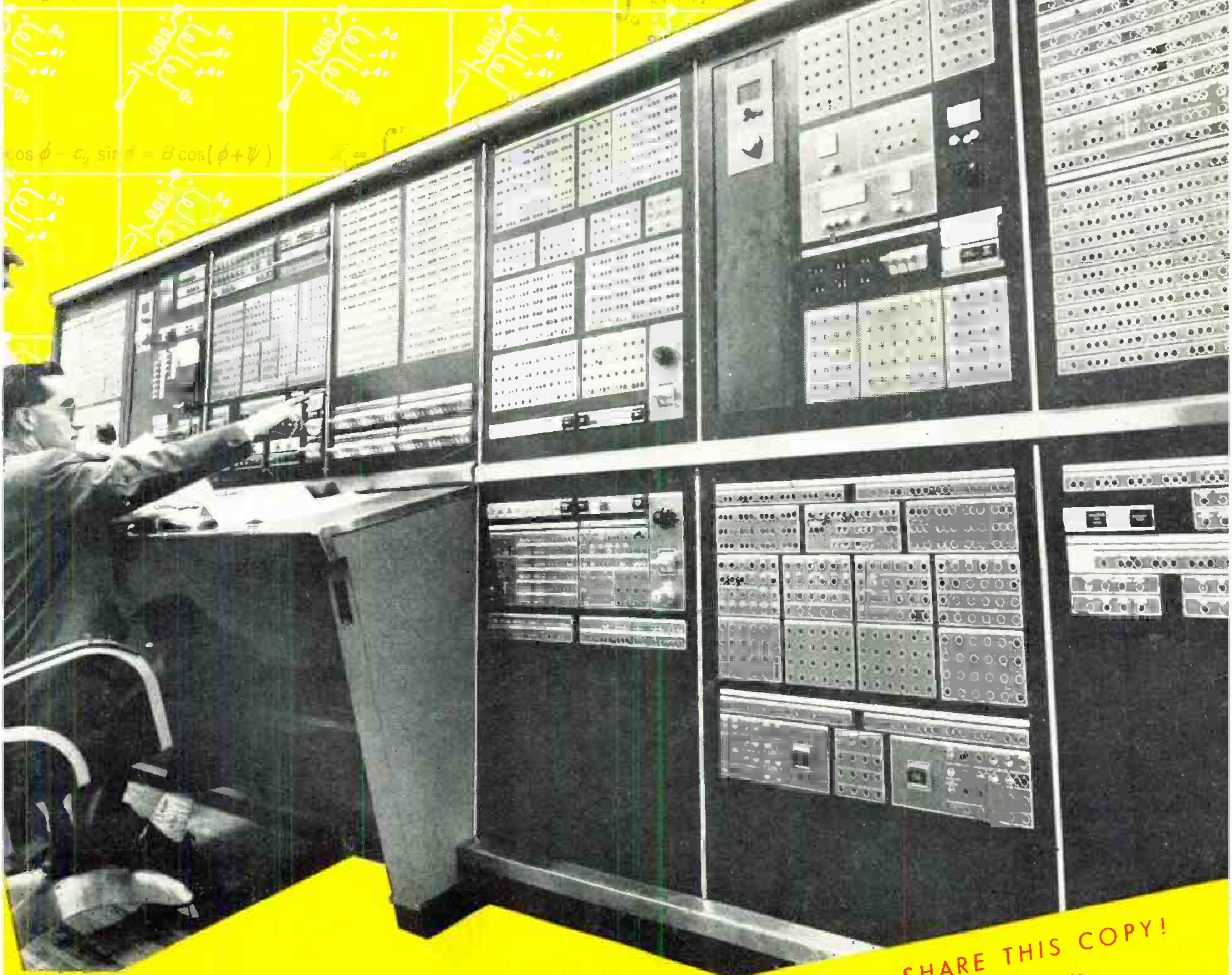

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BERNARD F. OSBAHR, Editor
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ORESTES H. CALDWELL Editorial Consultant

ELECTRONIC INDUSTRIES & Tele-Tech, Dec., 1956, Vol. 15, No. 12. A monthly publication of the Chilton Co. Executive, Editorial & Advertising offices at Chestnut & 56th Sts., Phila., Pa. Accepted as controlled circulation publication at Phila., Pa. Additional acceptance at N. Y., N. Y. 75¢ a copy. Subscription rates U. S. and U. S. Possessions: 1 yr. $5.00; 2 yrs. $8.00; 3 yrs. $10.00. Canada 1 yr. $7.00; 2 yrs. $11.00; 3 yrs. $14.00. All other countries 1 yr. $10.00; 2 yrs. $16.00.

ELECTRONIC INDUSTRIES

& TELE-TECH

Vol. 15, No. 12 — **December, 1956**

FRONT COVER: An artistic presentation that combines the control console of one of our larger digital computer installations against a related mathematical background. In this issue we focus editorial attention on engineering for the expanding computer fields. Editorial features appear on pages 32, 36, 38, 40, 44 and 46. Also note especially the 1957 Directory of Computer Equipment Manufacturers appearing on page 77.

MONTHLY NEWS ROUND-UP

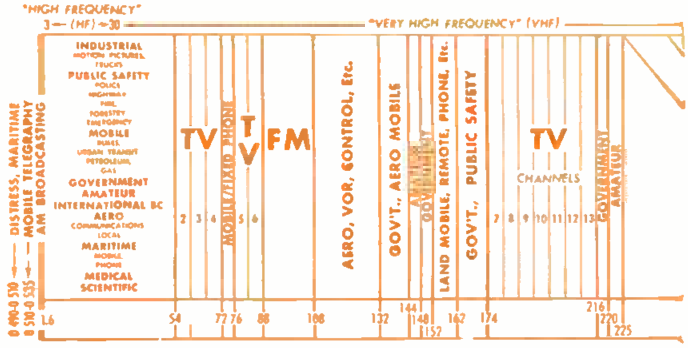
NEW ELECTRONIC EQUIPMENT

DEPARTMENTS

BPA NBP

RADARSCOPE

Revealing important developments and trends throughout the spectrum for radio, TV and electronic research, manufacturing and operation



RUSSIAN TECHNICAL JOURNALS are putting a heavy emphasis on abstracts of U. S. articles. The U. S. Central Intelligence Agency reports that in some instances abstracts of the articles are appearing in Russian abstract journals before appearing in American abstract journals. The abstracting service has become a state matter, accomplished primarily by ministerial offices and the USSR Academy of Sciences. Twelve series of technical abstract journals will be published this year, the total volume to compare in size with 35 volumes of the Encyclopedia Brittanica

PAY-TV will get an unofficial trial run under a plan arranged between Jerrold Electronics and a Bartlesville, Okla., theatre chain. First run films originating in the booths of local motion picture theaters will be transmitted over closed-circuit TV lines to homes of subscribers who will pay a monthly subscription charge.

THE TRAGIC CRASH of a light plane into WOR-TV's abandoned TV tower in N. J. will add fuel for aviation interests' fight against high towers.

EARLY WARNING RADAR

Bulging plastic radome on this Navy Sikorsky helicopter houses the antenna for an extremely high-powered GE search radar that detects low-flying planes more than twice as far as shipboard equipment.

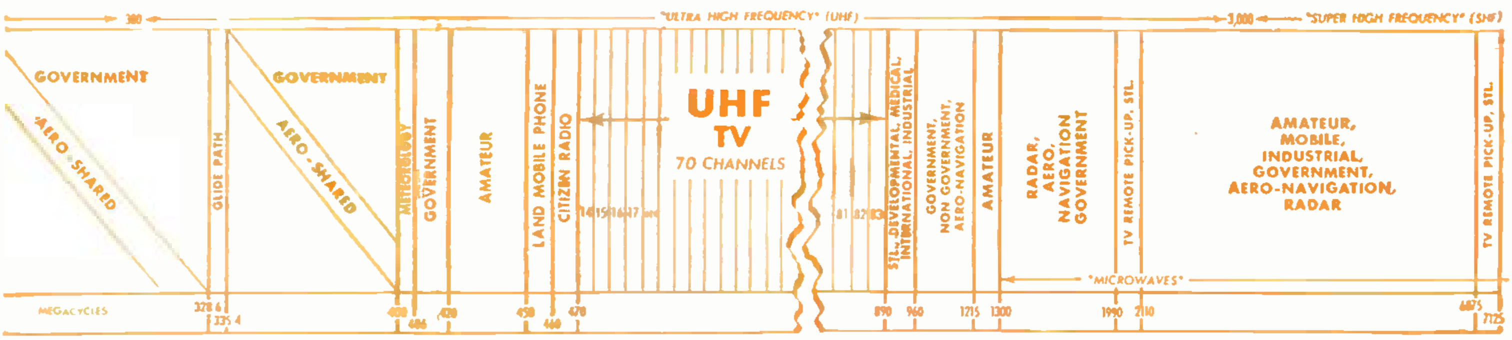
FOREIGN ELECTRONIC RESEARCH FIRMS are making attractive and persistent bids for American R & D business. In the latest move, thirteen top-rank French research firms and various Swiss and German companies have set up a new firm, the Franco-American Research Corp., 30 Whitehall St., New York City, to represent their interests in the U. S. Spokesmen for the organization point out that Europe is top heavy with good scientific theorists, and that the cost of engineering work done abroad is lower, as a rule, than that done in the U. S.

IN THE FUTURE all the expenses incurred in an unsuccessful bid for a TV channel will be tax deductible items. A new Revenue Service ruling permits all expenses attached to the application, such as legal, accounting and engineering fees, and travel expenditures of witnesses, to be deducted. If the station is awarded a license, however, the expenses must be capitalized as part of the value of the property and may not depreciate it—on the ground that such a license has an indefinite life which cannot be measured in advance for depreciation purposes.

AUTOMOBILE RADIO of the future will probably double as the family portable. Competely transistorized units will plug into a power supply socket and receiver holding clip assembly in the glove compartment.

FREQUENCY ALLOCATIONS

TELEVISION ALLOCATIONS STUDY. The FCC has agreed with the industry group of telecasters and manufacturers known as the TV Allocation Study Organization (TASO) that the television allocations research program should be confined to the development of technical facts about frequencies and propagation in the VHF and UHF bands and not as originally proposed by the government officials that it go into the economics of TV and equipment research. The concept of allocations studies based on technical facts, including both VHF and UHF transmitters and receivers as to frequency propagation and requirements, won the approval of the FCC leadership after a conference by an industry TASO subcommittee. TASO, meanwhile, has been making an intensive search for an executive director of the allocations study program and has been seeking a leading radio engineer with a comprehensive knowledge of frequency matters.



UNDER CONSIDERATION by the FCC is a proposal from the Radio Technical Commission for Aeronautics for a new VHF radio channel to be used exclusively by private flyers. The recommendation calls for a channel between 125 and 130 MC.

ENGINEERING PAY

ENGINEERS' INCOME is up 8.6% over last year, according to the American Management Association's Executive Compensation Service. The increase is almost twice that recorded for the previous 12-month period and is higher than that shown for any other executive or specialized group.

Engineers with less than one year of experience are now earning a median salary of $5,300 a year. The next higher category of engineers, with one to three years experience, has a median salary of $6,500 a year.

The highest salaries—in a few cases, up to $19,000—are paid to certain non-management specialists in research and exploration with some administrative duties. Physicists and mathematicians follow close behind, with average salaries up to $15,000 a year.

PRINTED CIRCUITS

At the recent Formica Printed Circuit Forum held in Cincinnati several elements of future interest were revealed. First, it is now apparent that printed circuits have become the accepted mode of circuit wiring by the electronic industries. In the past year great inroads into printed wiring for commercial electronic equipment and military electronic equipment have been made. In the next year for example a 10 fold increase in the use of printed circuits for business machines and computers is anticipated. The use of printed circuits for the wiring of electronic test instruments is also a fast developing market. One manufacturer was reported as using six square feet of copper clad laminate printed circuits for one instrument. Labor savings by conversion to printed circuits run as high as 60% according to this manufacturer.

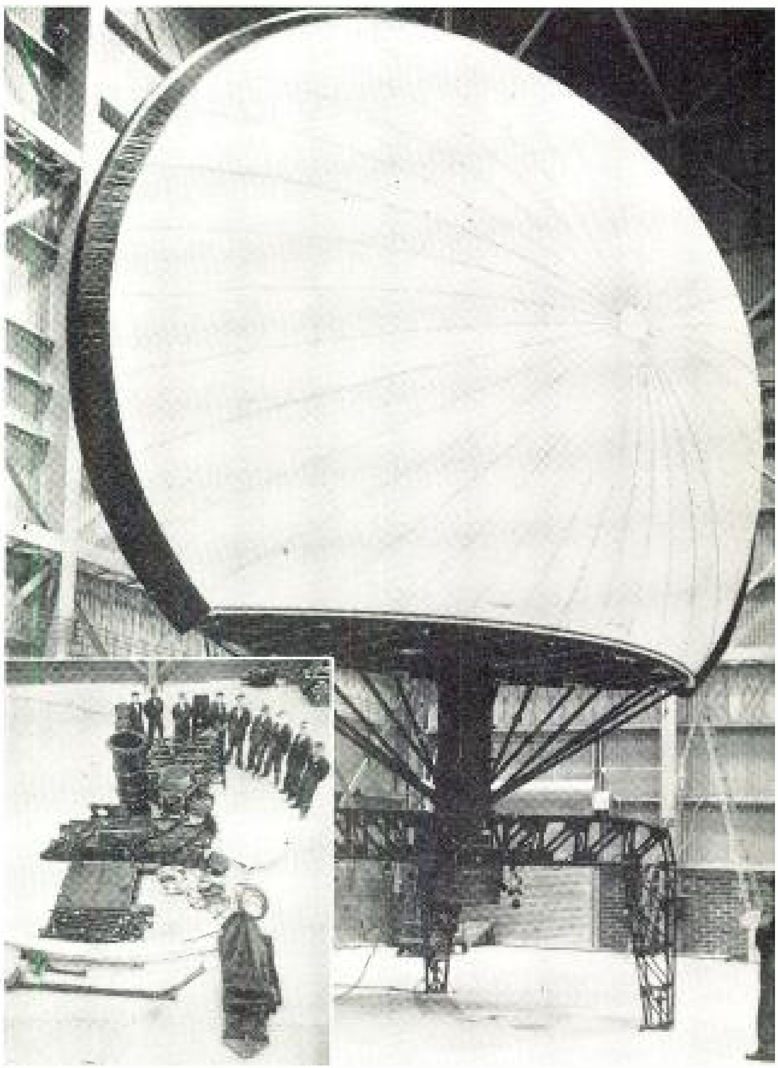
Printed circuits are now being developed for application in the power field also. A ½-in. wide copper strip on a glass base laminate carries 100 amperes of current without ill effects.

The automotive industry is looking toward printed circuitry as a means of resolving circuit interconnection problems under the dash board.

Automation in printed circuit manufacture appears to be on the horizon too. Dry Screen Process Inc., Pittsburgh, Pa. demonstrated their new machine which can produce 18x18 in. printed circuits at the rate of 600 per hour. Soon to be introduced will be an automatic etching unit capable of producing finished etchings at the same rate in the same size.

On page 53 of this issue ELECTRONIC INDUSTRIES presents a complete, up-to-date listing of the technical specifications for the 317 transistors now commercially marketed. Next month, look for the
1957 SEMICONDUCTOR DIODE SPECIFICATIONS

MOBILE RADAR



New "Paraballoon" radar antenna, developed by Westinghouse, consists of two inflated parabaloids, one coated with vaporized aluminum to form the reflector. Unit is designed to be air-dropped, and easily erected. Antenna dismantled is shown in inset with radar team.

H+ THERE IS ONLY ONE MAGNET WIRE WITH AN EXTREMELY HIGH SPACE FACTOR CAPABLE OF SUCCESSFUL, CONTINUOUS OPERATION AT **250°C**

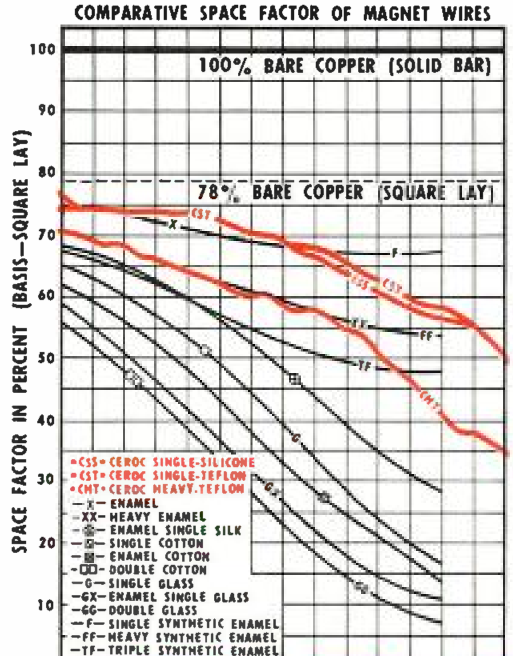
IT IS SPRAGUE'S . . . Ceroc®

CERAMIC INSULATED MAGNET WIRE

CEROC is an extremely thin and flexible *ceramic* insulation deposited on copper wire. *This ceramic base insulation is unaffected by extremely high temperatures.* Thus, in combination with silicone or Teflon overlays, Ceroc insulations permit much higher continuous operating temperatures than are possible with ordinary insulations.

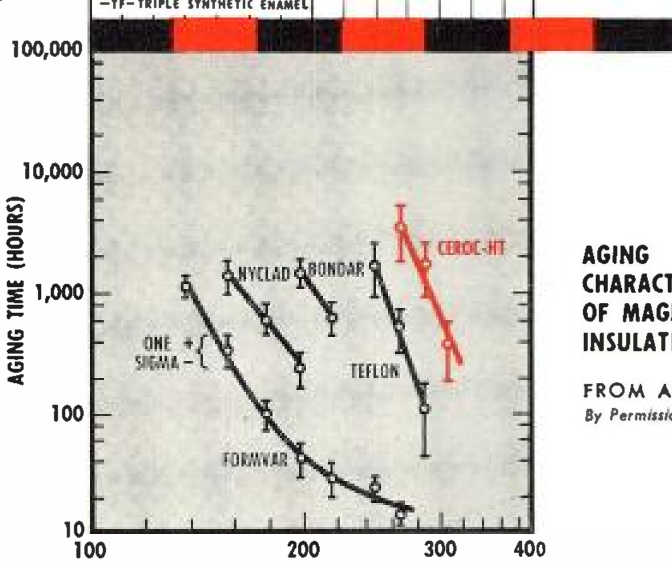
There are three standard Ceroc Wires: Ceramic Single-Teflon and Ceramic Heavy-Teflon for operation at 250°C feature unique characteristics of flexibility, dielectric strength and resistance to moisture. They have been used successfully to 300°C in short time military applications. Ceramic Single-Silicone, for 200°C application, pairs the ceramic with a silicone reinforcement to facilitate winding.

All three Ceroc Wires have far superior cross-over characteristics to all-plastic insulated wire—all provide an extraordinarily high space factor that facilitates miniaturization with high-reliability standards.



COMPARATIVE SPACE FACTOR OF MAGNET WIRES

ENLARGED CROSS-SECTIONS OF CEROC® COPPER MAGNET WIRE



AGING CHARACTERISTICS OF MAGNET WIRE INSULATIONS

FROM AIEE 55-48
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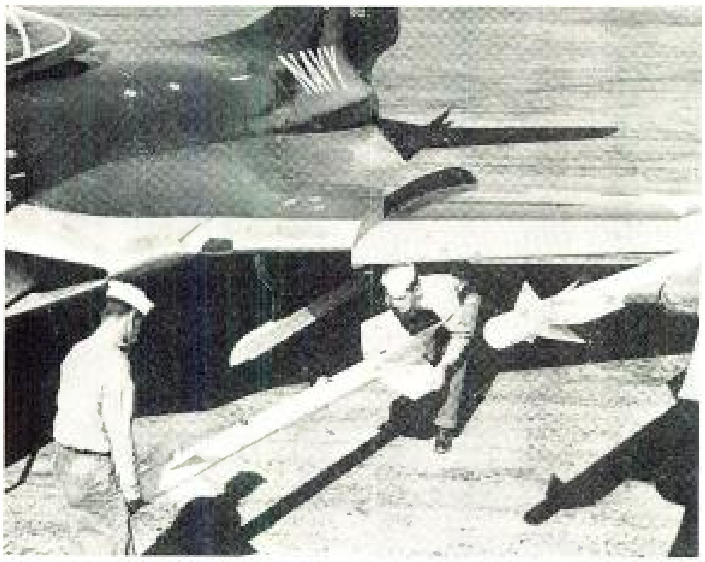
SPRAGUE ELECTRIC COMPANY
233 MARSHALL ST. . NORTH ADAMS, MASS.

For product information, use inquiry card on page 105.

As We Go To Press...



"Sidewinder" Guided Missile is being produced for the Navy's Bureau of Ordnance by Philco Corp., Govt. & Industrial Div., in Philadelphia. A lightweight, air-to-air missile, it can be carried in quantity by single-seat interceptor planes and fired singly or in salvos with high reliability.

"Sidewinder" Missile Produced for Navy

No special pilot training is required for the "Sidewinder," a light, deadly, air-to-air guided missile now being produced by Philco's Govt. and Industrial Div., Philadelphia, for the Navy's Bureau of Ordnance.

Missile, named for a vicious rattlesnake, is small and light enough to be carried in quantity by single-seat interceptor planes. It may be fired singly or in salvos and requires no complex launching equipment; it is fully maneuverable at supersonic speeds and has a high single-shot "kill" reliability.

Sidewinder may be launched well beyond reach of an enemy aircraft's defense. Its course can be changed to account for tactical movements of an enemy target.

Missile, Atomic Gun Unveiled by the Army

Some wraps have been taken off the Army's Redstone ballistic missile, and a new 175-mm. gun, a substitute for the cumbersome 280-mm. atomic cannon, has been announced.

At Aberdeen Proving Ground. Md., the Army said the missile travels at supersonic speed and can be fitted with an atomic warhead. The 175-mm. gun has a bore of 7 in., compared to 11 in. of the atomic cannon, and weighs 37 tons against 87. Gun was developed by Franklin Institute, Philadelphia, and the Watertown, Mass., and Watervliet, N. Y., arsenals.

NEW TV ANTENNA

New high-powered VHF helical TV broadcast antenna developed by General Electric. Three-bay antenna features simplified design; it weighs 7,700 lbs, measures 80 ft. in length.

Westinghouse Unveils Mobile Radar Antenna

Developed to detect high-flying aircraft and strengthen American and allied defense networks, the Paraballoon antenna has been announced by Westinghouse Electric Corp. for the U. S. Air Force. This lightweight, mobile radar set has long range and may be quickly erected and dismantled.

Radar antenna has two paraboloids, one coated on the inside with vaporized aluminum to form the radar reflector, which are joined at their rims and inflated. This Paraballoon antenna radar and its electronic equipment are protected by an air-supported radome, which is lightweight, sectionalized and designed to erect directly on the ground.

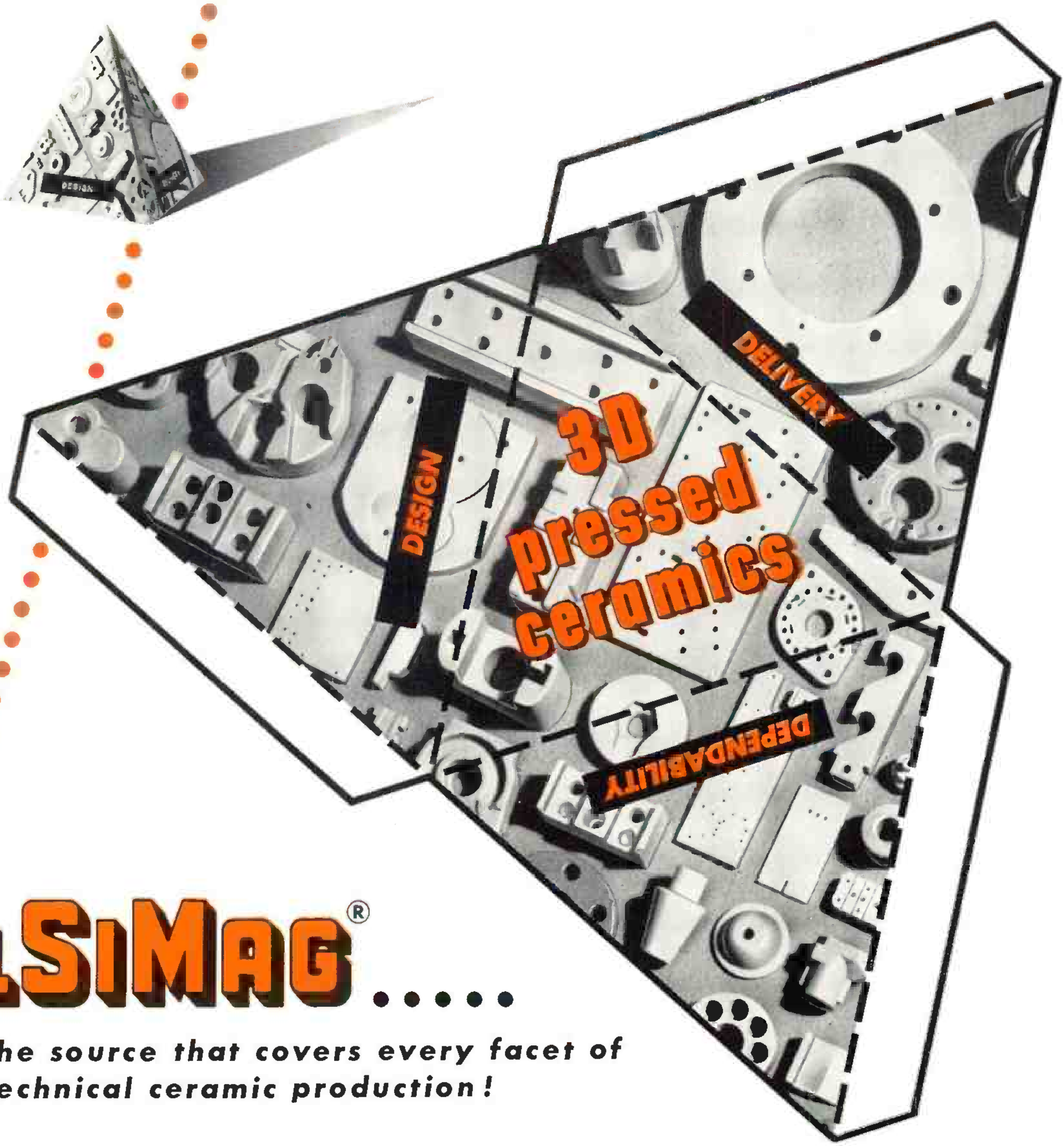
No special fixtures are required for checking the reflector surface contour when inflated antenna is erected. When packed in its special cases, entire radar set may be air-dropped.

Electro-Standards Unit Enlarges Testing Scope

Expanding its Qualification-Testing Program, the Armed Services Electro-Standards Agency (ASESA), Fort Monmouth, N. J., recently inaugurated an extensive program providing for qualification testing of electronic and electric parts in commercial testing labs and in the plants of parts manufacturers.

Equipment manufacturers, commercial testing labs and parts manufacturers are encouraged to obtain additional information from the Director, ASESA, Fort Monmouth.

MORE NEWS on page 7



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DELIVERY—As promised. Facilities for any volume. Line-ups of modern, high-speed automatic presses—rotaries, single stroke types, domestic, imported. Specialized equipment for every operation. Dies produced in our own shop. Enormous kiln capacity. Staffed by experts dedicated to getting jobs done!

DEPENDABILITY—Widest choice of special characteristic materials in the industry. Compositions carefully matched to requirements. Proven production techniques. Quality Control throughout. Constant research and development. Over half a century of experience in supplying technical ceramics exact to specification.

DESIGN—Wider range—simplest to most intricate. Miniatures, multi-planes, wafer thins. Precision tolerances. Prototypes for test purposes. Free redesign service to improve efficiency, cut manufacturing costs. We produce parts others fear to try!

***Your* problems might be solved by AlSiMag Pressed Ceramics. Why not try them and see? Send blueprint or sketch with details of operating procedure for complete information.**

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As We Go To Press . . .

Radio Fall Meeting Award to Podolsky

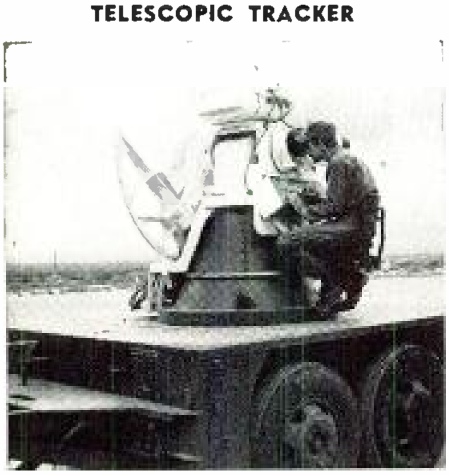
Cited for his excellent work in the electronic field, Leon Podolsky, Tech. Asst. to the President of Sprague Electric Co., North Adams, Mass., was given the gold plaque award at the recent 28th Fall Meeting of RETMA and IRE held in Syracuse. Recognition was for work in standardization in field of components.

Medal awarded at 1957 Radio Fall Meeting

Sylvania Shuts Plant

A leveling off of the market for black-and-white TV sets was given as the reason for the recent closing of Sylvania Electric Products' TV picture tube plant at Hatboro, Pa., near Philadelphia. Plant employed 450 and is one of four Sylvania units making picture tubes.

TELESCOPIC TRACKER



New tracker designed by Army Signal Corps Eng'g Labs has 400-lb lens of 160-in. focal length, tracks and photographs missiles, rockets, and jets up to 300 miles away.

More News on Page 11

ELECTRONIC SHORTS

Use of new microwave radar link, equipped with high-quality repeaters, enabled Marconi's Wireless Telegraph Co. recently to transmit radar info. from London Airport to Plan Position Indicator (P.P.I.) 20 miles away at Farnborough. Link used traveling-wave tubes and was capable of relaying radar pictures over 3 or 4 separate channels. Without link, radar center has to be near associated scanning equipment.

Raytheon and General Precision Lab demonstrated to U. S. Air Force officials a combination of Raytheon's CPS-9 storm detector radar GPL TVS cameras and Raytheon TV microwave relays that can bring a 200,000 sq. mi. weather picture directly to AF operations centers. System provides prevailing visual weather info. from a central source to specific locations.

Columbia University, New York, held Joint Program for Technical Education recently to plan search for high school students capable of filling U. S. need for scientists and engineers; it was first of a conference series . . . And a special program to train more students in the physical sciences is under way at Antioch College, Yellow Springs, Ohio, using evening courses, science workshops, and films to teach mathematical concepts.

Admiral Corp., Chicago, trained over 3,000 distributor and dealer servicemen for color TV installation during first 10 months of 1956.

TV Allocations Study Organization (TASO) launched by NARTB to conduct research in technical aspects of UHF and VHF broadcasting.

U. S. Air Force awarded contract to RCA and Honeywell's Aero Div. for design and development of complete and integrated electronic weapons system for the CF-105 jet combat plane of Royal Canadian Air Force. Project includes development of automatic flight controls and a complete electronic fire control radar system.

TV Bureau of Advtg. plans TV info. center—called Televic—using electronic "brain" to provide instant access to latest facts and figures on TV advertising for agencies and advertisers. Info. will be stored continuously in machine's memory.

KRON-TV, San Francisco, announced two machines that can operate any TV station automatically—the Automatic Broadcast Program System and the Automatic Sequential Program Switcher. First unit handles all switching procedures up to a full day; the other, for pre-determined periods up to 99 seconds. Both can be pre-set.

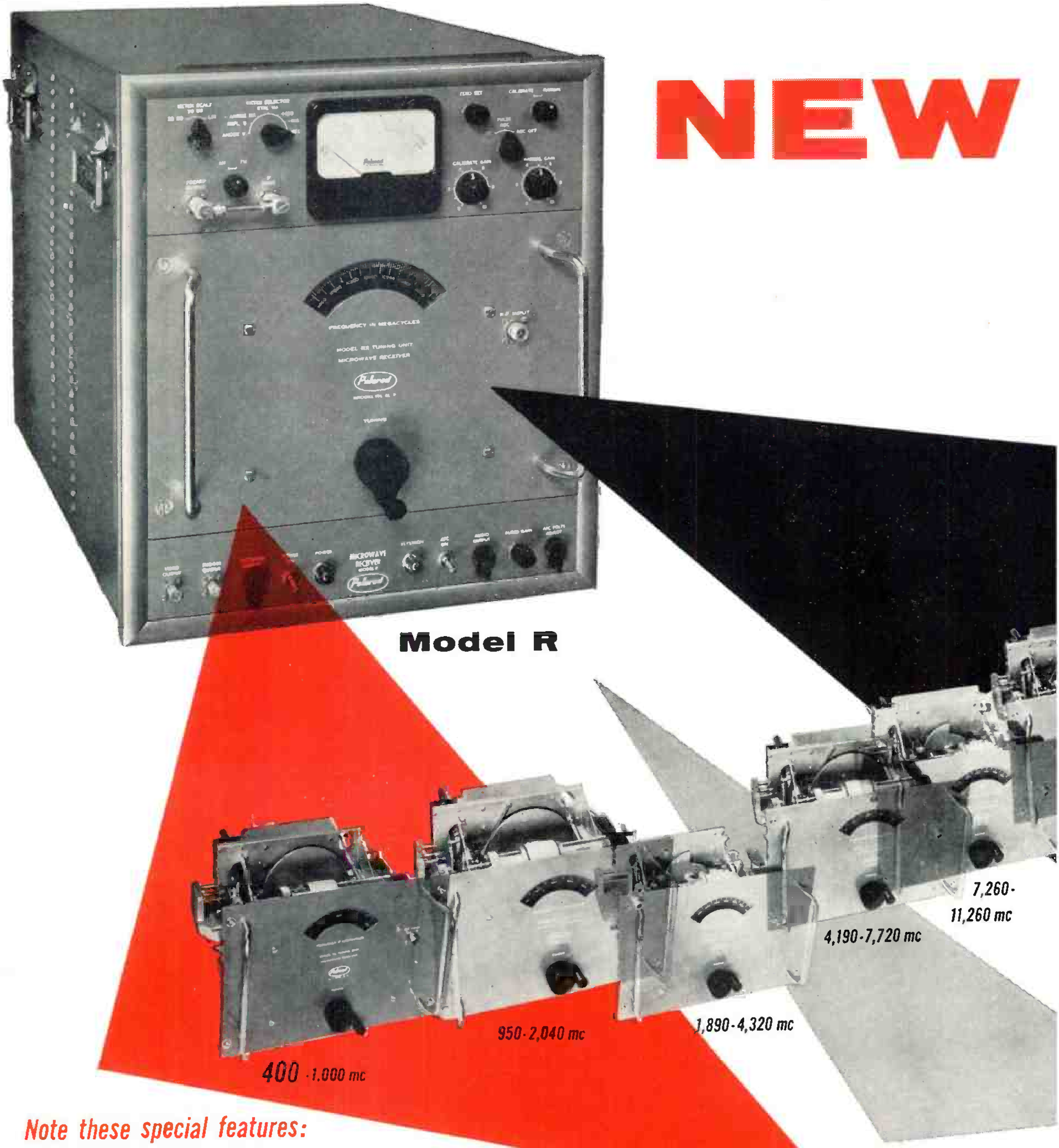
Predicted for 1966: Rocket-powered bombers capable of traveling more than five times the speed of sound, and nuclear-powered aircraft with unlimited range within the world's atmosphere, according to F. C. Ruling, Mgr., General Electric's Aviation & Defense Industries Sales Dept.

Kellogg Credit Corp., New York, an IT&T subsidiary, will expand its operations to include financial assistance to customers of all divisions and subsidiaries of IT&T.

At least 30, and perhaps 100, artificial moons will be launched before the first manned rockets voyage into space, say space physicists, who expect that satellites "in ever increasing sizes" will soon be commonplace.

Short SHORTS: Cornell-Dubilier, So. Plainfield, N. J., acquired majority stock interest in Tobe Deutschmann Corp., Norwood, Mass. . . . McDonnell Aircraft Corp., St. Louis, got $58,000,000 order from Navy for F3H-2N Demon supersonic all-weather fighters . . . Sperry Gyroscope, Great Neck, N. Y., given initial $2,293,000 U. S. Air Force contract for development of electronic guidance system for advanced drone aircraft . . . NBS Very Low Frequency Propagation Symposium set for Jan. 23-25, 1957, at Boulder, Colo. . . . Airborne Instruments Lab, Inc., Mineola, N. Y., acquired Mountain Systems, Inc., Thornwood, N. Y., makers of special-purpose business data equipment . . . Sparks-Withington, Jackson, Mich., got stockholder approval to change name to Sparton Corp. . . . Ultrasonic Corp., Cambridge, Mass., acquired Weathers Industries, Barrington, N. J., makers of hi-fi sound equipment . . . AMP, Inc., is new name of Aircraft-Marine Products, Inc., Harrisburg, Pa.

NEW



Note these special features:

- AM, FM, CW, MCW, and PULSE reception.
- Uni-dial control.
- Direct reading.
- Broadband coverage.
- Output level reading directly in db.
- High sensitivity.
- Seven interchangeable plug-in r-f tuning units cover the entire frequency range.
- Low noise figure; excellent gain stability.
- Microwave preselection, tracked and double-tuned, used in the plug-in tuning units covering the range 400 to 11,260 mc.
- Audio, video, and trigger outputs.
- Special recorder output.
- High video output—low impedance.
- AGC and AFC circuits.

For these applications:

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

For product information, use inquiry card on page 105.

EXTENDED RANGE MICROWAVE RECEIVER!

400 to 22,000 mc

Three new r-f tuning units double the frequency range of the well-known Polarad Microwave Receiver. Now more than ever the Model R becomes a basic multi-purpose instrument for microwave research and production in the field, in the laboratory, and in the factory.

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

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

Call any Polarad representative or direct to the factory for detailed specifications.

SPECIFICATIONS:

Basic Receiver: Model R-B

Tuning Unit Frequency Ranges:

Model RR-T	400 — 1,000 mc
Model RL-T	950 — 2,040 mc
Model RS-T	1,890 — 4,320 mc
Model RM-T	4,190 — 7,720 mc
Model RX-T	7,260 — 11,260 mc
Model RKS-T	9,500 — 15,600 mc
Model RKU-T	14,700 — 22,000 mc

Signal Capabilities:
AM, FM, CW, MCW, pulse

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

Frequency Accuracy: ±1%

IF Bandwidth: 3 mc

Video Bandwidth: 2 mc

Image Rejection:
(a) For Models RR-T thru RX-T: Greater than 60 db
(b) For Models RKS-T and RKU-T: Spurious response rejection obtained through the use of a bandpass filter

Gain Stability with AFC: ±2 db

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

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

Trigger Output:
Positive 10-volt pulse across 100 ohms

Audio Output:
5 volts undistorted, across 500 ohms

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

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

IF Rejection: 60 db

Input AC Power:
115, 230 V ac, 60 cps, 440 watts

Input Impedance:
Models RR-T through RX-T: 50 ohms
Models RKS-T & RKU-T: waveguide

VSWR: Less than 4:1 over the band

Range of Linearity: 60 db

Receiver Type: Superheterodyne

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

Video Response: 30 cps to 2 mc

Size: 17″ w x 23″ d x 19″ h

Weight: 180 lbs. for basic unit with one tuning unit.

AVAILABLE ON EQUIPMENT LEASE PLAN

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ELECTRONICS CORPORATION
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For product information, use inquiry card on page 105.

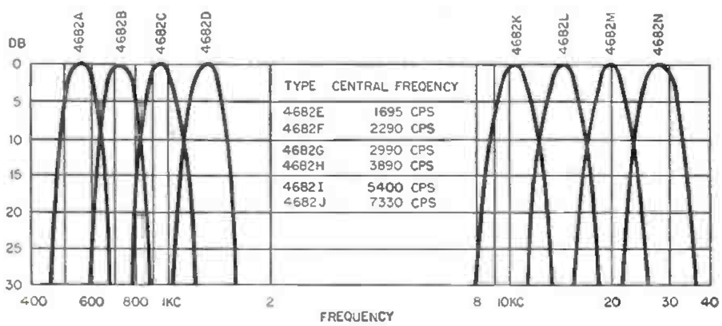
)UR MILLIONTH FILTER SHIPPED THIS YEAR...

FILTERS

FOR EVERY APPLICATION

ELEMETERING ILTERS

TC manufactures a wide variety of nd pass filters for multi-channel lemetering. Illustrated are a group filters supplied for 400 cycle to KC service. Miniaturized units ve been made for many applicaons. For example a group of 4 cubic ch units which provide 50 channels tween 4 KC and 100 KC.



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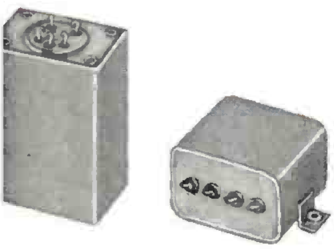
(4682A) 1½ x 2 x 4"



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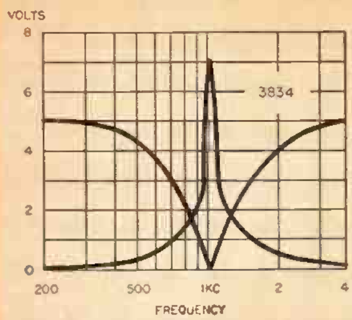
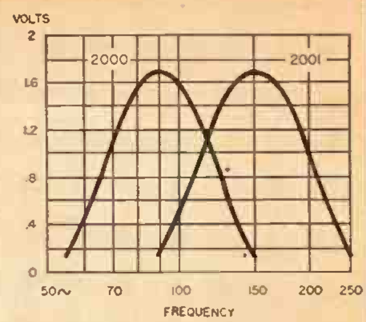




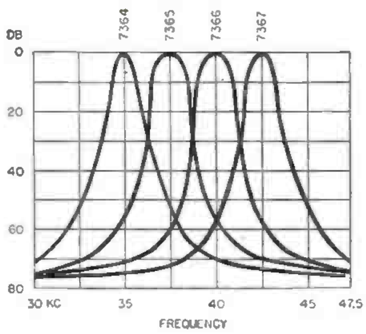
AIRCRAFT FILTERS

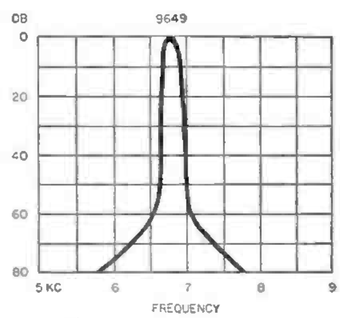
UTC has produced the bulk of filters used in aircraft equipment for over a decade. The curve at the left is that of a miniaturized (1020 cycles) range filter providing high attenuation between voice and range frequencies.

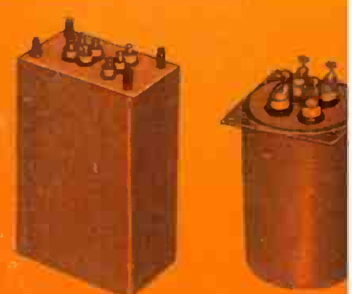
Curves at the right are that of our miniaturized 90 and 150 cycle filters for glide path systems.

:ARRIER ILTERS

wide variety of carrier filters are vailable for specific applications. his type of tone channel filter can e supplied in a varied range of band idths and attenuations. The curves hown are typical units.



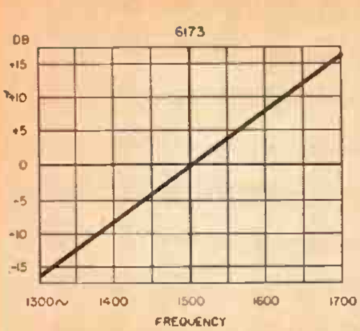


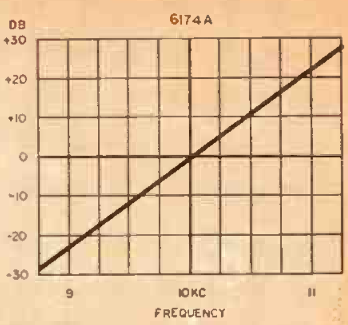


Dimensions:
(7364 series) 1⅝ x 1⅝ x 2¼".
(9649) 1½ x 2 x 4".

ISCRIMINATORS

hese high Q discriminators provide xceptional amplification and lineary. Typical characteristics available re illustrated by the low and higher equency curves shown.





Dimensions:
(6173) 1-1/16 x 1⅜ x 3".
(6174A) 1 x 1¼ x 2¼".

or full data on stock UTC transformers, eactors, filters, and high Q coils, write or Catalog A.

UNITED TRANSFORMER CO

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As We Go To Press . . .

Electronic Fuel Injection By Bendix

A new electronic fuel-injection system, completely transistorized, has been introduced to the automotive industry by the Bendix Aviation Corp. for use on passenger cars.

The timed, self-priming system, called the Electrojector by Bendix engineers of the Eclipse Machine Div., is now ready to be adapted to engines of any car manufacturer.

The system, described as quiet and clean by Bendix engineers, consists of an electronic modulator—"brain box" of the unit—a fuel-injection distributing commutator, fuel-injection breaker points, and

Bendix officials show details of "Electrojector" all-electronic fuel injection system

fuel-injection nozzles especially designed to minimize dirt problems. It is the first system to be developed that does not require a special drive off the engine.

The timing, sensing, and actuating elements—which will automatically control fuel flow to the engine under all operating conditions — feature an electronic pressure sensor, located on the throttle body. Also on the body is an electronic switch to sense and signal the need for proper fuel mixture, either for acceleration or idling. A third feature on the throttle body is an automatic cut-off switch that will cut down the smog problem created by exhaust gases.

The thermistor is located in the water jacket to sense and pass along temperature data to the electronic modulator for optimum performance in starting and warming up.

The 4 x 5-in. "brain" of the system is the transistor-equipped electronic modulator. It receives a timed signal from the distributor-breaker. It coordinates this signal with information from the devices that electronically sense engine operating conditions and continuously sends the correct action signal to injectors located at each cylinder intake port.

Electrojector literally shoots jets of fuel, electronically timed, into the intake ports of an engine's cylinders. Fuel is metered by intake - manifold pressure, controlled automatically by a sensor on the throttle unit, which provides precisely the right amount of fuel at the proper time.

Another outstanding feature of the new automatic unit is its distributor-breaker, which can be installed on any conventional distributor.

Coming Events

A listing of meetings, conferences, shows, etc., occurring during the period December into 1957, that are of special interest to electronic engineers

Dec. 5-7: 2nd IRE Instrumentation Conf. & Exhibit, PGI, Atlanta Section; at the Biltmore Hotel, Atlanta.

Dec. 10-12: Eastern Joint Computer Conference, sponsored by the PGEC, AIEE and the ACM; at the Hotel New Yorker, New York.

Jan. 14-15, 1957: Symp. on Reliability & Quality Control in Elec., sponsored by the PGRQC, ASQC and RETMA; at the Statler Hotel, Washington.

Jan. 23-25, 1957: Very-Low Frequency Symposium, sponsored by Denver-Boulder chapter of PGAP and the Boulder Lab., Nat'l Bureau of Standards; at the NBS Boulder Labs., Boulder.

Jan. 28-31, 1957: Plant Maintenance & Engrg. Show and Plaint Maint. & Engrg. Conference; at Public Auditorium, Cleveland.

Jan. 30, 1957: Electronics n Aviation Day, sponsored by the PGANE, IAS and RTCA; at New York

Feb. 7, 1957: Operations Research Symposium, sponsored by PG on Eng'g Management—Phila. Section, IRE, and SIAM; at Univ. Museum, Univ. of Pa., Philadelphia.

Feb. 14-15, 1957: Transistor & Solid State Circuits Conf., sponsored by IRE, AIEE and Univ. of Pa.; at Univ. of Pa., Philadelphia.

Feb. 26-28, 1957: Western Joint Computer Conf., sponsored by IRE, AIEE and ACM; at Statler Hotel, Los Angeles.

March 11-15, 1957: The 1957 Nuclear Congress, incl. International Atomic Exposition; sponsored by AICE and four other engineering societies—**AIMMPE, ASME, ASCE and AIEE; 2nd Nuclear Engrg. & Science Congress**, sponsored by Engineers Joint Council; **5th Atomic Energy in Industry Conf.**, sponsored by NICB: and **Hot Labs Committee's 5th Hot Labs & Equipment Conf.**; all events in Convention Hall, Philadelphia.

March 18-21, IRE National Convention, sponsored by all P.G.'s; at the Waldorf-Astoria Hotel, New York.

April 7-11, 1957: Annual Convention of NARTB; at Conrad Hilton Hotel, Chicago.

April 7-11, 1957: Broadcasting Eng'g Conference and 35th Annual NARTB Convention; at Conrad Hilton Hotel, Chicago.

April 14-27, 1957: U. S. World Trade Fair; at the Coliseum, New York.

May 20-24, 1957: Design Engineering Show; at the Coliseum, New York.

June 16-21, 1957: 60th Annual Meeting, American Society for Testing Metals; in Atlantic City.

Oct. 7-9, 1957: National Electronics Conference; in Chicago.

Oct. 28-29, 1957: 4th Annual East Coast Conference on Aeronautical and Navigational Electronics, sponsored by IRE Baltimore Section and PG on Aeronautical and Navigational Electronics; in Baltimore.

Oct. 28-30, 1957: Radio Fall Meeting, sponsored jointly by IRE PG groups and RETMA; at King Edward Hotel, Toronto.

Nov., 1957: New England Radio Engineering Meeting, sponsored by Region 1, IRE; in Boston.

Dec., 1957: Eastern Joint Computer Conference, sponsored by IRE-PGEC, ACM and AIEE; in Washington.

Abbreviations:

AICE: American Inst. of Chemical Engrs.
AIEE: American Inst. of Electrical Engrs.
AIMMPE: American Inst. of Mining, Metallurgical & Petroleum Engineers
ASCE: American Society of Civil Engineers
ASME: American Soc. of Mechanical Engrs.
ASTM: American Society for Testing Materials
IAS: Inst. of Aeronautical Sciences
IRE: Institute of Radio Engineers
ISA: Instrument Society of America
NARTB: National Assn. of Radio & TV Broadcasters
NICB: National Industrial Conference Board
RETMA: Radio-Electronic-TV Mfrs. Assn.
ACM: Assn. for Computing Machinery
SIAM: Society of Industrial and Applied Mathematics

"to honor an inestimable benefactor of mankind . . . He will be remembered when all the rest of us are long forgotten."

A statement by HERBERT HOOVER at a Testimonial to Dr. de Forest, April 8, 1952

Dr. Lee de Forest

His invention of the 3-Electrode Grid Vacuum Tube fifty years ago in 1906 was the birth of today's Electronics Industry.

THE WHITE HOUSE
WASHINGTON

March 16, 1956

Dear Dr. de Forest:

. . . I congratulate you on your many contributions to scientific progress. Through your long and distinguished career you must have experienced many moments of pride that your imagination and talent furthered the development of modern radio, television and radar. You must also feel great satisfaction in remembering your past decades of service and in anticipating future achievements that your handiwork has made possible . . .

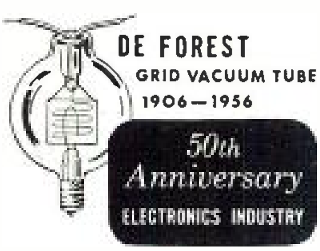
Sincerely,

Dwight D. Eisenhower

The Measure of a Mighty Contribution

Of all the creations shaped by his genius, Dr. de Forest's 3-element grid Audion tube—the miracle seed responsible for the swift growth of electronics—best reflects his enormous gift to mankind.

To understand this vastness, appraise the value of the lives spared in wartime and protected in peacetime . . . and add these seemingly limitless electronic inventions fathered by his precious Audion.



TELE-TIPS

ELECTRONIC FATHERS . . . In the years to come Dr. William Shockley, recipient of this year's Nobel prize, will undoubtedly come to be known as the father of the transistor just as today Dr. Lee de Forest is known as the father of the three-element vacuum tube. Interestingly enough, 1956 is the 50th anniversary of the audion, and two booklets in commemoration of this event have now been published.

TV IN AUTOMOBILES might be practical at that. A closed circuit system using infra-red sensitive camera tubes could provide a means for night driving. Cars would no longer be bothersome because of glaring headlights.

RADIO-TV service shop in Cincinnati is displaying an interesting new sign in its window. "We repair 'Do it Yourself' work."

PRINTED CIRCUIT developments over recent years have made some startling cost reductions possible. In today's 21-in. TV's circuit costs are about 1/5 that in 1950.

TUBE CHECKERS for the public are now making their appearance. "U-Test-M," a Milwaukee, Wis. manufacturer, provides an emission type tester using 118 tube sockets and a go no-go type meter. You can find such checkers standing alongside the stamp vending machines in drug stores.

MORE TELEPHONES NEEDED along highways. Roadbuilding in the U. S. is shortly due for a great upsurge. Thus far no plans have been revealed which would make it possible for motorists to obtain phone service at reasonable intervals along the highways. Apparently this service is still to be available only at roadside gas stations and restaurants. Additional facilities at road pull-off points might well be added because aside from permitting traveling motorists to communicate the installations can be used as emergency service call points.

(*Continued on page* 14)

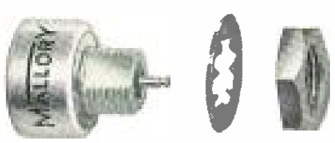
MALLORY

At temperatures from —55° to +200° C, Mallory XT Tantalum Capacitors maintain stable capacity, series resistance and impedance . . . and provide long life.

Mallory Tantalum Capacitors

lead in long, stable life at extreme temperatures

New Mounting Designed for heavy shock and vibration



Mallory XT tantalum capacitors are now available in a single hole mounting design which will withstand severe shock and vibration. A flatted neck with ½-20 threads fits through a keyed slot in the chassis . . . is held in place by a lock washer and hex nut. Assembly takes only seconds . . . requires no strap or other hardware. This design is supplied in a variety of ratings, with cases up to 2¼" in height. Write for information.

WHEN YOU design for extreme temperatures . . . in military electronic equipment, miniaturized apparatus and the like . . . be sure to choose capacitors that you *know* will meet severe conditions.

Specify Mallory XT tantalum capacitors . . . proved by test and field usage to give consistently long, stable service across an extremely wide temperature range. Pioneered by Mallory, these units embody design and production techniques developed during twelve years of research and manufacturing in the high temperature capacitor field.

Standard XT's cover the range from —55° C to +175° C. When specified, they can be supplied rated for continuous operation at 200° C. A complete selection of capacitance and voltage values is available.

Representative performance data, based on sampling tests representing hundreds of thousands of capacitors, is now available on Mallory tantalum capacitors. To see for yourself the specifications which these units can be relied upon to meet, write today for our latest Technical Bulletin.

Serving Industry with These Products:
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
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Parts distributors in all major cities stock Mallory standard components for your convenience.

Expect more . . . get more from

P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

For product information, use inquiry card on page 105.

TELE-TIPS

(*Continued from page* 12)

A SHORT-RANGE RADIO that would permit the captains of passing ships to confer with each other was recommended to the Radio Technical Commission for Marine Services. It was pointed out that bridge - to - bridge communication could be invaluable in preventing collisions and in aiding search and rescue operations.

RADAR speed meters are increasing speed violation arrests up to 60%. A total of 1,400 radar sets have been licensed and new installations are being added at a rate of 50 per month.

A PUNCH COMPUTER that automatically totals the number of solid punches landed by a boxer will simplify the scoring of fights. Sensing element is a bladder type unit in the glove which triggers a counter when a substantial blow is struck.

TV DX'ing attempt by NBC's experimental center at Riverhead, N. Y., finally paid off. After repeated efforts they brought in a faint image from a London, England, TV station. NBC officials described it as "a fuzzy but recognizable image of a woman which lasted less than a minute."

NEWEST AIR SAFETY recommendation by the CAA calls for aircraft to be painted with a fluorescent paint that will make the plane stand out against any background.

TRANSISTORS need never be replaced if used within the limits set by the manufacturer, according to GE's Semiconductor Products Dept. In life tests being conducted at GE transistors picked at random from regular manufacturing lots show no failures after 18,000 working hours at full power. This is equal to maximum load on the transistors eight hours a day for six years. And even after 18,000 hours the transistors look and act like new transistors.

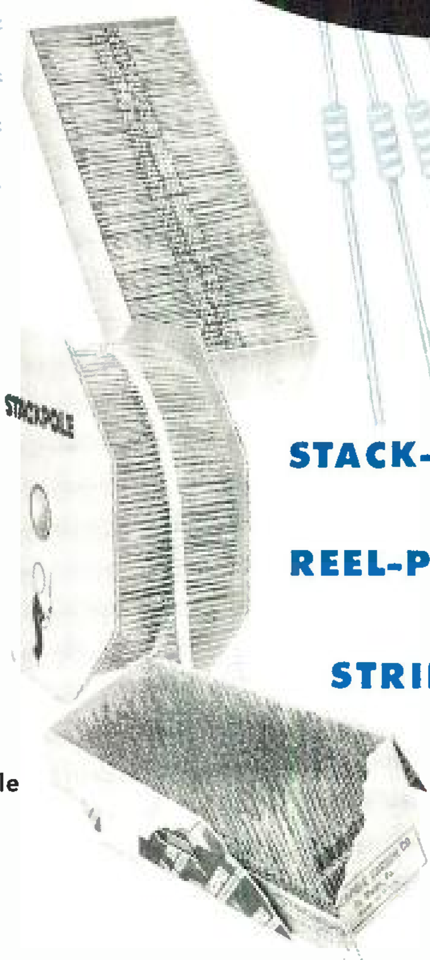
Meet or surpass today's critical performance requirements with

STACKPOLE

fixed composition

RESISTORS

Packaged for convenient assembly... MANUAL or AUTOMATIC



Conservatively rated at 70° C.

Low noise level.

Unsurpassed humidity protection.

Easy-to-solder, firmly anchored leads.

STACK-PACK

REEL-PACK

STRIP-PACK

Drawings available for detailed packaging specifications.

Electronic Components Division
STACKPOLE CARBON COMPANY
St. Marys, Pa.
Canada:
Canadian Stackpole Ltd.,
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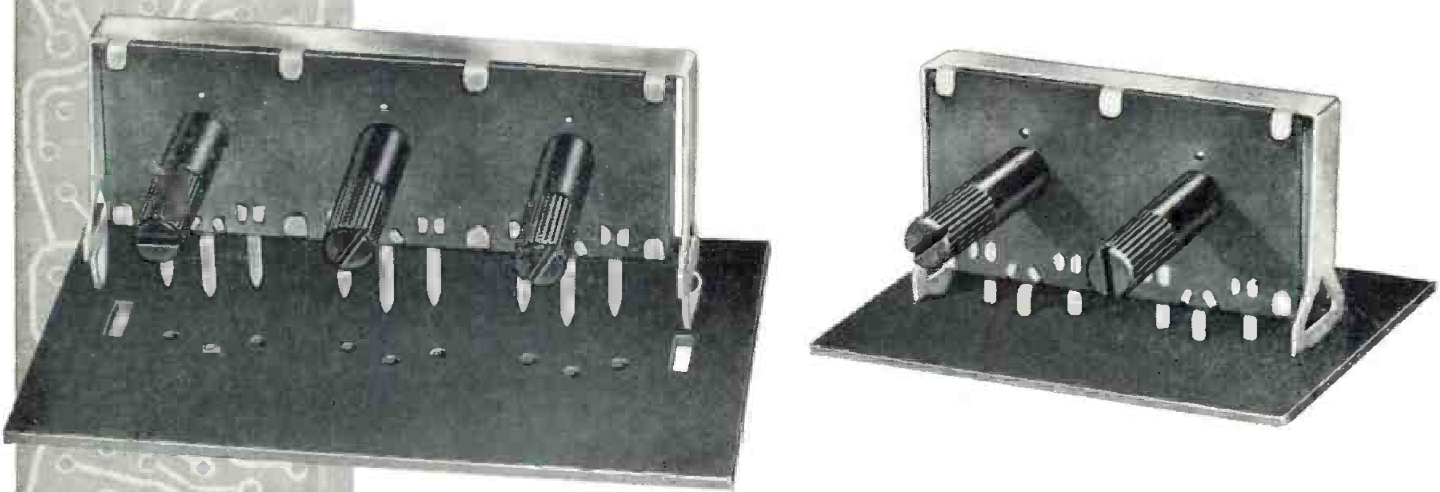
Toronto 14, Ont.

Stackpole Fixed Composition Resistors are stocked by leading parts distributors

For product information, use inquiry card on page 105.

MULTIPLE VARIABLE RESISTORS
designed specifically for PRINTED CIRCUITS

SNAP INSTANTLY INTO PLACE—REMAIN FIRMLY LOCKED



Illustrations are actual size—note compact multiple units

CONSERVES PANEL SPACE—REDUCES HANDLING COSTS

A NEW TOTALLY FUNCTIONAL DESIGN CONCEPT

1. Snaps instantly into place with full length sturdy spring supports that lock control rigidly to printed panel.
   Wide shoulders provide rugged support.
   No mounting hardware, no separate support needed.
2. Compact multiple units conserve panel space, reduce handling costs and number of automatic assembly stations.
3. The only variable resistor with external contour designed specifically for mechanized handling and feeding into a printed panel.
4. Exclusive clip-off mounting supports and terminals for easy removal by service man without a solder pot.
5. Mounts upright with shafts parallel to printed panel, eliminating need for shaft protection during panel solder immersion.
6. Available in 2-control units (Series X52) or 3-control units (Series X53) as illustrated.

Many other types of controls available for your printed circuit and automation needs.

A CTS control can be tailored to your specific requirement. Let CTS SPECIALISTS help solve your current control problems. Write or phone today.

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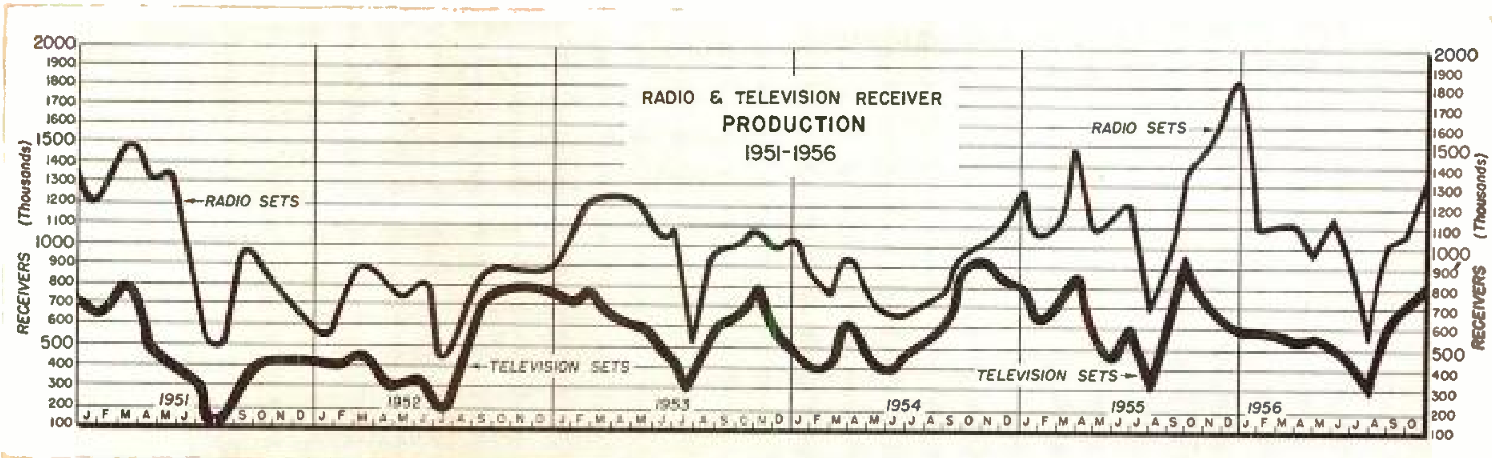
ELKHART • INDIANA

The Exclusive Specialists in Precision Mass Production of Variable Resistors

BURTON BROWNE ADVERTISING

TOTALS



TRANSISTOR PRODUCTION

1956	Factory Production (Units)	Factory Sales (Dollar Value)
January	572,000	1,893,000
February	618,000	1,739,000
March	708,000	2,056,000
April	832,000	2,196,000
May	898,000	2,198,000
June	1,131,000	3,645,000
July	885,000	2,330,000
August	1,315,000	3,660,000
TOTAL	6,959,000	19,717,000

(From statistics supplied by RETMA)

ELECTRONIC PARTS DISTRIBUTORS

Year	Number in Business	Year	Number in Business
1945	1,030	1951	1,350
1946	1,200	1952	1,370
1947	1,300	1953	1,380
1948	1,320	1954	1,425
1949	1,300	1955	1,679
1950	1,300		

—RETMA Fact Book

Number of Producers of Functional Types of Electronic Test Instruments by Employment Size Groups

	Over 500*	150 to 500*	50 to 150*	15 to 50*	Total**
Voltage & Current Measuring Inst.	2	2	15	17	36
Frequency & Time Interval Measuring Inst.	3	7	11	25	46
Impedance & Standing Wave Ratio Measuring Inst.	3	4	10	22	39
Power & Electromagnetic Field Measuring Inst.	2	5	13	11	31
Waveform Measuring and/or Analyzing Inst.	3	6	19	17	45
Signal Generating Inst.	3	10	19	43	75
Active Network Type Inst., For Test and Measurement Purposes	3	4	14	17	38
Passive Network Type Inst., for Test and Measurement Purposes	2	4	17	21	44

* Engaged in Electronics Test Instrument production

** Of firms having more than 15 employees engaged in Electronics Test Instrument production

From "The General-Purpose Electronics Test Instrument Industry"—U. S. Dept. of Commerce.

GOVERNMENT ELECTRONIC CONTRACT AWARDS

This list classifies and gives the value of electronic equipment selected from contracts awarded by Government procurement agencies in October, 1956.

Amplifiers	323,754	Radar Equipment	394,652
Amplifiers, R F	131,127	Radio Receivers	381,727
Amplifiers, Servo	44,279	Radio Receivers-Transmitters	38,709
Battery Chargers	77,345	Radio Transmitters	103,215
Batteries, Dry	185,733	Record Players	183,307
Batteries, Storage	735,671	Recorders & Accessories	56,728
Cable Assemblies	58,205	Rectifiers, Metallic	85,160
Computers & Accessories	1,834,868	Relays	38,731
Connectors	75,159	Switches	26,940
Headsets	72,701	Telemetering Equipment	37,918
Insulators	28,050	Teletype Equipment	109,159
Kits, Radio Modification	619,932	Test Sets, Misc.	999,386
Meters	282,730	Test Sets, Radar	432,476
Meters, Frequency	366,619	Transformers	59,391
Oscilloscopes	127,722	Tubes, Electron	2,426,737
Power Supplies	184,629	Vibrators	38,560
Radar Components & Spares	290,574	Wire & Cable	502,963

More than 40,000 persons engaged in the manufacture of TV sets.

10% of the patents issued in 1955 were held by the U. S. Government.

By 1960 Finland expects to have 4 TV stations and 1 relay station covering 1.59 million people.

There are 477 licensed TV stations in the U. S.

The West Coast market is growing from 12-14% annually.

Approximately 50 manufacturers out of 3600 in the electronic industry account for over 80% of the dollar spent.

Missile and rocket expenditure has increased from $21 million in 1951 to almost $1 billion in 1955.

Military electronics is expected to maintain a level of $2.4 billion for the next few years.

Nearly 900,000 mobile, base, and portable transmitters are in operation.

Transistor sales in 1955 nearly tripled over 1954.

Research expenditures by the U. S. Government and industry amounts to more than $4 billion annually.

Industrial electronic apparatus sales in 1955 was approximately $700 million.

'Hi-Fi' sales are expected to exceed $500 million in retail sales this year.

Mexico has approximately 200,000 TV sets in use.

Of the 45 million homes in the U. S. wired for electricity, 78-80% are inadequately wired.

BOOKS

Handbook of Basic Circuits, TV-FM-AM

By Matthew Mandl. Published 1956 by The MacMillan Co., 60 Fifth Ave., New York 11. 383 pages. Price $7.50.

The book should appeal to all interested in electronics, for it provides a source of ever-ready reference material on a wide variety of transmitting, receiving, and general purpose circuits. The essential data on virtually every different type of circuit encountered in radio, TV, and audio will be found for the first time within a single volume.

This book lends itself readily for use in the periodic review of circuits found so necessary by all practicing technical personnel. For each of the 136 circuits described herein there are: (1) a schematic diagram, (2) a description of the place the circuit occupies in electronic equipment, (3) a discussion of the purpose of the circuit, and (4) a description of its characteristics and function.

Spectroscopy at Radio and Microwave Frequencies

By D. J. E. Ingram. Published 1956 by Philosophical Library, Inc., 15 E. 40th St., New York 16. 344 pages. Price $15.00.

Although approaching the subject in a general way, considerable space is given to the design of experimental apparatus for those who wish to set up such spectroscopes, and in considering the applications of the technique a balance is preserved between fundamental and applied research. The theory is given for each of the three main branches of the subject and although detailed mathematical treatment is avoided, this is illustrated at some length by reference to the various experimental results.

Color Television

Published 1956 by Philco Corp., P. O. Box 9817, Philadelphia 40, Pa. 154 pages, price $5.00.

Produced by Philco's Electronic Education Unit, this textbook presents simplified theory and service techniques. This usually complex subject has been described in easy-to-understand terms, and is generously illustrated in color for further simplification. A review of monochrome TV is presented in Chapter One. Subsequent chapters deal with colorimetry, composite color signals, typical circuitry, color CRT, adjustment and alignment, and trouble shooting and set-up considerations.

(Continued on page 26)

For product information, use inquiry card on page 105.

Electronic Industries News Briefs

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

EAST

GENERAL ELECTRIC CO., Syracuse, announced formation of Missile and Ordnance Systems Dept., Defense Electronics Div., with headquarters in Philadelphia.

RADIO CORP. OF AMERICA, Camden, and **PHILCO CORP.**, Philadelphia, among firms receiving contracts from Air Materiel Command. Dayton. RCA's Engrg. Products Div. got $9,800,946 award for engineering services and reports for fire control system; Philco, a $3,642,000 contract for tech. services on electronic and communications equipment.

IBM CORP., New York, predicted a 1956 gross income of $704,000,000—an increase over 1955 of 25%.

DAYSTROM, INC., Elizabeth, N. J., announced contract for its Nuclear Div. to build equipment for Curtiss-Wright Corp.'s research reactor at Quehanna, Pa.

O'HARA ASSOCIATES, a new firm offering professional engineering services, is located at 112 Dewitt St., Syracuse 3.

NEUTRONICS RESEARCH CO., founded at 165 Lake St., Waltham, Mass., for R & D work in countermeasures, communications, medical devices, educational devices, and control circuits. Partners are: Dr. Harry Stockman, H. Philip Hovnanian and E. James Johnston.

DUNLAP & ASSOCIATES, INC., 429 Atlantic St., Stamford, Conn., announced Workshop in Manager Development starting Jan. 31, 1957, in New York for 10 successive Thursdays. Two-hour sessions, at Columbia U. Club, cover management, job performance, personnel development, planning, application. For information, check with Dr. B. J. Covner.

RETMA, Washington, announced that the Statistical Dept. is now called Marketing Data Dept.

DE FOREST PIONEERS, INC., Mineola, N. Y., marking 50th year of electronics as an industry with special publications and tributes to Dr. Lee de Forest.

DR. PAUL J. FLORY, Cornell University, named Executive Director of Research at Mellon Institute. His duties are part-time until Summer of 1957, when he starts full-time. Dr. Flory will plan and guide the investigational future of the Institute.

NEW YORK TRANSFORMER CO., Alpha, N. J., and **ESSEX ELECTRONICS**, Berkeley Heights, N. J., joined forces to expand the former's product line. New officers of Essex include: J. B. Schaefer (Pres. of NYT), Chairman of the Board, and B. M. Goldsmith (Pres. of Essex), President and General Manager.

SERVO CORP. OF AMERICA, New Hyde Park, N. Y., awarded an Army Signal Supply Agency contract for development of an infrared detector system for drone aircraft surveillance.

THE NEW YORK AIR BRAKE CO. has acquired Optical Film Engineering Co., Philadelphia, to be operated at its present location as the parent company's Vacuum Equipment Div. Products of new unit include components and systems for TV tubes, and various applications for the electronics industry.

AIRTRON, INC., Linden, N. J., has opened a Cambridge Div., at 317 Vassar St., Cambridge, Mass., which is a microwave ferrite components center, including research, design, development and production facilities.

MID-WEST

NATIONAL CASH REGISTER CO. and **PITNEY-BOWES, INC.**, announced 10-year agreement to cooperate in developing and producing "sorter-readers" of checks and other original forms for use in connection with electronic data processing machines.

BURROUGHS CORP., Detroit, plans to spend about $73,000,000 for expansion in 1957 and 1958, announced K. C. Tiffany, Vice President-Finance.

NATIONAL UNION ELECTRIC CORP., New York, bought assets of Armstrong Furnace Co., Columbus, for nearly $4,000,000. Armstrong manufactures and markets warm air heating and air conditioning equipment for both home and industry.

CHRYSLER CORP., Detroit, has named James H. Carmine a Consultant on merchandising and marketing. The former President of Philco Corp., Philadelphia, is still on Philco's board and finance committee.

ADMIRAL CORP., Chicago, has begun an extensive National advertising compaign, using all major media, to promote new TV, radio, phonograph and appliance lines.

WEST

RAYTHEON MFG. CO.'s Chicago Laboratory has moved to Santa Barbara, Calif.

ARNOUX CORP., Los Angeles, received $300,000 order from Thompson Products, Inc., for a high-speed electronic data processing system, to be installed at Thompson's Aircraft Fuel Systems Research Facility, Inglewood, Calif.

J. B. REA CO., INC., Santa Monica, received $275,000 in production contracts for Readix II Computers and Rea analog-to-digital converters. Computers were ordered by duPont and Edwards Air Force Base, Pasadena: Edwards AF Base at Muroc, Calif., and Naval Air Missile Test Center, Point Mugu, Calif., ordered converters.

WESTERN ELECTRONIC SHOW & CONVENTION (WESCON), Los Angeles, appointed Don Larson as Business Manager. He was formerly General Mgr., West Coast Electronic Mfrs. Assn., a co-sponsor of WESCON.

BILL WEST ADVERTISING, 369 So. Robertson Blvd., Beverly Hills, is the new name of Don Larson Advertising, now under new management. West assumes full responsibility for former Larson agency; Larson is devoting full time to WESCON as Business Manager.

CANNON ELECTRIC CO., Los Angeles, expanding East Coast facilities with acquisition of 100,000 sq. ft. on 10-year lease in Salem, Mass., Industrial Center for its Diamond Division.

MINNESOTA MINING & MFG. CO. named Francis C. Healey to General Manager's post for its new Mincom Div., Los Angeles, formerly the Electronics Div. of Bing Crosby Enterprises. John T. Mullin is Research Director of the unit.

KAAR ENGINEERING CORP., Palo Alto, manufacturer of mobile radiotelephones, is marketing some of its products through radio and electronics parts distributors having industrial sales departments, instead of direct to users. Distributors will be serviced by technically trained manufacturer's reps in some sections of the country.

LITTON INDUSTRIES, Beverly Hills, has announced the purchase of Triad Transformer Corp., Los Angeles. Acquisition includes Triad's Indiana subsidiary, Utrad Corp., and gives Litton nine U. S. plants.

DALMO VICTOR CO., Belmont, Calif., has moved into its new $1,500,000 plant where all offices and production lines have been consolidated into the 180,000 sq. ft. building. Firm, a Division of Textron, Inc., Providence, R. I., acquired eight acres of adjacent land for future expansion.

WEBER AIRCRAFT CORP.'S Electronics Div. has moved into a new air-conditioned building next to company headquarters in Burbank, Calif.

RESIN INDUSTRIES, Santa Barbara, Calif., has opened new offices in the Borden Co. plant at Compton, Calif. Firm is a subsidiary of Borden's Chemical Div.

DAYSTROM PACIFIC CORP.'S new million-dollar plant in Westchester, Calif., was scheduled for groundbreaking early in the Fall, with occupancy planned for the office-research-manufacturing structure in Feb., 1957. The unit, which includes the American Gyro Div., is now in Santa Monica. New 50,000 sq. ft. building is on a seven-acre site.

UNIVERSITY OF CALIFORNIA, Berkeley, is establishing a new computer lab with an IBM 701 to assist in basic scientific and industrial research, and to train experts in computer techniques.

FOREIGN

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Chelmsford, Essex, England, has supplied the complete radio receiving station for a new international radio system at Addis Ababa, ordered by the Imperial Board of Telecommunications of Ethiopia.

FEDERAL CARIBE, INC., organized at Santa Isabela, Puerto Rico, as manufacturing subsidiary of Federal Telephone & Radio Co., Clifton, N. J. New unit produces selenium rectifiers, starter switches for fluorescent lights, and other electronic components.

BENDIX AVIATION CORP. purchased 40% interest in Computing Devices of Canada, Ltd., Ottawa. Agreement includes sales and licensing arrangement by which Ottawa firm will handle Bendix electronic products and missile components, and also exchange engineering developments.

GATES RADIO CO., Quincy, Ill., sold a Model BC-50B 50,000 watt broadcast transmitter to Radio Station XET, Monterrey, Mexico.

LENKURT ELECTRIC CO., San Carlos, Calif., formed a corporation in Mexico to manufacture Lenkurt communications equipment. E. J. Rudisuhle, of Palo Alto, elected Vice President-General Manager of Lenkurt de Mexico.

BRITISH LABORATORY WARE ASSN., LTD., London, announced that, to contribute to its Government's price stabilization policy, laboratory furnishers who are Association members have decided to stabilize prices of lab equipment and apparatus, other than chemicals, they manufacture and distribute for six-month period from 1 Sept. 1956. Decision applies to prices fixed by each laboratory furnisher individually and is subject to wage and materials costs' remaining stable.

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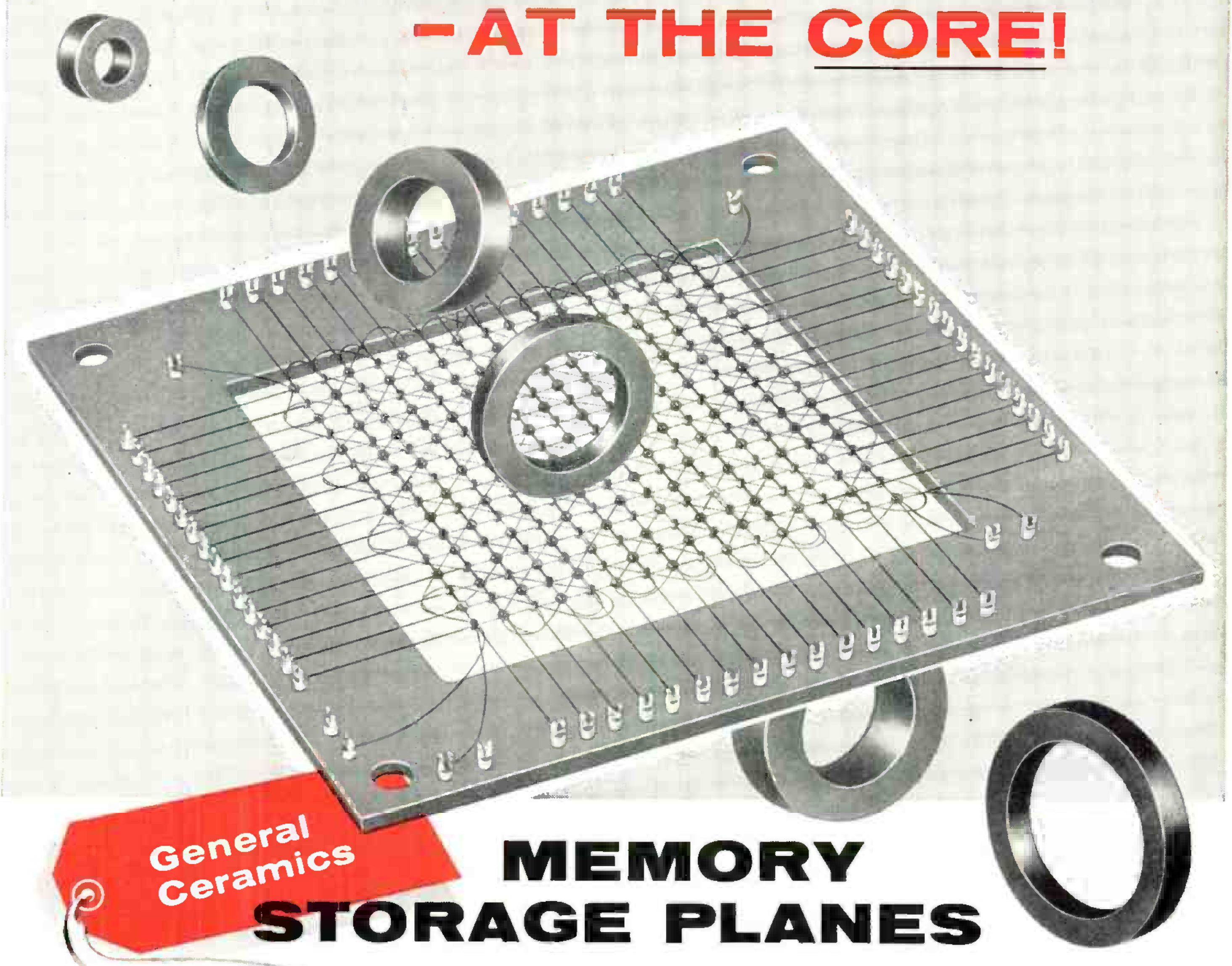

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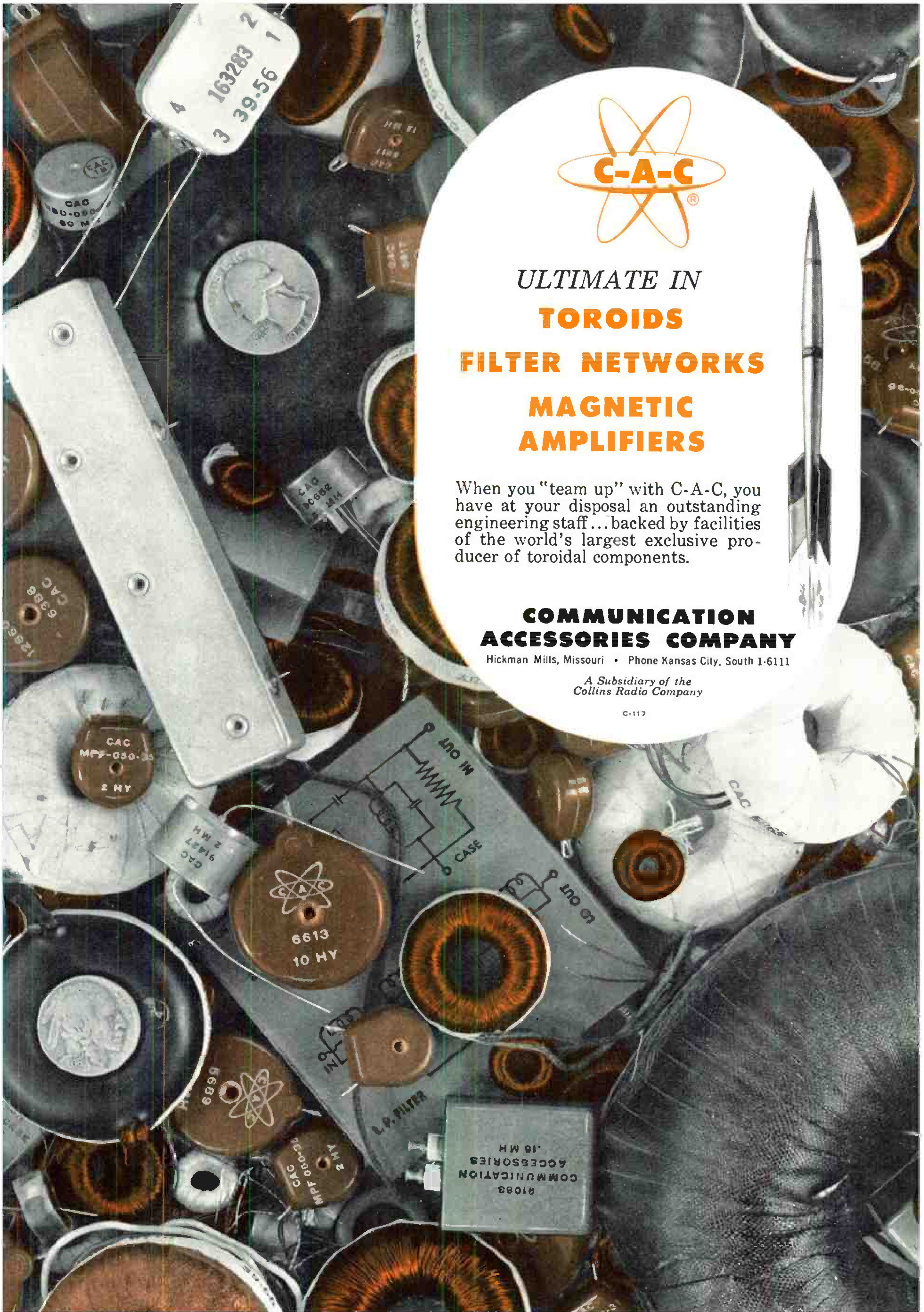
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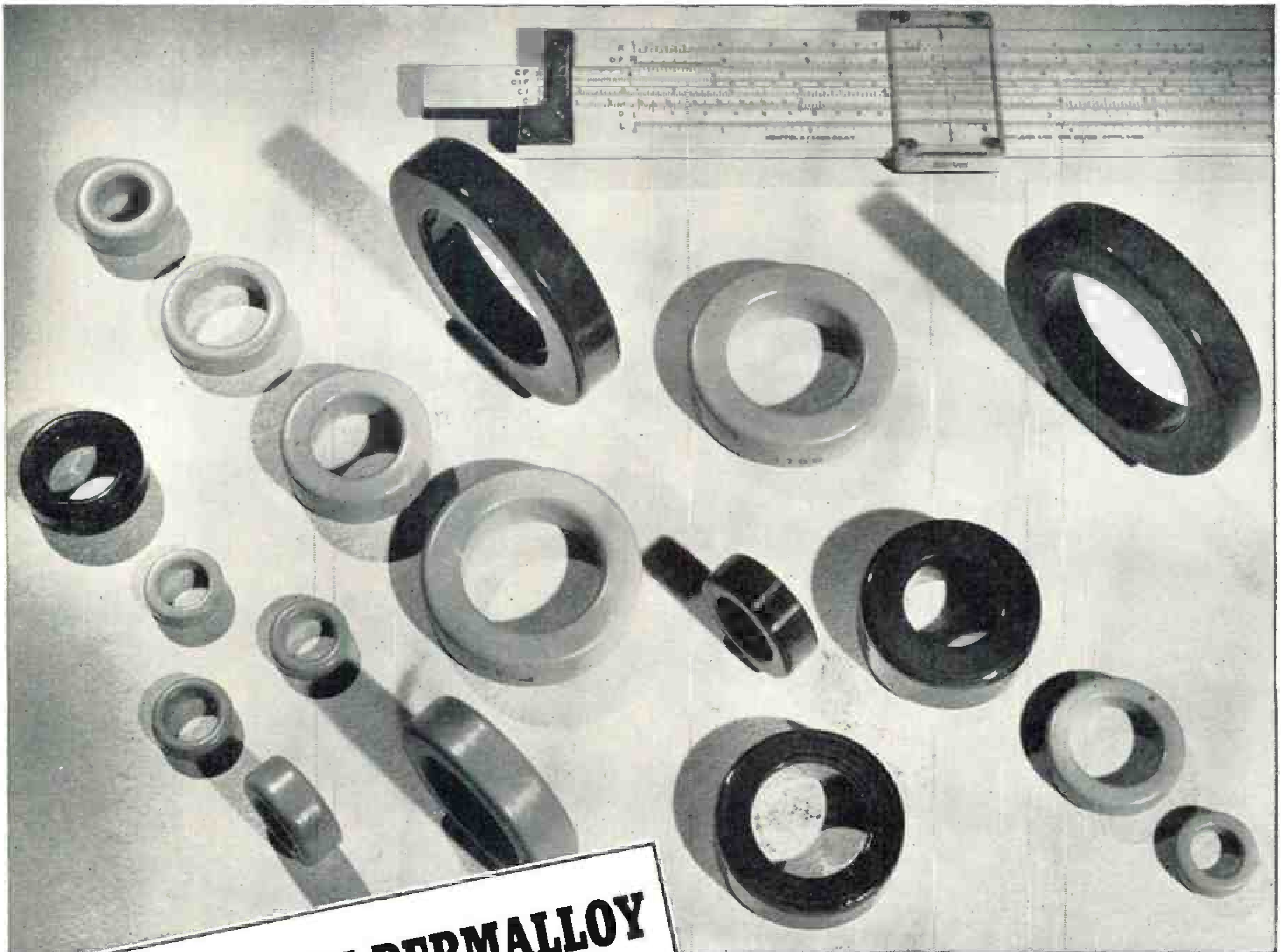

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(New technical data now available)
Write for Bulletin PC-104B, dated October, 1956

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(Continued from page 18)

Mathematics for Electronics with Applications

By H. M. Nodelman & F. W. Smith. Published 1956 by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36. 399 pages. Price $7.00.

This text approaches the problem of presentation in an unique manner. The practical applications that industry makes of mathematics, rather than the mathematical theory itself is emphasized deliberately. Student motivation is therefore increased considerably.

In 6 parts, the book successively treats the calculus, dimensional analysis, matrix algebra, series approximations, Laplace transforms, and Boolean algebra. Interwoven with this mathematics, the parts present case histories of practical applications, solution of electronic networks, prediction of nonlinear electronic device behavior, and a study plan for electronic specialists.

Basic Research in Electronics

Published 1956 by U. S. Department of Defense, Office of the Assistant Secretary of Defense, Research and Development, Washington 25, D. C. 49 pages. Paper bound.

Consultants to the Department of Defense present suggestions for basic research areas in the field of electronics which, in their opinion, need additional support at this time.

Books Received

RCA Magnetrons and Traveling-Wave Tubes

Published 1956 by Tube Division, RCA, Harrison, N. J. 40 pages, paper bound. Price 50¢.

Application of Transistors in Military Electronics Equipment

Published 1956 by U. S. Dept. of Commerce, Office of Technical Services, Washington 25, D. C. 508 pages. Price $5.00.

Linear Transient Analysis, Vol. II

By Ernst Weber. Published 1956 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16. 452 pages. Price $10.50.

The Art and Science of Protective Relaying

By C. Russell Mason. Published 1956 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16. 410 pages. Price $12.00.

Inverse Feedback (Electronic Tech. Ser.)

By Alexander Schure, Ph.D., Ed.D. Published 1956 by John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y. 56 pages, paper bound. Price $0.90.

RCA Power & Gas Tubes

Published 1956 by Tube Div., RCA, Harrison, N. J. 24 pages, paper bound. Price 20¢.

IMC Electrical Insulation Manual

Published 1956 by Insulation Mfgrs. Corp., 565 W. Washington Blvd., Chicago 6, Ill. 300 pages. Heavy paper cover, spiral binding. Price $5.00.

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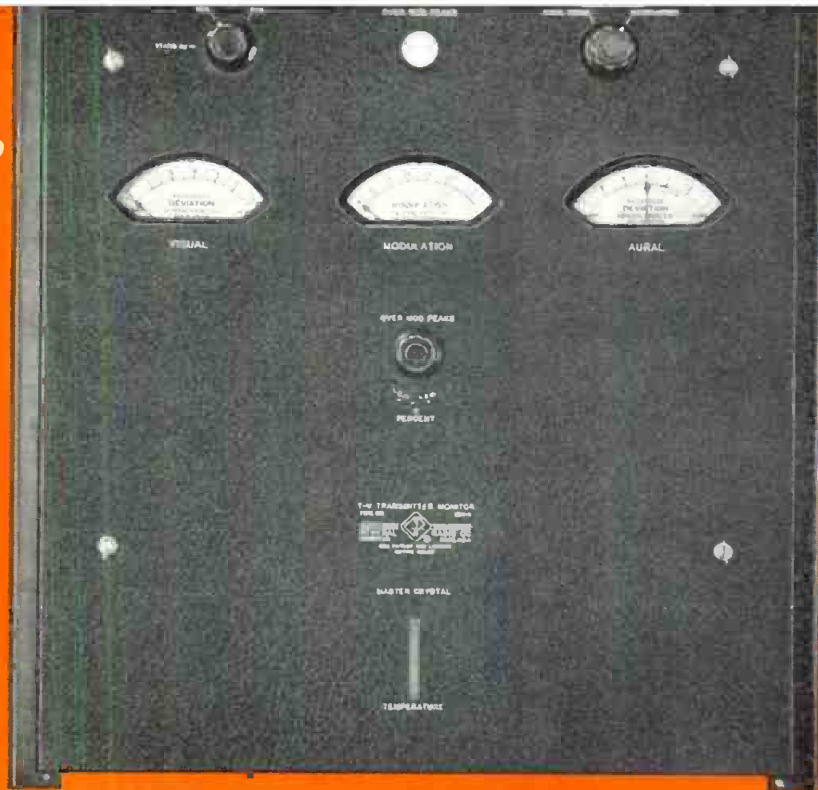

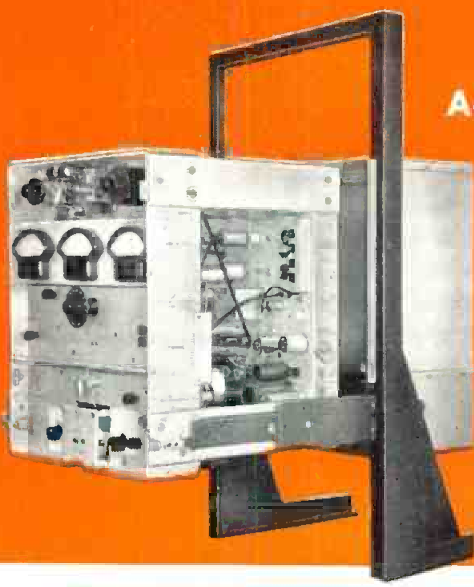

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Unique chassis marking is so comprehensive that most maintenance can be performed without need of instruction book or circuit diagram.

Flow lines showing signal paths between tubes, adjustments and test points immensely simplify circuit tracing — Red-Amber-Green color code flags attention, clearly marks relative importance of various adjustments.

Key voltages are conveniently checked by panel meters — pin jacks permit rapid check against normal current and voltage values printed at each test point.

Type 1184-A TV Transmitter Monitor, $2650

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. . . meets or exceeds all new FCC Color-TV Standards and Provides for Additional Functions Not Yet Required

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Continuous audible monitoring against loss of either carrier, and continuous meter monitoring of f-m noise on the visual carrier are important new conveniences. The complete intercarrier sound-detection system is typical of the additional operating aids and functions built into this instrument — the response provided is identical to that of an intercarrier-type receiver, making possible realistic correlations of transmitter performance with receiver listening tests.

Reliability is far beyond normal requirements for laboratory-type electronic instruments. Conservative tolerances take into consideration the effect of time on components and the possible tightening of FCC specifications, they permit use of "off-the-shelf" tube replacements and provide for non-critical adjustments, insuring reproducible measurements.

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INDUSTRY NEWS

Cecil R. Russell appointed Vice President of J. B. Rea Co., Inc., Santa Monica, and **Lloyd E. Schumacher** reassigned as Vice President-Customer Relations.

John C. Merman named Director of Mfg. for Remington Rand Univac Div., Sperry-Rand Corp., in Philadelphia.

A. R. Hopkins in new post of Manager, Commercial Electronic Marketing Dept., RCA, Camden.

A. R. Hopkins

M. J. Gaut

Marvin J. Gaut appointed Manager, Electronic Div., Otis Elevator Co., Brooklyn.

Herman J. Schorle appointed Director of Manufacturing by Pyramid Electric Co., North Bergen, N. J.

John J. Burke elected Vice President-Engineering, Hallamore Electronics Co., Anaheim, Calif.

Richard M. Klein appointed to new post of Product Engrg. Mgr., Electronic Product Sales Dept., Sylvania Electric Products, Inc., New York.

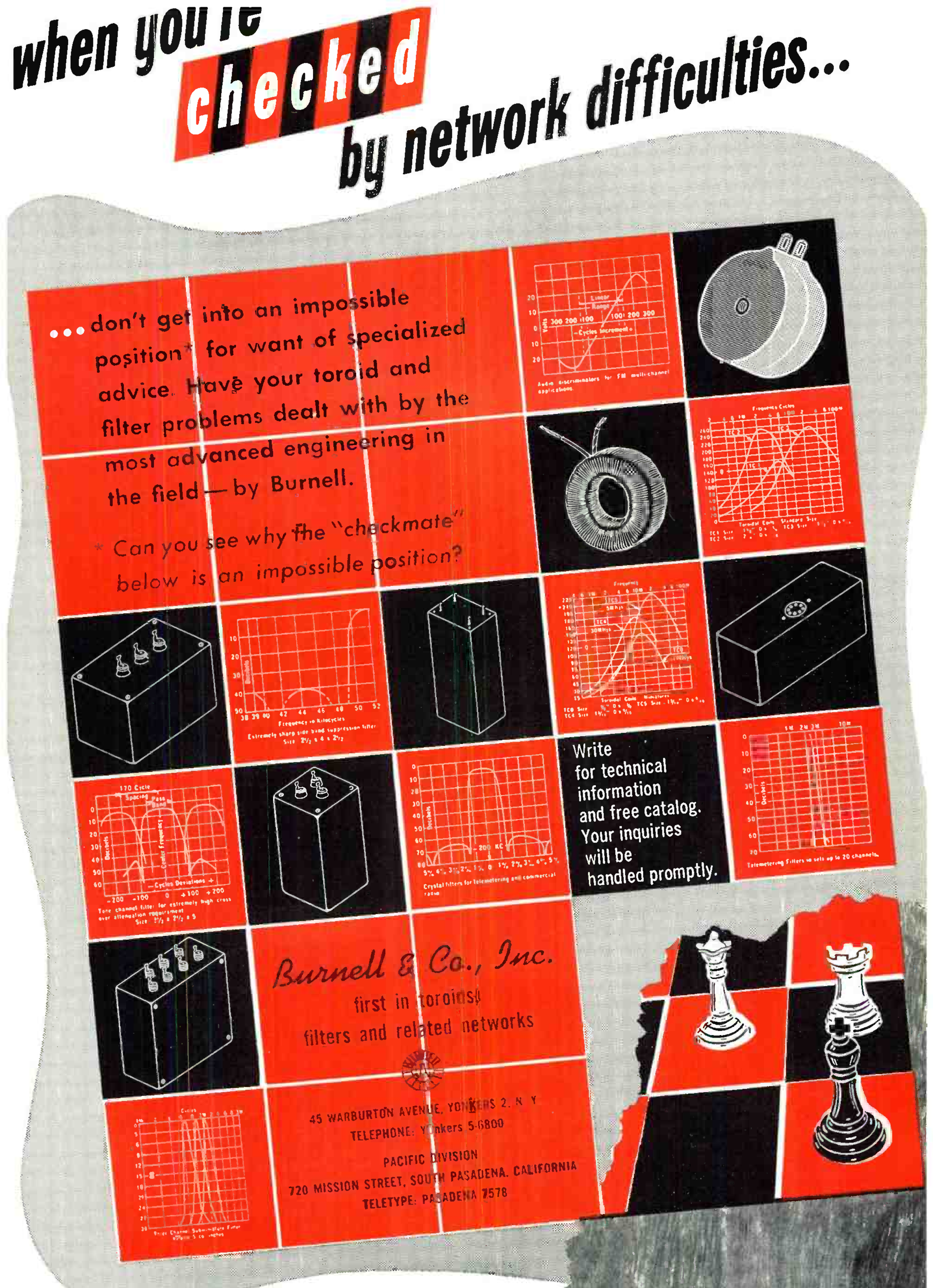
Barton Kreuzer, Director-Product Planning for RCA, Camden, elected President, Society of Motion Picture & TV Engineers (SMPTE), for 1957-58.

Herman B. Amster named Mgr. of Industrial Engrg. for the radio product line, at Federal Telephone & Radio Co., Clifton, N. J.

George Friedl, Jr., to Litton Industries, Beverly Hills, as a Vice President.

Donald N. Martin joined executive staff, National Assn. of Radio & TV Broadcasters (NARTB), Washington, as Asst. to President in charge of Public Relations.

Philco Corp., Philadelphia, formed separate departments for sales promotion and advertising with **Raymond B. George** as Vice President-Sales Promotion and **Max Enelow** as Advertising Manager.



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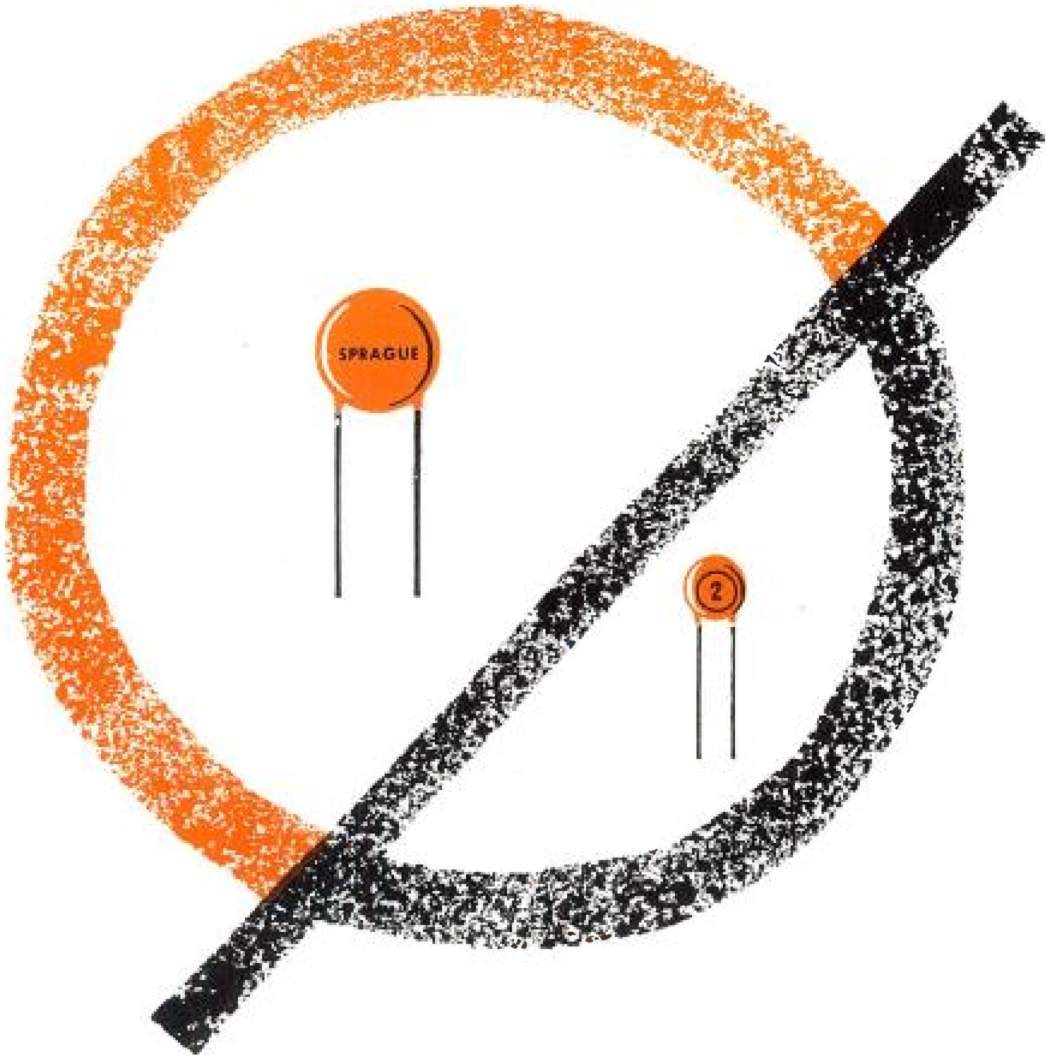

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Complete technical data on Cera-Mite capacitors for transistor applications is given in Engineering Data Sheet 6121. Write (on your business letterhead, please) for your copy to the Technical Literature Section, Sprague Electric Company, 233 Marshall Street, North Adams, Mass.

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ELECTRONIC INDUSTRIES

& TELE-TECH

M. CLEMENTS, Publisher ★ O. H. CALDWELL, Editorial Consultant ★ B. F. OSBAHR, Editor

Diversification . . . The Time Is Now!

Most of us are aware of the continuing shrinking in the number of radio and television set manufacturers that is taking place year by year. From approximately 100 manufacturers in 1950 we find that today more than 90% of the annual production can be traced to less than 10 manufacturers. We are aware too, that many old-line component and instrument suppliers have lost their identity through mergers and combinations. What we may not be aware of, however, is that many component suppliers may face sharp business declines in the future because of the rapid technological advances that have been taking place in recent years.

The most notable development which is hastening the day is the transistor. Three years ago we found it difficult to make reliably performing transistors for less than $2.00 apiece. Today, Dr. William Shockley, father of the transistor, is predicting production units at 25 cents apiece in less than a decade. The combination of tubes and transistors in present day automobile radios is already having profound effects on vibrator and power supply component suppliers. The development of a completely transistorized switchboard for the military is a cause for concern among relay manufacturers. The increased power handling capacity of present transistor types will undoubtedly make possible completely transistorized television receivers in the near future and this in turn means that the tube industry, too, has grave problems.

Each year during the past four years we have been focusing editorial attention on the developments in printed circuits. Modular printed circuits and etched printed circuits have now been developed to the point where they have become the accepted method of wiring assembly for all types of electronic equipment. Coupled with automation for mass production items, these circuits literally mark the end for hook-up wire, spaghetti tubing, etc.

Not all manufacturers will suffer as a result of these changes, in fact, some may receive the proverbial "shot-in-the-arm." Manufacturers who will benefit most will probably be the dry-cell battery manufacturers.

Some electronic component manufacturers are already aware of the shifting times and have taken steps to evaluate their position. In fact, during the last month, representatives from two well known industrial research houses have contacted us for diversification suggestions for their clients. We know that there are many other well-known organizations making similar products who should also be alert as to what's ahead. Product diversification is necessary in many instances and the time for such evaluation is now!

About that Book . . .

This is the title of an interesting special editorial feature we are presenting this month. There have been many times that electronic engineers have voiced a desire to write a text on a subject in which they are particularly well versed. Too often the many publishing questions confronting the new author, the lack of a clear cut approach channel to the publisher stifles even the starting attempt. In this article, Mr. Charles Heinle, Manager of the Book Division, Chilton Company, provides the answers to most often asked questions. How much are the royalities? How to choose a publisher? What about copyrights? We hope this feature will be of service to you and we'll be glad to provide reference reprints for as long as our supply lasts. "About That Book" appears on page 50 in this issue.

Electronic Roadways

We are about to embark on a tremendous new highway building program under Federal and State sponsorships. Construction is expected to extend over more than ten years. We have seen some interesting reports on how many tons of concrete and steel will be needed for this work but so far nothing has appeared to indicate that we shall be making use of the many useful products that the electronic industries can provide. Modern electronic control systems for traffic lights and for street lights can greatly assist vehicular safety. Telephonic, radio, microwave and radar systems can greatly aid the law enforcement agencies and the traveler alike. Let's not overlook this opportunity for expanding or diversifying operations.

N-u-m-b-e-r S-y-s-t-e-m-s F-o-r C-o-m-p-u-t-e-r-s

Complex mathematical problems are solved by a sequence of arithmetic and logical operations, governed by a coded set of instructions. A number of codes have been devised, the binary being the basis for most. Advantages of popular systems are compared.

By IRVING J. GABELMAN

2^0	1
2^1	2
2^2	4
2^3	8
2^4	16
2^5	32
2^6	64
2^7	128
2^8	256
2^9	512

AUGEND \ ADDEND	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
0	0	1	10	11	100	101	110	111	1000	1001	1010	1011	1100	1101	1110	1111	10000	10001	10010	10011	10100	10101
1	1	10	11	100	101	110	111	1000	1001	1010	1011	1100	1101	1110	1111	10000	10001	10010	10011	10100	10101	10110
2	10	11	100	101	110	111	1000	1001	1010	1011	1100	1101	1110	1111	10000	10001	10010	10011	10100	10101	10110	10111
3	11	100	101	110	111	1000	1001	1010	1011	1100	1101	1110	1111	10000	10001	10010	10011	10100	10101	10110	10111	11000
4	100	101	110	111	1000	1001	1010	1011	1100	1101	1110	1111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001
5	101	110	111	1000	1001	1010	1011	1100	1101	1110	1111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010
6	110	111	1000	1001	1010	1011	1100	1101	1110	1111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011
7	111	1000	1001	1010	1011	1100	1101	1110	1111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100
8	1000	1001	1010	1011	1100	1101	1110	1111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101
9	1001	1010	1011	1100	1101	1110	1111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110

Fig. 1: (l.) Binary powers for step-by-step conversion from decimal system. (r.) Examples of completed binary addition.

Among the number systems used in modern electronic digital computers are the decimal, binary, octal, bi-quinary, coded-decimal, and excess three. This article describes these number systems and their associated arithmetic operations.

The decimal system uses 10 symbols, 0, 1, 2, . . . , 9, and a decimal point to designate a number. The magnitude and position of each digit with respect to the decimal point specify a multiple of a power of 10, the multiple being equal to the value of the digit and the power being determined by its position. The nth digit column to the left of the decimal point represents a multiple of 10^{n-1} while the nth digit column to the right of the decimal point represents a multiple of 10^{-n}. The total value of the number is the sum of the multiples of the powers of 10 expressed as described. For example,

$$13.25 = (1 \times 10^1) + (3 \times 10^0) + (2 \times 10^{-1}) + (5 \times 10^{-2}). \quad (1)$$

Since the digit position relative to the decimal point represents a multiple of a power of 10, the decimal system is known also as a base 10 or radix 10 number system. If the digit position represents a multiple of a power of x, a base x or radix x number system is formed. The general representation of a number y in a radix x system is given by

$$a_n a_{n-1} \cdots a_1 a_0 a_{-1} \cdots a_{k-1} a_k.$$

where the value of y is

$$y = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0 + a_{-1} x^{-1} + \cdots + a_{-k} x^{-k}. \quad (2)$$

Radix Conversion

The theoretical basis for radix conversion and examples illustrating the derived methods are given below. When an integral number y is expressed in a radix system x, approximately n digits are required where n is given by

$$y = x^n.$$

When expressed in a radix system z, the quantity y will require m digits for its representation. Here m and n are approximately related by

$$x^n = z^m,$$

$$\text{or } m = \frac{n}{\log_x z}.$$

For decimal to binary conversion, x = 10 and z = 2; thus,

$$\frac{m}{n} = \frac{1}{\log_{10} 2} = \frac{1}{0.301} \cong 3\tfrac{1}{3}$$

This means that the binary representation of a quantity requires approximately 3⅓ as many digits as the decimal. For octal to binary, exactly 3 times the number of digits are required.

Conversion Technique

Eq. 2 defines a number y in the radix x number system as equal to the sum of a series of terms. Each term of the series is a multiple of a power of x. The number y may also be expanded as the sum of a series, each term of which is a multiple of a power of another base z, as follows:

$$y = b_n z^n + b_{n-1} z^{n-1} + \cdots b_1 z + b_0 + b_{-1} z^{-1} + \cdots b_{-k} z^{-k} \quad (3)$$

where each of the coefficients b_i assumes any one of the set of values 0, 1, 2, . . . (z-1).

If y is expressed as a number in the radix x system, it may be converted to the radix z system by determining the coefficients b_i as follows:

$$\text{From Eq. 3. } z^n \leq y < z^{n+1}. \quad (4)$$

Eq. 4 determines n. The coefficient b_n is the largest value of the set 1, 2, · · · (z − 1) for which

$$b_n z^n \leq y. \quad (5)$$

Form a number y′, defined as:

$$y' = y - b_n z^n = b_{n-1} z^{n-1} + b_{n-2} z^{n-2} \cdots b_{-k} z^{-k}. \quad (6)$$

If $y' < z^{n-1}$, then $b_{n-1} = 0$; however,

I. J. GABELMAN,
Rome A. D. C.,
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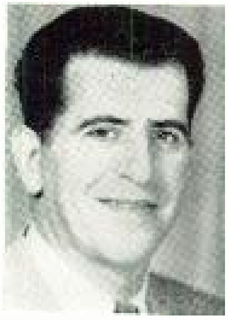


any radix system and a knowledge of decimal or radix 10 addition is readily extensible to any other number system. Fig. 1 and 3 are addition tables for the binary and octal systems.

Negative Numbers

Circuitry for subtraction is usually not included in the arithmetic unit of a digital computer. Negative numbers are represented by their radix complements, and subtraction is performed in an adder by addition of the minuend and the complement of the subtrahend. The radix z complement of a number s, with (n-1) digits to the left of the radix point, is defined as

$$\bar{s} = z^n - s. \qquad (7)$$

From Eq. 7, the difference (m-s) is obtained as $(m+\bar{s}) - z^n$, i.e., by adding the complement of s to m, modulo z^n. Addition of 2 numbers modulo z^n refers to addition wherein any carries into the z^n digit column are discarded. The circuits or registers which store numbers in the adder circuitry are fixed in length so that the highest digit column represented is z^{n-1}. Attempted carries into the non-existent z^n stage are lost leading to automatic modulo z^n addition.

An adder thus includes subtraction as part of its addition process or, more generally, one may say that negative numbers are represented by their complement. Four cases of addition in this sense are performed by the adder and these are examined in detail below. For illustrative purposes, addition examples with integral decimal numbers will be used.

Case 1. m + s.

When adding modulo 10^n, the operands must be resiricted so that $(m+s) < 10^n$ to prevent register overflow.

Case 2. m — s; m > s.

This difference is a positive number, given by

$$(m - s) = (m + \bar{s}) - 10^n. \qquad (8)$$

Since $(m-s) > 0$, then $(m+\bar{s}) - 10^n > 0$, or $m+\bar{s} > 10^n$. A carry is always propagated into the 10^n digit column. This carry is discarded in modulo 10^n addition. Therefore, it follows directly that the difference (m—s) is obtained by adding the complement of s to m, discarding the 10^n carry, or

DECIMAL	BINARY	EXCESS 3	EXCESS 3 COMPLEMENT	BI-QUINARY	OCTAL
0	0000	0011	1100	00 00001	0
1	0001	0100	1011	00 00010	1
2	0010	0101	1010	00 00100	2
3	0011	0110	1001	00 01000	3
4	0100	0111	1000	00 10000	4
5	0101	1000	0111	01 00001	5
6	0110	1001	0110	01 00010	6
7	0111	1010	0101	01 00100	7
8	1000	1011	0100	01 01000	10
9	1001	1100	0011	01 10000	11

Fig. 2: Equivalent of decimal numbers in a few of the other popular computer number systems in use.

if $y' \geq z^{n-1}$, then b_{n-1} is the integral part of $\frac{y'}{z^{n-1}}$.

The above process is iterated to determine the remaining b_i.

This technique is applicable to simple conversions and may be used for the integral and fractional parts of a number.

Decimal to Binary

The largest value of n for which 2^n is less than 81.5 is 6. In accordance with equation 5, $b_6 = 1$. Note that in the binary system the coefficients b_i assume the set of values 0 or 1.

$$\begin{array}{rll} & & b_6 = 1 \\ 81.5-64 = & 17.5 < 2^5 & b_5 = 0 \\ & 17.5 > 2^4 & b_4 = 1 \\ 81.5-64-16 = & 1.5 < 2^3 & b_3 = 0 \\ & 1.5 < 2^2 & b_2 = 0 \\ & 1.5 < 2^1 & b_1 = 0 \\ & 1.5 > 2^0 & b_0 = 1 \\ 81.5-64-16-1 = & .5 = 2^{-1} & b_{-1} = 1 \end{array}$$

The binary equivalent of 81.5 is 1010001.1.

Arithmetic Operations

Subtraction, multiplication, and division are all variations of the fundamental arithmetic operation addition. Addition is the same in

$$m - s = m + \bar{s}.$$

As an example, let m = 40 and s = 27.

$$\bar{s} = 10^2 - 27 = 73$$
$$m = 40$$
$$\bar{s} = 73$$
$$m + \bar{s} = \underline{1}13$$

The underlined 1 is the 10^2 digit carry which is discarded, giving the correct difference, 13.

Case 3. (m—s); m < s.

This difference is a negative number and, as might be suspected, the operation $m+\bar{s}$ gives as a result the complement of the difference.

From Eq. 8,

$$m - s = (m + \bar{s}) - 10^n.$$

Since $m - s < 0$, then $m+\bar{s} < 10^n$ and there is no discarded 10^2 digit. Rearranging Eq. 8,

$$m + \bar{s} = 10^n - (s - m) \qquad (9)$$

$$m + \bar{s} = (\overline{s - m}).$$

To illustrate, let m = 27 and s = 40.

$$m = 27$$
$$\bar{s} = 60$$
$$m + \bar{s} = 87 = (\overline{s - m})$$

Case 4. (—m) + (—s).

Representing the negative numbers by their complements, this sum is

(*Continued on page* 112)

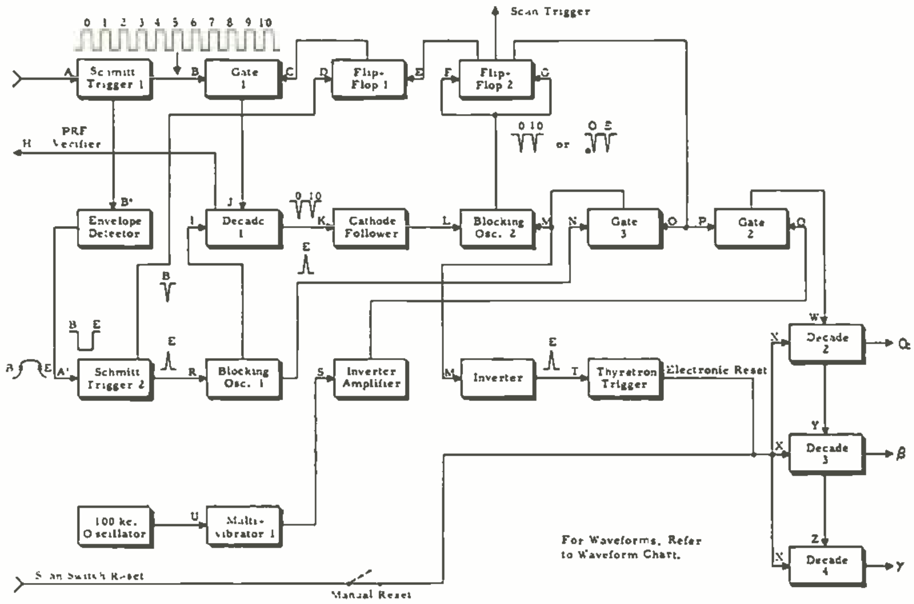


Fig. 1: Block diagram reveals functional parts of Tone Burst Counter.

By E. J. OELBERMANN,
Project Engineer,
Haller, Raymond
& Brown, Inc.,
State College, Pa.

Tone Bursts Counted

E. J. Oelbermann

In order to determine the frequency of short bursts of audio tones, it has been necessary to record and repeatedly scan each burst with a harmonic analyzer. Since this process is rather time consuming, it is desirable to have a device which will quietly and accurately extract the desired information from these bursts without the repeated scanning heretofore necessary.

The burst counter shown in Fig. 1, is capable of measuring the repetition frequency of short duration signals and presenting this signal count in the form of a staircase waveform which may be recorded quite easily on a chart recorder. Each decimal digit is represented by a single DC voltage level on the chart record and the frequency can be determined rapidly.

A standard, commercial events-per-unit-time meter or time-interval meter cannot be used conveniently for this purpose, and with the exception of the new Hewlett-Packard counters, which utilize staircase decade units, the output of most electronic counters is generally a binary code, i.e., four bits are required to represent any digit between 0 and 10.

Operation

The burst counter consists essentially of a variable-base time interval meter and gated pulse counter. The time interval base is set by the period of 10 signal pulses, i.e., each pulsed signal defines a 10 pulse interval during which standard pulse counts are accumulated in 3 staircase output decades.

The frequency is easily obtained by dividing the output count into a constant, 10f, where f is the frequency of an internal reference signal derived from a crystal controlled oscillator. The frequency may be read out immediately by referring to a nomogram, Fig. 3.

Detailed operation of the tone burst counter may be understood by referring to the block diagram in Fig. 1. An unknown pulse signal or sinusoidal signal of short duration is introduced to the counter at A, Schmitt trigger 1. Two differentiated outputs are obtained from this circuit, one which is detected and used to operate Schmitt trigger 2, and another which is introduced to gate 1 at B. The positive output waveform of Schmitt trigger 2 is also differentiated and the leading pulse, pulse B, is used to open gate 1 by means of flip-flop 1. Pulses are then allowed to pass through gate 1 to decade 1, which is initially set on 9. Decade 1 immediately returns to 0 and a negative pulse is obtained at the regular output terminal of this decade. This pulse is designated as the "0" pulse.

The "0" pulse opens gates 2 and 3 by means of flip-flop 2, and standard frequency pulses, 20 KC in the present model, are allowed to accumulate in decade units 2, 3 and 4. When the 10th signal pulse comes through gate 1, a second pulse from decade 1, shuts gates 2 and 3, locking the standard frequency count in these decades. A trigger signal is derived from the return of flip-flop 2 to its normal state and this signal is used to

Short bursts of audio frequencies can now be analyzed without repeated scanning. Repetition frequency is presented in the form of a staircase waveform which is easily recorded on a chart recorder. Features of design are illustrated.

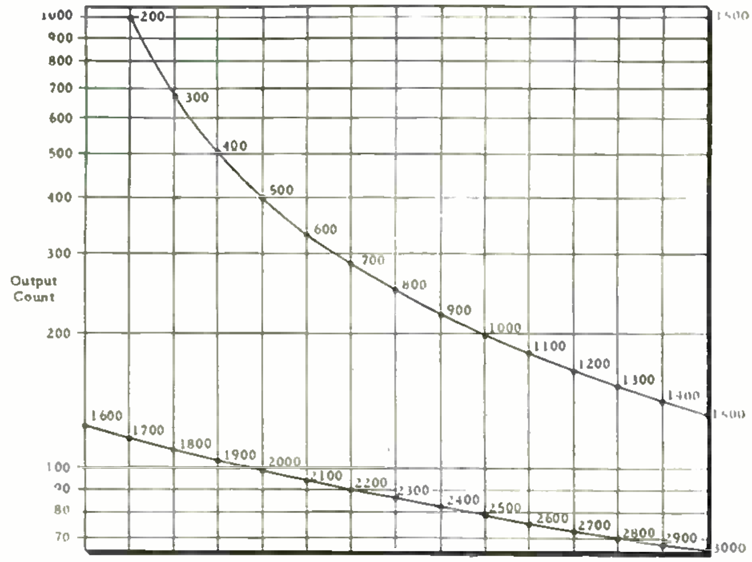


Fig. 3: Nomograph for bursts ranging from 200 to 3000 cps.

By Staircase Decades

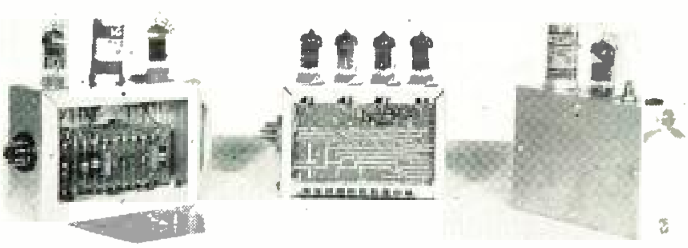
initiate scanning. A motor driven switch successively scans the staircase output terminals of decades 2, 3 and 4 and the output count is presented as 3 DC levels on a chart recorder.

Reset

Biased blocking osc. 1 is used to reset decade 1 to 9 for the next count operation, and the return of the scan switch to 0 position is used to reset decades 2, 3 and 4 to 0 again.

Abnormal operation due to the occurrence of less than 10 pulses is prevented by means of a reset signal which passes through gate 3, if the 10th pulse has not already shut this gate. This reset signal operates the thyratron reset circuit which returns decades 2, 3 and 4 to 0 immediately so that an incorrect count cannot be registered.

Fig. 2: Each functional part is a plug-in unit.



Design Data

Each functional block in the present model of the tone burst counter has been constructed in a 4 x 6 x 2 in. aluminum plug-in unit as shown in Fig. 2. These units may be tested separately on an extension cable which plugs into the main chassis.

Neon lamps are used on Schmitt triggers 1 and 2 and gates 1 and 2. Proper operation of these circuits on a normal count is indicated by simultaneous illumination of all 4 lamps.

The present burst counter has been designed to measure frequencies from 200 cps to 3 KC. The accuracy of the counter is directly proportional to the reference frequency and inversely proportional to the frequency to be measured. Using a reference frequency of 20 KC, 1% accuracy is obtained at a frequency of 3 KC. Frequency near 200 cps can be measured to 0.1%. If higher accuracy is desired at higher signal frequencies, the reference frequency may be increased proportionately. The optimum reference frequency to be used depends on the required range of frequencies to be measured.

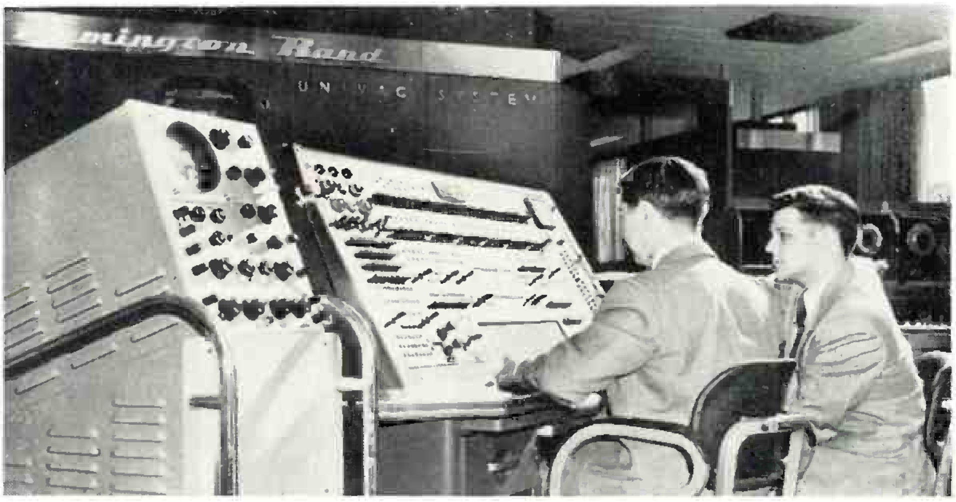
Operation of the present model is independent of pulse shape. Due to the nature of the Schmitt trigger circuit, it is possible to use any type of repetitive signal or waveform. Noise discrimination is provided by varable threshold controls on the Schmitt trigger circuits and the small time constant used in the envelope detector, which prevents stray noise pulses from providing a voltage large enough to fire Schmitt trigger 2.

* * *

Preview of the 1956 Eastern Joint Computer Conference

Dec. 10-11-12

Hotel New Yorker New York City



Sylvania's installation of a Remington-Rand Univac

Record attendance of engineers, mathematicians and management executives is anticipated for the three-day conference on "New Developments In Computers." Technical sessions will feature the presentation of 28 technical papers by leading computer authorities, and free copies of the proceedings of the conference for all registrants.

Engineers, management executives and other interested people from all over the nation will be converging on the New Yorker Hotel and adjoining Manhattan Centre in New York City to attend the three day Eastern Joint Computer Conference which will begin there on December 10, 1956.

This year's conference will have as its theme "New Developments in Computers," and will be sponsored jointly by the Institute of Radio Engineers, American Institute of Electrical Engineers and the Association for Computing Machinery. A reduced rate for members of the three sponsoring societies is available to registrants; all persons registering will receive a free copy of the Proceedings of the Computer Conference.

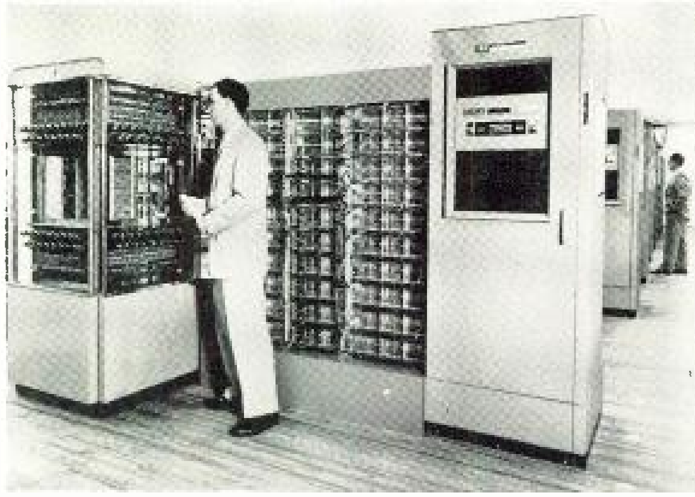
Registrants will be greeted on Monday morning by Conference Chairman J. R. Weiner of Remington Rand and will hear Howard T. Engstrom of the National Security Agency deliver the Introduction and Keynote address. This will be followed by two additional talks by Everett S. Calhoun and L. D. Whitelock on new computer and computer components.

The expected record attendance will hear more than 28 technical papers presented by the foremost computer authorities during the 6 half-day sessions of the conference. At least 20 of the leading manufacturers of computers and associated products will display their latest items and machinery at nearly 100 attractive booths and displays.

There will be a luncheon on Tuesday, Dec. 11, at which Robert Watson-Watt, Director General of Watson-Watt Labs. will speak.

J. W. Leas of RCA has been appointed Chairman of the Program Committee. V. N. Vaughn of AT&T is Chairman of the Publications Committee and J. A. Haddad of IBM Corp. has been appointed Chairman of the Local Arrangements Committee for the conference.

Bendix's G-15D computer and DA-1 Digital Differential Analyzer



Magnetic core memory of IBM's AN/FSQ air defense computer

Conference Program

Monday Afternoon, December 10, 1956

New Systems, Professor Norman Scott, Session Chairman

1. "The TRANSAC S-1000 Computer," by J. L. Maddox, J. B. O'Toole, and S. Y. Young.
2. "A Transistor Computer with a 256 x 256 Memory," by J. L. Mitchell and K. H. Olsen.
3. "Design Objectives for the IBM STRETCH Computer," by S. W. Dunwell.
4. "A New Large Scale Data Handling System—DATAMATIC 1000," by R. M. Bloch, W. C. Carter, E. J. Dieterich and J. E. Smith.
5. "The TRADIC LEPRECHAUN Computer," by J. A. Githens.
6. "Functional Description of the NCR 304 Data Processing System for Business Applications," by M. S. Shiowitz and A. A. Cherin, and M. J. Mendelson.

Tuesday Morning, December 11, 1956

Circuits and Components, Theodore A. Kalin, Session Chairman

1. "Ambient Approach to Solid-State Computer Components," by J. K. Hawkins.
2. "A Magnetically-Controlled Gating Element," by D. A. Buck.
3. "A 2.5 Megacycle Ferractor Accumulator," by T. H. Bonn and R. D. Torrey.
4. "High-Temperature Silicon-Transistor Computer Circuits," by J. B. Angell.
5. "A Saturable-Transformer Digital Amplifier with Diode Switching," by E. W. Hogue.

Tuesday Afternoon, December 11, 1956

Input-Output Devices, William H. Burkhart, Session Chairman

1. "An Automatic Input for Business Data Processing Systems," by K. R. Eldredge, F. J. Kamphoefner and P. H. Wendt.
2. "The Burroughs Electrographic Printer - Plotter for Ordnance Computing," by Herman Epstein and Paul Kintner.
3. "A Transistorized Transcribing Card Punch," by C. T. Cole, K. L. Chien, and C. H. Propstere.
4. "Apparatus for Magnetic Storage on Three-Inch Wide Tape," by R. B. Lawrence, R. E. Wilkins, and R. A. Pendleton.
5. "Synchronization of a Magnetic Computer," by J. Keilsohn and G. Smoliar.

Wednesday Morning, December 12, 1956

High-Speed Memories, Professor Morris Rubinoff, Session Chairman

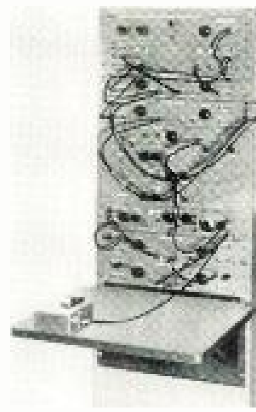
1. "A Technique for Using Memory Cores as Logical Elements," by L. Andrews.
2. "Recent Developments in Very High-Speed Magnetic Storage Techniques," by W. W. Lawrence.
3. "A Low-Cost Megabit Memory," by R. A. Tracy.
4. "A Compact Coincident-Current Memory," by A. V. Pohn and S. Rubens.
5. "A Cryotron Catalog Memory System," by A. E. Slade.

Wednesday Afternoon, December 12, 1956

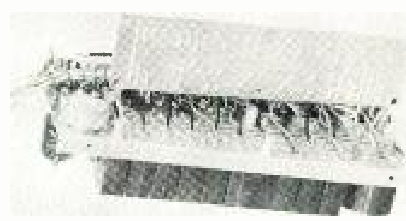
Random Access Memory Files and Conference Summary John Howard, Session Chairman

1. "The Datafile—A New Tool for Extensive File Storage," by D. N. MacDonald and C. L. Ricker.
2. "Engineering Design of a Multiple Access Storage System (MASS)," by M. L. Greenfield.
3. "A Large-Capacity Drum File," by V. J. Porter and H. F. Welsh.
4. "System Organization of the IBM 305," by M. L. Lesser and J. W. Haanstra.

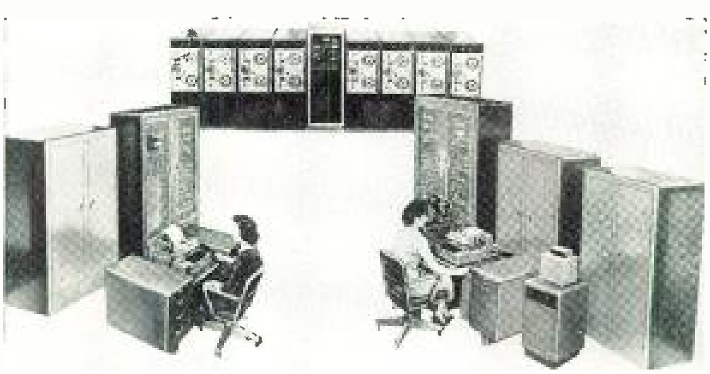
Conference Summary—John W. Carr, III



Burroughs Corp.'s core tester



Lab for Electronics' "Syncpulser"



(r) Franklin Electronic's data reduction system

(l) Underwood's Elecom 125 system. Computer (r) and file processor (l)

Computer Switching With Micro-alloy Transistors

By J. B. ANGELL and M. M. FORTINI

New units have characteristics of low emitter-to-collector saturation voltages and large current amplification. Described are basic switching circuits employing transistors and a review of the characteristics important in switching applications.

Fig. 1: Cross-section of jet etched-jet plated blank.

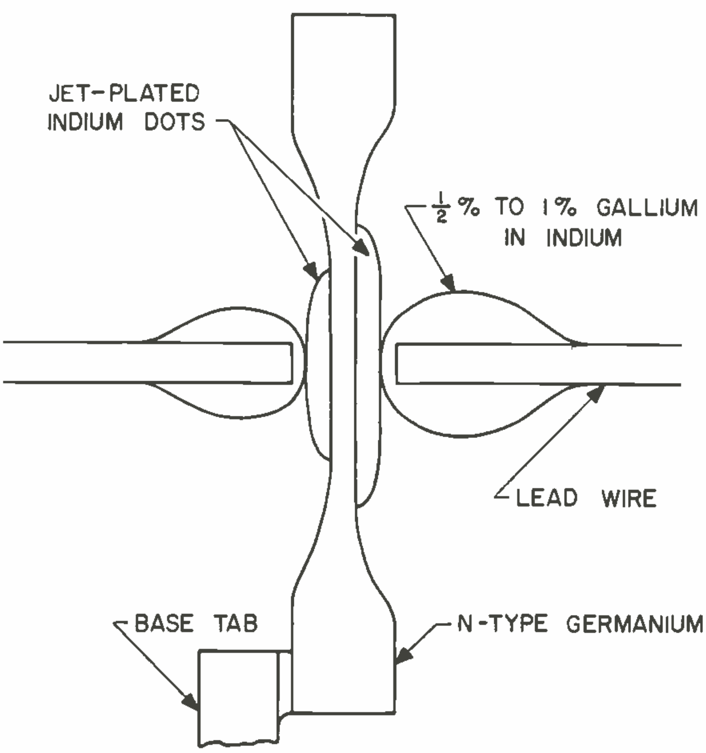
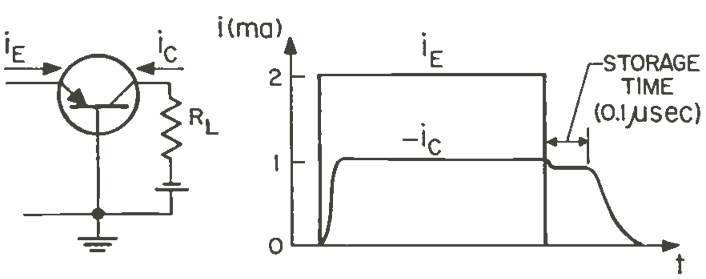


Fig. 2: Computation of hole-storage figure-of-merit.



The initial steps in fabricating microalloy transistors are identical with those used in making surface-barrier transistors. A wafer of N-type germanium, with a resistivity of perhaps 0.5 ohm-cm. and initially 0.004 in. thick, is electrolytically jet etched on both sides until the minimum wafer thickness, at the bottom of the etch pits, is the desired value, which might be 0.1 mil (0.0001 in.). This thickness can be very accurately monitored by continuously measuring the percentage of infrared transmission through the etched portion of the wafer. After the etching is completed, the emitter and collector dots are plated onto the bottoms of the etch pits. These dots are chiefly indium; the necessary small amount of gallium may be added either during the plating process, together with the indium, or during the alloying cycle, from the solder. After the required amount of indium is plated, the emitter and collector leads, with small balls of solder already applied to the leads, are brought up to the plated dots, as suggested in Fig. 1. The assemblage is then subjected to the heat cycle which yields the microalloy contacts. The heating process lasts for only a few seconds at a temperature which is preferably just slightly higher than that required to melt both the solder and the plated dots. The transistor is thus completed, except for cleaning and encapsulation.

Characteristics

Representative small-signal and low-frequency characteristics of present-day microalloy transistors are listed in Table 1. These numbers are the averages from a large set of data taken on pilot-line transistors made on 0.5 ohm-cm. material with a collector diameter of 7 mils (before final cleanup). The microalloying process provides two principal improvements in the characteristics as compared with the numbers before heating. First, the small-signal common-

J. B. ANGELL and M. M. FORTINI,
Research Div., Philco Corp., Phila., Pa.

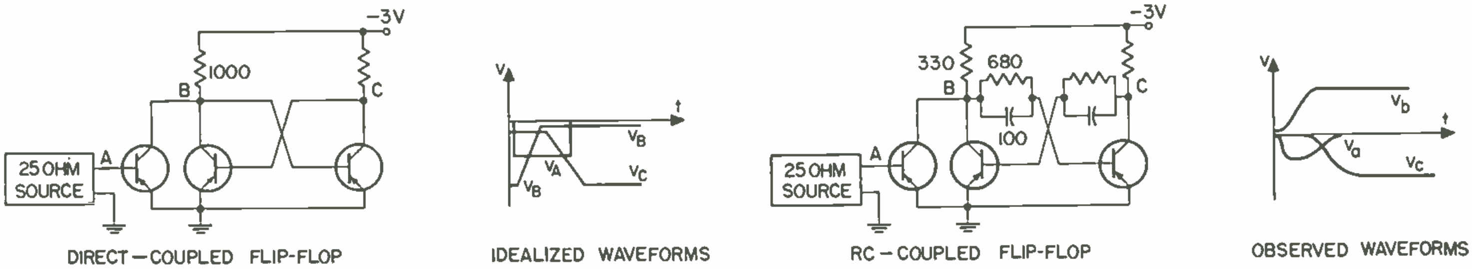


Fig. 3: Gated flip-flop circuits. Observed voltage waveforms shifted to a common reference by measuring oscillograph.

TABLE I

f_α = 60mc	I_{CO} (5 volts) = 1.5 μa
f_{MAX} = 65 mc	$(\bar{\beta}) = h_{FE}$ (I_C = -50ma) = 100
$r_b' C_C$ = 450 $\mu\mu$sec	V_{CE} (I_C = -8ma, I_B = -1 ma) = 0.035 volt
C_{ob} = 3.5 $\mu\mu$f	PUNCH THROUGH = 13 volts
$(\beta) = h_{fe}$ = 200	
(V_{CE} = -3 volts I_C = 0.5 ma)	

emitter current amplification at low currents, h_{fe} or β, is increased substantially. Secondly, the fall-off of current amplification with increasing current is substantially reduced by the microalloying treatment.

Hole Storage

Hole storage, or more accurately, the storage of minority carriers in the base region of a conducting transistor, is a basic limitation to the max. speed at which the transistor can be switched.

A hole-storage figure-of-merit can be prescribed in many ways. One simple method, illustrated in Fig. 2, is to measure the time required for the collector to come out of saturation after the emitter current is reduced to zero from some value considerably greater than the collector current (typically $I_E = 2I_C$ = 2.0 ma.). For the L-5131 microalloy transistor the storage time in this test is in the range of 50-250 μsec.

Rise Time

Rise time is the time it takes to turn a transistor "on". Initially the transistor is cut off ($I_C = 0$). The final state usually finds the transistor near or well in saturation.

If the transistor does not reach saturation, the rise time is just that of the transistor used as a video amplifier.

If the transistor reaches saturation, the rise time is shortened because the "bottoming" of the collector cuts off the long tail of the video transient response. This point is illustrated in Fig. 4. It is thought that the reason the curves do not coincide exactly is the lower alpha-cutoff frequency associated with the lower collector voltages.

Fall time is considered as the time required after a transistor has come out of saturation until it is essentially cut off.

The fall times corresponding to different degrees of saturation can be seen in Fig. 4. For the partic-

(*Continued on page* 123)

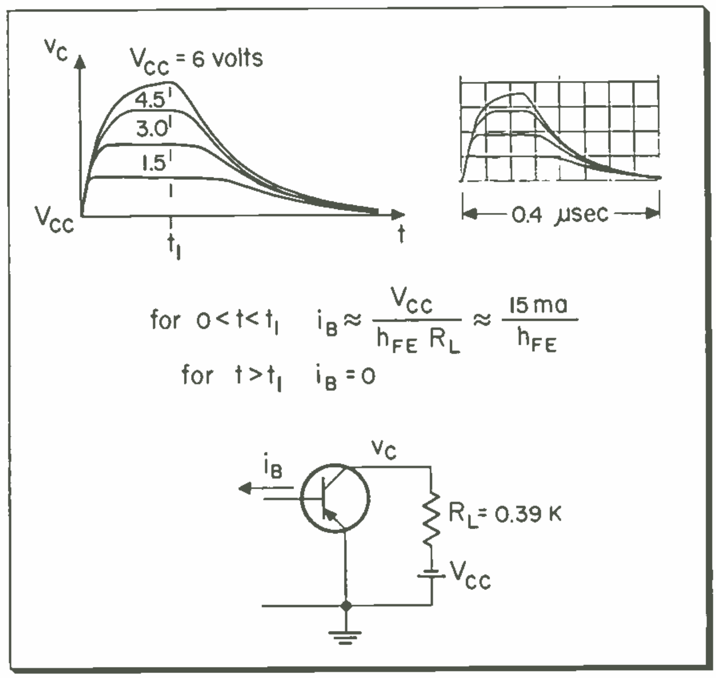
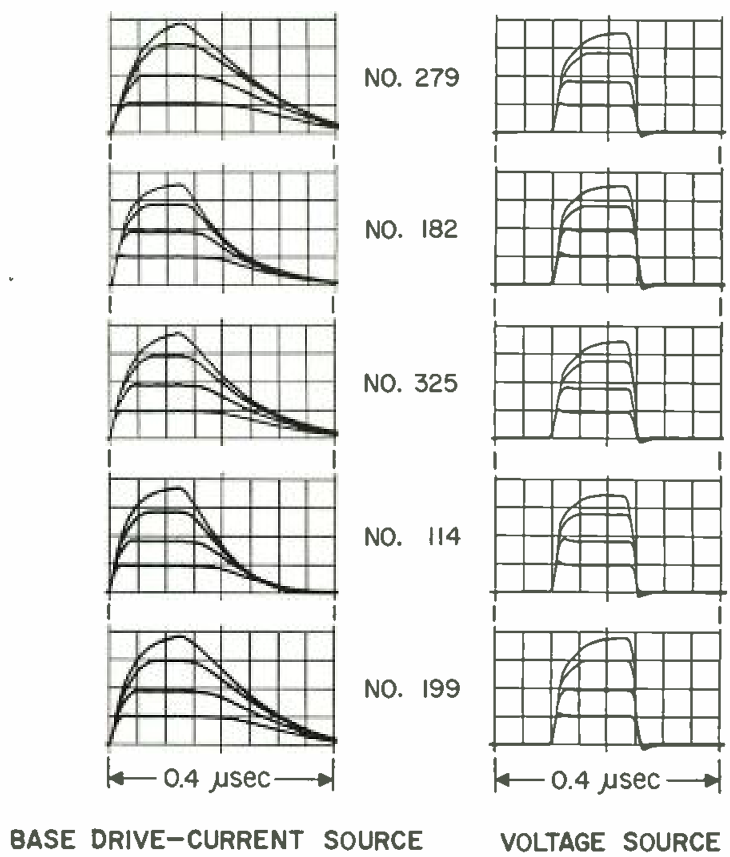


Fig. 4: Transient response to current step. Curves do not concide due to lower alpha-cutoff.

Fig. 5: Characteristics of 5 different microalloy transistors with current drive on the base.



'Reading' and 'Writing' Defined

By A. BLUNDI

A plain-language description of magnetic drum read-write techniques, components, and technical terms

A common computer component is the Magnetic Drum, usually a rotating cylinder, the surface of which is coated with some magnetic substance, e.g., iron oxide. Information is stored on the drum in the form of magnetic spots representing some type of binary code.

Writing

The process of putting these spots on the drum is known as Writing. This is accomplished by means of a recording head which is mounted close to the surface of the drum. When pulses of current are passed through the head in a certain direction, an electro-magnetic field is set up and a small spot on the drum is magnetized to saturation with a certain polarity. This we will call writing a "1." When current is passed through the head in the opposite direction, the electromagnetic field is reversed and a small spot is magnetized to saturation with the opposite polarity. This we will call writing a "O." In this manner, the two symbols of the binary system can be represented on the surface of the drum.

Reading

The process of recovering this information which previously had been written on the drum is called Reading. As the magnetized spot on the drum passes under the read-write head, current is induced in a direction corresponding to the polarity of this spot. When the spot passes away from the head the current ceases. In this way it is possible to translate the magnetized spots into pulses of opposite polarity. For convenience, the positive pulses will be called "1"s and the negative pulses will be called "O"s.

Read Amplifier

In order to uses these pulses for information handling, they must be amplified and shaped. This is done by a Read Amplifier, and in order to eliminate some of the problems of handling positive and negative pulses on one line, it is common practice for the Read Amplifier to accept positive pulses only. Consequently, in the system (apart from the drum) a "1" is represented by a positive pulse and a "O" is represented by a "no pulse."

Channel

Each read-write head controls the narrow strips of the drum which rotates under it. This strip, one pulse wide, is called a Channel or a Track (designated by a dotted line on the diagram).

Band

A number of associated channels is called a Band.

Capacities

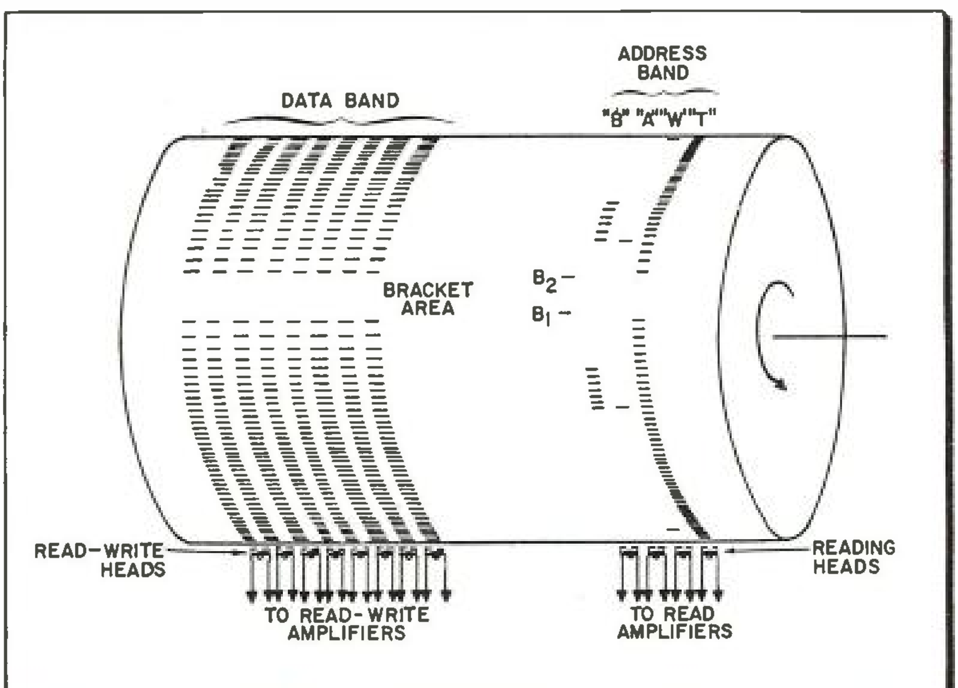
We have discussed the various physical features of the memory—how the information is transferred to and from the surface of the drum. We must now consider briefly the capacities involved. For purposes of illustration an imaginary drum will be described.

Memory Size

The amount of information which can be stored on a particular drum is called the Memory Size. There are various ways of express-

(*Continued on page* 92)

Fig. 1: Magnetic drum recording



A. BLUNDI, Electronic Instruments Div., Burroughs Corp., Phila., Pa.

CUES for BROADCASTERS

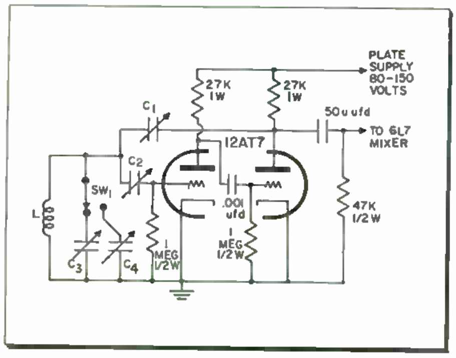
Practical ways of improving station operation and efficiency

Franklin Oscillator

HAROLD E. ALLEN, Ch. Engr.
KGDE, Fergus Falls, Minn.

SIMPLE version of Franklin osc. is used as local osc. in a 4-channel fixed-tuned Conelrad receiver. Osc. is adjusted to frequencies between 610 and 1180 KC. Tube used is twin-triode 12AT7. Type 12AU7 functions equally as well. Half a dozen of each tube type have been tried in service with no retuning necessary, despite a rather sharply tuned IF section. Tuning coil is Miller type 242A with primary removed. C1 and C2 are 3 μμf Erie Ceramitons.

Actually greatest degree of frequency stability is assured when C1 and C2 are adjusted to minimum value consistent with stable oscillation. These 2 capacitors could be physically combined in a small split-stator type tuning condenser. Minimum value required in some circuit arrangements may be less than 1 μμf. Load is taken from anode of second triode section. In general, it is better practice to connect load to anode of first or grid of second triode section. At these 2 points there is the greatest degree of isolation between load and the frequency controlling circuit.



Local oscillator for Conelrad receiver.

In addition to use as a local osc., Franklin circuit works well in laboratory osc., secondary frequency standards and transmitters not requiring crystal control. A crystal may be substituted for the tuned circuit. Due to high gain of resistance coupled amplifier even resonating type crystals will oscillate satisfactorily.

The circuit is named after C. S. Franklin who developed it for the Marconi Co. Because frequency can be altered by switching a single connection it is often called a single terminal osc. The single terminal feature adapts readily to fixed-tuned or push button design. Construction is simplified with stator side of tuning capacitors at ground level.

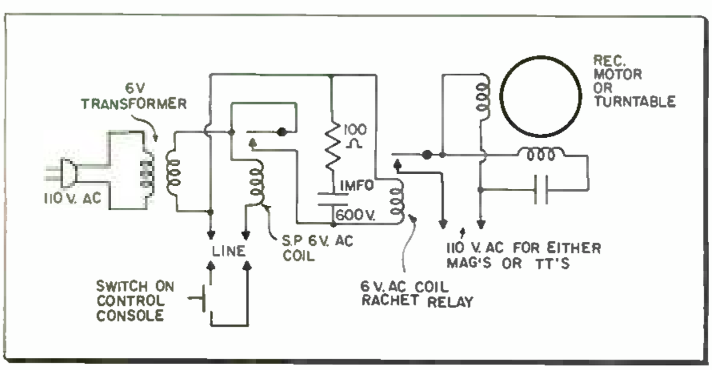
The Franklin osc. possesses excellent frequency stability due to 2 factors; merit of tuning circuit and loose coupling between tuning circuit and tubes. Extremely small values of C1 and C2 are required to sustain smooth oscillation. This results in a frequency controlling circuit of high Q due to light loading effect and tube capacitances connected in series with coupling capacitors or high reactance. Fluctuations of heater or anode voltages have negligible effect on oscillating frequency.

Remote Control

JOHN P. TEIKEN, Ch. Engr.
KVOX, Moorhead, Minn.

IN building our studios at the transmitter site, we didn't have the room for our "Mag's" in the control room, and also had to put 4 turntables on one side of the control room. Having this problem, we came up with this solution. The momentary push button switches for the "Mag's" are mounted on a panel next to the console with our remote switching gear. The switches for the turntables are mounted on the base of the console right under the faders for each turntable, making for easy operation. All of the relays are mounted inside the transmitter room so there is no noise. One 110 to 6v. transformer is used for all 12 relays, using 6VAC coils on relays to keep the 110VAC away from console.

The results have been so satisfactory, that we're now building a dual channel, 5 position push button system for our network switching using the same principle.



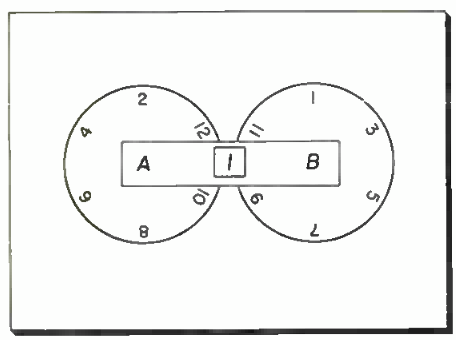
Recorder push button switch mounted at console for remote control.

Slide Number Indicator

PAUL D. FORD
WTHI-TV, Terre Haute, Ind.

ONE of the greatest causes of error in small TV station operation is taking the wrong slide on the air because the switcher has not had the opportunity to preview the slide or otherwise determine which slide is next in line.

If the station projection room is so located that the rear of the slide projector may be viewed either directly or in a mirror from the switcher position, all guesswork may be eliminated. As shown in the illustration, large numbers are painted on the back side of the slide projector discs so that the number appearing at the top of the disc corresponds with the number



Indicator for slide, disc, and slide run.

of the slide ready to be shown. "A" and "B" discs are likewise identified by letters painted on the back of the projector. Where desired, a paper clamp may be mounted to hold a small card showing the switcher the number of the slide run.

This system has been in use for several months and has proved effective in reducing operational errors.

Transistorized Low-Level

Advantages of speed, ruggedness, and life expectancy more than compensate for lower switching "quality." Use of multiples and external "stabilizing" and "compensating" resistance is described.

R. B. HURLEY

Most available alloyed germanium transistors are constructed asymmetrically. That is, the collector is generally of larger area than the emitter so that a favorable solid angle exists for carriers moving across the base region to be collected. Thus the normal alpha (common-base current gain) is greater than the inverted alpha ("collector" side used as an emitter and "emitter" side used as a collector). Such asymmetry along with the use of the inverted (low-gain) connection has been established as desirable for chopper service.[2, 3, 4] Common practice in transistor chopper literature is to illustrate the transistor as if it were operating in common-collector, though inverted common-"emitter" is intended (Fig. 1a).

Chopper Studies

For low-level chopper studies where collector currents of the order of microamps and collector voltages of the order of millivolts are of most concern, it is probably valid to consider that the transistor is operating in the "Shockley" region.[1] That is, the applied voltages and currents do not cause appreciable changes from thermal equilibrium conditions, and, thus, the alphas can be considered reasonably independent of the operating point. Under such conditions[5]

$$\alpha_i I_{CO} = \alpha_n I_{EO}, \qquad (1)$$

where α_n = common-base current gain (emitter to collector),

α_i = common-base current gain (collector to emitter),

I_{CO} = collector-base body saturation current (reverse biasing), and

I_{EO} = emitter-base body saturation current (reverse biasing).

Ebers and Moll[5] have shown that, neglecting surface leakage and

RICHARD B. HURLEY, Design Specialist Convair, Pomona, Calif.

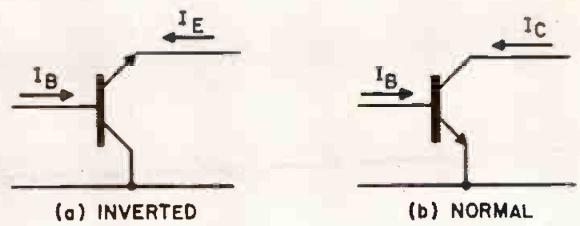


Fig. 1: Common-"emitter" symbols. (b) is used herein.

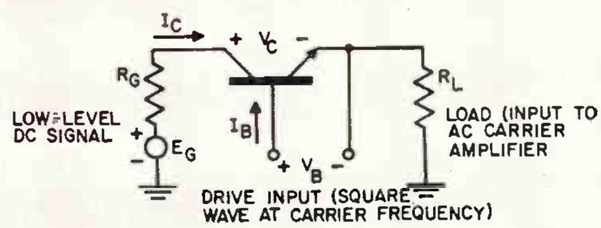


Fig. 2: Circuitry for common-emitter transistor switch.

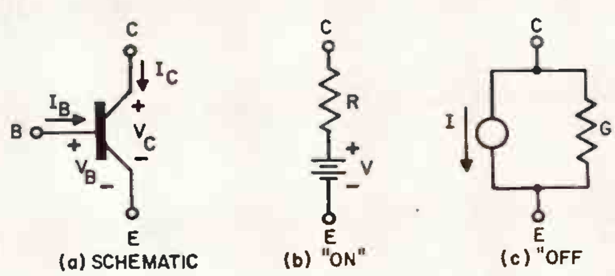


Fig. 3: Ideal equivalent output circuits for very low I_O and V_O.

Chopper-Circuits

By RICHARD B. HURLEY

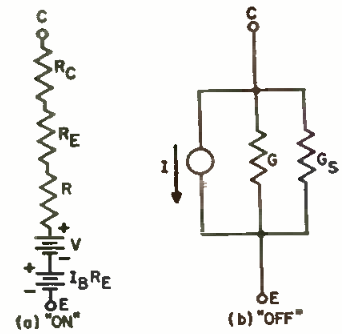


Fig. 4: Practical equivalent circuits.

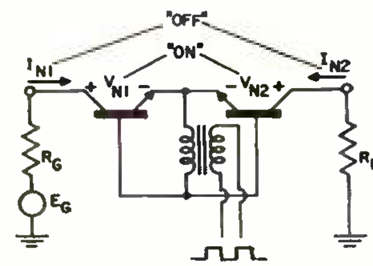


Fig. 5: Series-pair chopper circuit.

body ohmic drops, the emitter and collector currents are each composed of two parts: an ideal diode current and a collected current. Following their analyses and making free use of Eq. 1, it can be shown that the pertinent equations of the common-emitter switch (Fig. 2) are as follows (Similar expressions were developed by Bright.[2]):

$$I_C = \frac{\alpha_i}{1-\alpha_i\alpha_n} I_{CO}\,\epsilon^{qV_B/kT}\left[1 - \frac{\epsilon^{-qV_C/kT}}{\alpha_i}\right] + \frac{1-\alpha_i}{1-\alpha_i\alpha_n} I_{CO} \quad (2)$$

$$\text{and } I_B = \frac{\alpha_i}{\alpha_n} I_{CO}\left(\epsilon^{qV_B/kT} - 1\right) - (1-\alpha_i) I_C \quad (3)$$

While Eq. 2 and 3 are sufficient to describe the performance of an idealized transistor switch, it is found convenient to develop equivalent circuits for the "on" and "off" qualities. Furthermore, these qualities will be of most concern for very small signals and hence small collector voltages. Therefore it seems reasonable to assume that

$$V_C << \frac{kT}{q} \cong 0.026 \text{ v. at normal room temperatures.} \quad (4)$$

For the above assumption, Eq. 2 can be made linear for the collector voltage by using only the first 2 terms in the series expansion of an exponential.

$$\epsilon^{-qV_C/kT} \cong 1 - \frac{qV_C}{kT}. \quad (5)$$

Substituting Eq. 5 into Eq. 2 and solving for the collector voltage, the resulting equation takes on the form

$$V_C = R\,I_C + V, \quad (6)$$

where

$$R = \frac{kT}{qI_{CO}}(1-\alpha_i\alpha_n)\,\epsilon^{-qV_B/kT}, \quad (7)$$

and

$$V = \frac{kT}{q}(1-\alpha_i)(1-\epsilon^{-qV_B/kT}). \quad (8)$$

Eq. 6 suggests a series circuit, and it is found most useful for describing the "on" condition. When the switch is "on," however, the drive input impedance (base-emitter) is very low, and in practical cases the drive circuit probably contains a fair amount of resistance in series with the chopping voltage. Thus it may be more convenient to express the equivalent circuit in terms of the drive current, I_B, rather than the drive voltage, V_B. Rearranging Eq. 3,

$$\epsilon^{qV_B/kT} = \frac{\alpha_n I_B}{\alpha_i I_{CO}} + 1 + \frac{\alpha_n(1-\alpha_i)}{\alpha_i I_{CO}} I_C. \quad (3a)$$

For practical choppers, $I_B >> I_{CO}$ and $I_B >> I_C$ in the "on" condition, hence only the first term of Eq. 3a is significant.

$$\epsilon^{qV_B/kT} \cong \frac{\alpha_n}{\alpha_i}\frac{I_B}{I_{CO}}, \quad (3b)$$

and therefore

$$R \cong \frac{kT}{qI_B}\frac{\alpha_i}{\alpha_n}(1-\alpha_i\alpha_n). \quad (7a)$$

Furthermore, for the "on" condition, the drive voltage is positive. Hence,

$$V \cong \frac{kT}{q}(1-\alpha_i), \text{ for } \epsilon^{-qV_B/kT} << 1. \quad (8a)$$

For the "off" state, a parallel equivalent circuit is found most representative of the output of a transistor chopper. If Eq. 5 is again assumed, and Eq. 2 is rearranged. it takes the form

$$I_C = G\,V_E + I, \quad (2a)$$

where

$$G = \frac{I_{CO}}{1-\alpha_i\alpha_n}\frac{q}{kT}\epsilon^{qV_B/kT}, \quad (9)$$

and

$$I = I_{CO}\frac{1-\alpha_i}{1-\alpha_i\alpha_n}(1-\epsilon^{qV_B/kT}) \quad (10)$$

When the transistor is "off," its drive input impedance is very high. Hence Eq. 9 is appropriately a function of the drive voltage, V_B. Also the drive voltage is negative, thus

$$I \cong \frac{1-\alpha_i}{1-\alpha_i\alpha_n} I_{CO}, \text{ for } \epsilon^{qV_B/kT} << 1. \quad (10a)$$

Equivalent Circuits

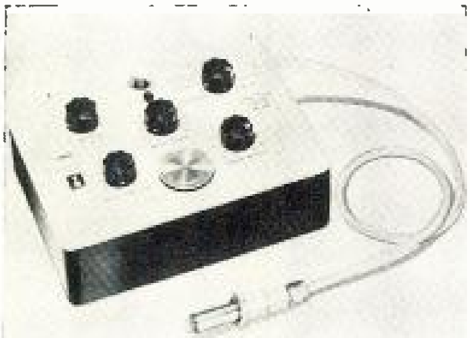
The equivalent circuits for the "on" and "off" conditions between the collector and emitter terminals have now been established for the ideal transistor for very low collector currents and collector-emitter voltages (Fig. 3). To make the low-level circuits practical, however, surface leakage and body ohmic drops must be added to the ideal "barrier" effects. For the "on" state, and assuming a known constant current, I_B, an additional battery can be used to represent the drop in the ohmic resistance of the

(*Continued on page* 108)

New Computer Products

AMPLIFIER

For use where max. mobility and flexibility is desired, plus for those applications where limited space is a factor, a new multi-channel dc amplifier unit has been developed. The unit



consists of 6 completely interchangeable plug-in dc amplifier sections, plus power supply, plus a 6 channel oscillograph. The instrument is also available in a portable cart, allowing maximum ease of movement to a required job location. It is particularly suited for such applications as computer readout. The unit features a measurement range from 0.050 to 400 v. Brush Electronics Co., Cleveland. (Ref. No. 12-41).

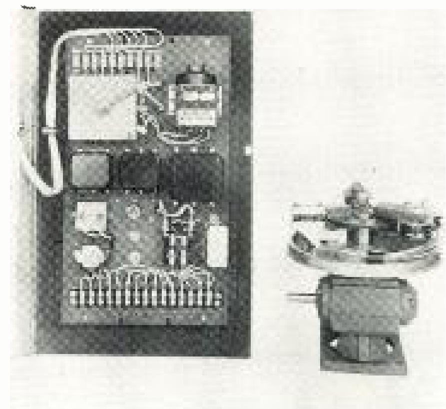
CHECK-OUT SYSTEM

A new, automatic system for obtaining absolute dc and ac voltage and frequency values, as well as "go/no go" checks, has been developed. The system, developed for missile check-

out, is extremely flexible, requiring only a change in the test programming to accommodate changing test requirements. The program units include an input scanner, a programmer, card memory and printer. The control unit consists of visual indicators and necessary circuitry for utilizing the measurement units for monitoring junctions under test. Electro Instruments, Inc., San Diego. (Ref. No. 12-44).

MEMORY SYSTEM

A unique magnetic memory system especially designed for delayed control of high speed continuous process lines and automatic sorting of items moving through complex conveyor



systems has been announced. These systems accept signals from almost all measuring devices such as photoelectric controls, pressure switches, relays, beta gauges, ultrasonic detectors, magnetic detectors, etc. No exact gearing or coupling ratio need be prescribed between the processing or conveyor line drive shaft and the input shaft of the unit. Automation Inc., Wellesley Hills, Mass. (Ref. No. 12-45).

Obtain more information on these products by filling in the reference number on the inquiry card, p. 105

PRINTERS

The printers are basic adding, multiplying, or calculating machines equipped with electrically actuated keys. Thus, figures can be entered into the machines electrically and at high speeds. Having an extremely wide range of versatility, the Digitmatic can be used with paper tape typewriters, electronic counters, digital testing equipment, digital scales,

production counters, and for such integrated data processing office applications as automatic invoice calculating, purchase order extensions, account selection and totaling. Victor Adding Machine Co., Chicago. (Ref. No. 12-42).

PROGRAM COMPUTER

A general purpose, digital, one-address, stored program computer of the medium speed class. It is available for either fixed point operation alone, or for fixed point and floating point operation. Alphabetic, as well as numeric data, may be operated on, assuring maximum flexibility for both commercial and scientific users. Each of the words of internal drum storage

consists of 10 decimal digits and sign, or 2 commands, complete with addresses. Internal operation is in the decimal number system, with each decimal digit represented by four binary bits. J. B. Rea Co., Inc., Santa Monica. (Ref. No. 12-47).

SHAPED-BEAM TUBE

A new model of the shaped-beam tube which can reproduce 1,200,000 tiny letters and numbers per minute for recording photographically has gone into production. The new tube, designated the Type C7C11, has a 7-in. dia. The small size of the characters enables the 7 in. tube to reproduce 9 times the information density (characters psi) possible with other

models. This vastly reduces the number of pictures required to reproduce in permanent form the electronically-produced characters. For use with photo-recording devices in an electronic computer. Stromberg-Carlson, San Diego. (Ref. No. 12-46).

And Accessory Equipment

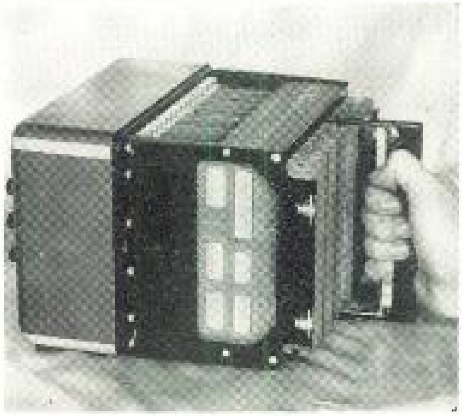
PRECISION POT

Series 18-100 multi-turn, linear and non-linear potentiometers with a new method of exterior winding, have an operating temperature range of from —55°C. to +100°C. linearity as low as

0.015% and electrical noise output only slightly above resolution level. These potentiometers have a max. dia. of 1.825 in. Optional terminal linearity makes field service practical where replacement might be necessary. All taps and terminal connections are welded to a single selected turn of wire. Three turn pots available from 500 to 75,000 ohms; 10 turn pots from 500 to .2 meg. **Electromath Corp., Stamford, Conn.** (Ref. No. 12-73).

CONTROL UNIT

This computing unit occupies ⅓ cu. ft. and weighs less than 12 lbs. It operates on only 3 v. potential and contains nearly 1,000 transistors, 300 resistors, and 12 capacitors perma-



nently dip-soldered into compact, plug-in, printed-circuit cards. Each card provides all the functions for 1 binary digit including add, subtract, multiply, divide, square root, shift right, shift left, sign and absolute magnitude. Ten "math" and 7 "control" cards are plugged into the 10 in. long unit to provide all arithmetic processing facilities. It adds 2 numbers in 1.5 μsec, multiplies in 15 μsec. **Philco Corp., Phila.** (Ref. No. 12-75).

SIGNAL GENERATOR

These generators are designed to provide ultrastable, accurate statistical functions for computer analysis, missile system analysis, and radar countermeasures studies. Available

in 6 different models covering the frequency range from .01 cps to 5 MC, the random function generator provides noise signals whose amplitude distribution with time is accurately Gaussian, at an output level of 5 v.RMS into 600 ohms with direct reading calibrated attenuation. Total distortion in amplitude distribution is less than 2%. **Sigmatron Div., Intercontinental Dynamics Corp., Englewood. N. J.** (Ref. No. 12-76).

Obtain more information on these products by filling in the reference number on the inquiry card, p. 105

CARD CONVERTER

The new ALWAC Card Converter automatically translates alphabetically and decimally coded data recorded on cards into binary "language" understood by the electronic digital computer. This new converter makes possible the direct and automatic transfer of data from cards to computer for processing. Addition of this new Card Converter greatly increases the AL-

WAC III-E computer system's range of applications which now includes processing payroll, personnel, sales, records, alphabetically and decimally coded on cards. **Logistics Research Inc., Redondo Beach, Calif.** (Ref. No. 12-68).

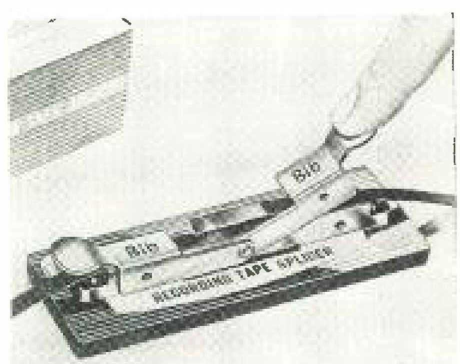
REFERENCE SOURCE

A secondary-standard voltage-reference source combines a dc voltage source with 5 decade switches as incremental voltage dividers to provide a versatile, easy-to-operate instrument. The continuous dc reference outputs of ±100.00 v. have initial accuracy of 0.01% and maximum drift of 0.02% *per year*. Output voltage is selectable between +111.112 and

—111.112 in discrete steps of 1 mv.; minimum-resolution steps of 10 μv are obtainable when a precision (100:1) attenuator is used. Available as a portable unit or in the 14 in. size for standard rack mounting. **Epsco, Inc., Boston.** (Ref. No. 12-37).

TAPE SPLICER

An indispensable accessory for any tape recorder user, this new British-made splicer is extremely simple to use and can be employed both for mending broken tapes and for editing purposes. Made of nickel-plated brass, the BIB splicer comes mounted on a flock-sprayed base, or can be mounted directly on any tape deck. The body of the splicer has two pivoted clamps



which lock into position to hold the sections firmly in a channel. Both vertical and diagonal mitres are provided for either editing or mending, which is done by means of cellulose tape. A razor-type cutter is included. **Ercona Corp., New York.** (Ref. No. 12-66).

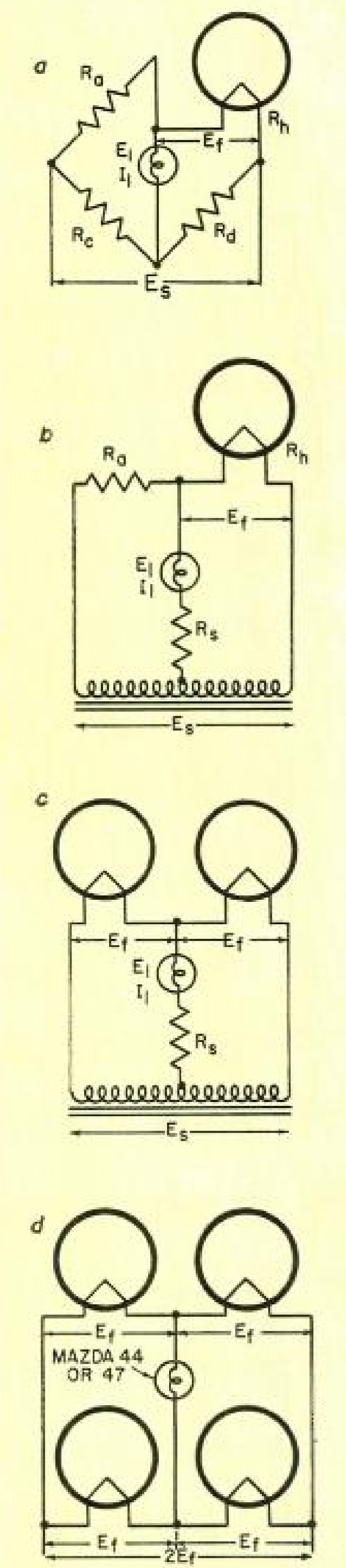


Fig. 1: (a) Wheatstone Bridge indicates filament "open"; (b) Filament transformer replaces resistive arms; (c) Second tube eliminates last resistor and, (d) four tube filaments form bridge.

With computer rental going at $350/hr., elimination of "down time" is essential. High speed inspection of tube filaments is a prime requirement. Described here is circuitry which indicates continuity of large banks—in seconds.

Locating "Open Heaters" In Computer Circuitry

By RONALD L. IVES

Detection of a single open filament in a multi-tube shunt-wired system is somewhat difficult, and most of the detection and indication systems investigated are unworkable because of bulk, cost, or complexity. Two systems, however, seem to be useful in a wide variety of applications. One of these, called the bridge system, is direct indicating. In some of its applications, the bridge system draws no current when all of the monitored filaments are whole. The other, called the "Biblical System," operates on the principle "seek and ye shall find."

Bridge Systems

The various bridge systems for continuous monitoring of filament continuity all work on the general principle of the Wheatstone Bridge.

As applied to filament monitoring (see Fig. 1a), a lamp indicator is used to detect an unbalance, and one bridge arm is replaced by the tube filament. The resistance which is effective here is the hot resistance of the filament, designated by R_h, and determinable from the tube filament ratings. The cold resistance of the filament, as determined by an ordinary low-current ohmmeter, is about ⅕ R_h.

RONALD L. IVES, John C. Beckman Co., 2172 Staunton Court, Palo Alto, Calif.

Once the supply voltage, E_s, which must be higher than the required filament voltage, E_f, is chosen, and the tube is selected, R_a can be immediately evaluated from $(E_s—E_f))/I_f$; and the ratio R_c/R_d can be determined next from R_a/R_h, or from $(E_s—E_f)/E_f$.

When the lamp current, I_l, and the lamp voltage, E_l, are chosen, R_c and R_d can be evaluated "easily" in about 30 min. by skillful use of Ohm's and Kirchoff's Laws. The lamp must, in general, operate at a voltage and current much less than that of the tube filament.

With currently available equipment, bridge operation is most economical of power when E_s is very roughly twice E_f. In this arrangement, $R_a = R_h$; and $R_c = R_d$. The lower 2 arms of the bridge, in consequence, function merely as a center tap. As a perfectly good center tap is already supplied on most filament transformers, we may

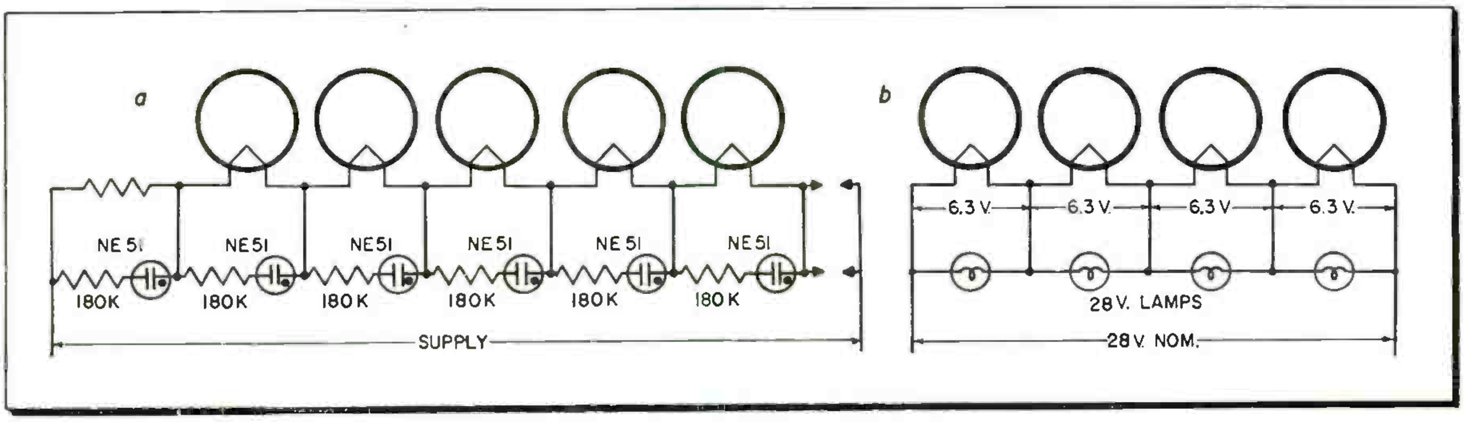


Fig. 2: (a) For 115 v., supply voltage across open filament ignites neon lamp; (b) For 28 v., brightest lamp indicates open filament.

omit the unnecessary elements, arriving at a simplified bridge, Fig. 1b. Here, the monitoring components consume exactly as much power as the tube filament, when the filament is whole.

Since $E_s = 2E_f$ and $R_a = R_h$, R_s can be easily calculated by use of the following equations:

$$(R_a + R_s) I_1 + E_1 = E_f$$

$$R_s = \frac{E_f - E_1}{I_1} - R_a$$

Two-Tube Bridge

By making R_a another functioning tube filament, power waste is reduced to Zero, and the monitoring circuit becomes a "free rider." This can be accomplished by connecting two like tubes, as regards E_f and I_f, across the line, or by use of tubes which have a center-tapped filament, such as the 12AT7, 12AU7, 12AX7 family. The first alternative is ideally suited for push-pull circuits; the second for general use. Circuit diagram is shown in Fig. 1c.

In these arrangements, value of the lamp series resistor must be computed from the lamp characteristics and from the warm resistance R_w, of the still-whole tube filament. It should be specifically noted

TABLE 1: R_s for Mazda #49 lamp

	6L6	6SL7	½–12AT7
E_f	6.3 v.	6.3 v.	6.3 v.
I_f	0.9 a.	.3 a.	.15 a.
R_h	7 Ω	21 Ω	42 Ω
R_w[1]	1.77 Ω	7.6 Ω	18.5 Ω
R_s[2]	75 Ω	68 Ω	56 Ω

[1] at 60 ma.
[2] nearest higher stock value.

that this is a working approximation, satisfactory for this application, and not a rigorous evaluation. R_w, found by the equation

$$R_w = \frac{R_h}{5} + \left(\frac{4\,R_h}{5} \times \frac{I_1}{I_f}\right)$$

is substituted in the foregoing equation to find the proper value of R_s.

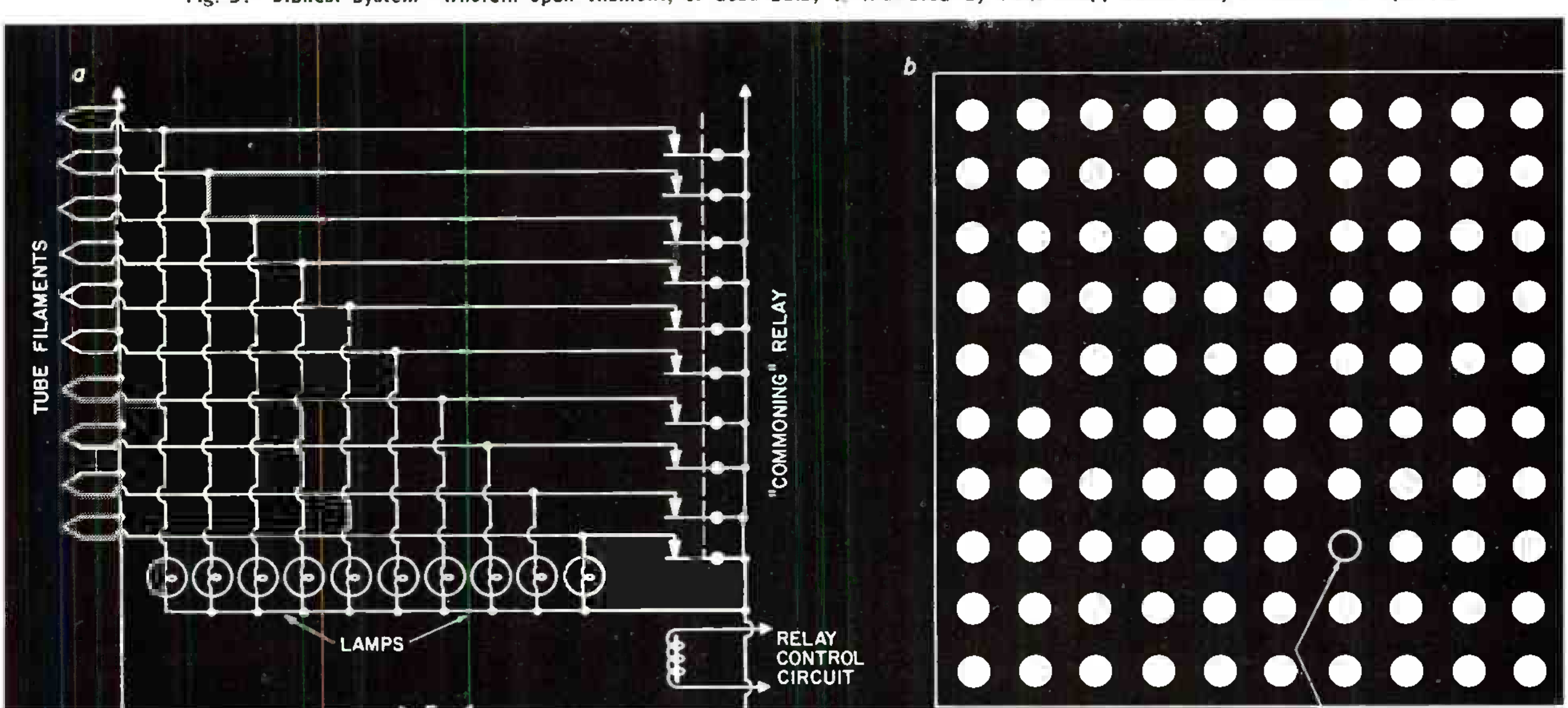
Values of R_s for use with a Mazda #49 lamp (2v., 60 ma.) and 3 representative tube types are shown in Table 1. It is notable here that the warm resistance of power tube filaments is very low. In consequence, a Mazda #44 lamp (6.3v., 250 ma.) can be used with 6L6 and similar tubes without a series resistor; and a Mazda #47 (6.3v., 150 ma.) with tubes drawing 300 ma. or more.

Four-Tube Bridge

Another filament monitoring circuit, also employing the bridge principle, is especially applicable to push-pull parallel circuits, such as are currently popular with 6L6's and 5881's in high-fidelity circuits. This is shown in Fig. 1d, and like

(*Continued on page* 102)

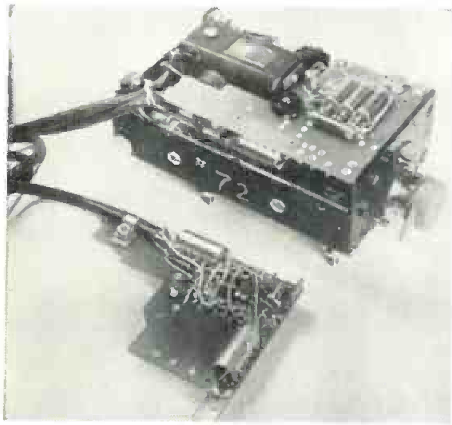
Fig. 3: "Biblical System" wherein open filament, or dead bulb, is indicated by unlit lamp, when relay contacts are opened.



New Avionic Products

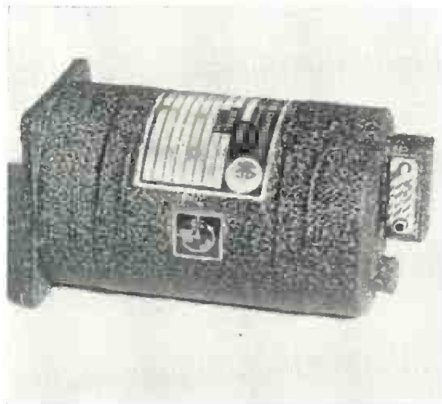
TIMING GENERATOR

A new, virtually "G-immune" timing generator which can be designed to pulse at any rate from once to 3,000 times/sec., will be used to establish a time base on the film of airborne data recording cameras. Weighing only 2¼ oz. and occupying 4 cu in. of space, the unit can be installed as an integral part of a recording camera, replacing bulky signal-generating equipment. The unit has withstood acceleration loads in excess of 100-G. In tests, it has performed accurately despite very high vibration levels, high altitudes, or temperature variations. **Electromation Co., Burbank, Calif.** (Ref. No. 12-48).



FREE GYRO

Compact versatility is the primary characteristic of the Model F10A-1 Free Gyro. It's a unit small enough to meet space requirements for missile applications and capable of delivering full efficiency in both missile and piloted aircraft systems. Compactness centers around its dimensions—length of 6.250 in., dia. of 3.297 in. and weight, 4.5 lbs. A unique feature is the ac pickoff adjustment which can be made on the exterior of the gyro case. DC pickoffs are furnished in resistance ranges from 100K to 500K. AC pickoffs can be either synchro or two-phase resolver. **American Gyro Corp., Santa Monica.** (Ref. No. 12-49).



AC MOTORS

These motors are compact, precision made units for applications where size, weight and high performance are the governing factors. Protection for military environmental specifications has been considered in the design. They can be wound as follows: 3-phase, 2 or 4 pole; 2-phase, 2 or 6 pole. Both 3-phase and 2-phase units can be operated single-phase with a suitable phasing capacitor. The induction rotor will provide a unit with more output than a unit with a hysteresis rotor, but the hysteresis unit will operate at synchronous speeds. **Globe Industries, Inc., Dayton.** (Ref. No. 12-50).

Obtain more information on these products by filling in the reference number on the inquiry card, p. 105

GYRO

A new free gyro offers unusual ruggedness and insensibility to mounting and dynamic loads. Designated the Model 3416 Free Gyro, this instrument features a cast steel frame mounted solidly inside a structural outer shell having an integral CG mounting flange. Shock specification is 50g in all axes. Drift rate is less than 18 min. of arc/min., and the potentiometer pickoffs which supply outputs up to 70 v. for telemetering and control operations have a linearity of ±0.5% and resolution of 0.09°. Available as a single unit or as a pair. **G. M. Giannini & Co., Inc., Pasadena.** (Ref. No. 12-51).

FIRE CONTROL

Built to withstand the rigid environmental requirements of today's jet aircraft, the hermetically sealed control provides automatic programming for missile firing. Opening of rocket pods and other functions in complete and proper sequence of a firing mission are controlled to μsec accuracies. Compact size, light weight, extreme accuracy and standard AN connectors are the predominate features. Primarily on prime or sub-contract to the Air Force, the precision fire controls and intervalometers are produced in accordance with MIL-I-5923B. **Abrams Instrument Corp., Lansing, Mich.** (Ref. No. 12-71).

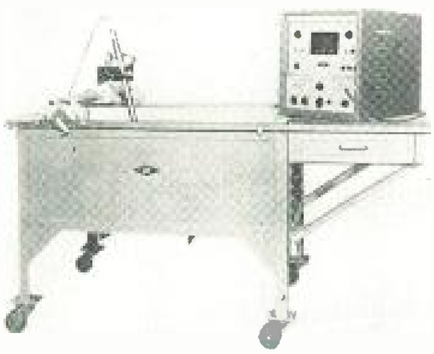
PRESSURE SWITCH

Designed especially for use in airborne electronic systems, the GAB 1000 series vacuum pressure switches respond to pressure as low as 2 in. of mercury absolute, retain their accuracy to ±1 in. of mercury pressure under extreme environmental conditions in aircraft and missile systems. The basic operating element in this switch design is the rigid miniature bellows, which is supported in a manner that enables it to resist self-actuation up to 2000 cps at 10g. The GAB 1000 series switch is specifically designed for use in inert gas vacuums. **Gorn Aircraft Controls Co., Stamford, Conn.** (Ref. No. 12-72).

New Test Equipment

ULTRASONIC TESTER

A portable unit for precise and positive inspection of all metal parts. Designed for stabilizing high quality control standards while lowering inspection costs, the unit is also easily



and inexpensively expanded to meet increased production demands. The "package" consists of: an Immerscope, nerve center of the system, a four foot immersion tank, search tube and rack, precision manual manipulator, longitudinal and transverse manual scanning mechanism and a complement of crystals. Metal parts to be inspected are placed in the partly water-filled tank. **Curtiss-Wright Corp., Caldwell, N. J.** (Ref. No. 12-39).

CALIBRATOR

Comprises, with power supply and headphones, all the circuits necessary for the calibration of osc., receivers, and other wide-range devices up to frequencies above 1000 MC. It also

provides square-wave markers for oscilloscope sweep-time calibration at intervals from 0.1 μsec. to 100 μsec. Features incorporated include harmonic series with fundamentals of 10, 1, 0.1, and 0.01 MC, a crystal mixer good from low frequencies to frequencies above 1000 MC, an amplifier for audible beats, and a video-frequency amplifier output for sweep-time calibrations. **General Radio Co., Cambridge, Mass.** (Ref. No. 12-35).

DEVIATION METER

A Frequency Deviation Meter, which will measure FM or AM modulation characteristics over a range of carrier frequencies from 20 to 600 MC, is available. The meter has the un-

usual capability of simultaneously indicating the incidental AM in an FM signal being measured and, conversely, the incidental FM in an AM signal. The range of indication for full scale frequency deviation is 0 to 10/30/60/150 KC. However, provisions are made for connecting external indicators to be used for measuring FM deviations as low as 40 cps. **Federal Telephone and Radio Co., Clifton, N. J.** (Ref. No. 12-36).

Obtain more information on these products by filling in the reference number on the inquiry card, p. 105

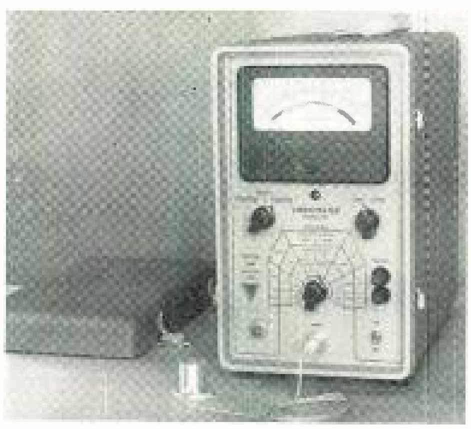
OSCILLOGRAPH

Type 401 offers calibrated sweeps, both driven and recurrent and superlative stability. These features set a precedent for a general purpose oscillograph. A completely redesigned front panel—division of the front panel into visual and manual areas by use of an offset cast frame, new lettering styles, and new control knobs and rearranged groupings of

these knobs in basic "blocks of functions," all in sharp, contrasting colors. Other features are identical direct coupled high gain X- and Y-amplifiers and amplitude calibration. **A. B. DuMont Laboratories, Inc., Clifton, N. J.** (Ref. No. 12-74.)

VIBROMETER

For measurement and analysis of mechanical vibration. Measures, conveniently and accurately, acceleration, velocity and displacement of mechanical vibrations from 3 cps to 20,000 cps. Measures displacement as small as 0.0001 in. and as great as 3.0 in.: velocities from 0.03 in/sec to 1000 in/sec; accelerations from 10 in/sec/sec to 300,000 in/sec/sec (0.03 g to



780 g). Used with oscilloscope, permits quantitative analysis of impact shock and impulsive motions. Polarity switch provided for determining positive and negative peaks of vibration. **Televiso Corp., Des Plaines, Ill.** (Ref. No. 12-34).

REGULATED SUPPLY

The Model CVPS-105 is a dual purpose power supply designed to provide either constant current or constant voltage as desired, for use in semiconductor and electronics research or as a general laboratory supply. Regulation is provided by feedback loops, a control amplifier, and series regulator tubes. The current or voltage, at any desired value from zero to maxi-

mum, is set by continuously variable coarse and fine controls. The output is monitored by a multirange combination voltmeter-milliammeter. On constant voltage, the output is 0-200 ma. and 0-500 v. **Matthew Laboratories, Yonkers, N. Y.** (Ref. No. 12-31).

For those who have considered engineering texts of their own, a technical book publisher answers some of the many questions that confront new authors. How much profit is there? How to choose a publisher? How to protect author's rights?

By

CHAS. E. HEINLE,
General Manager,
Chilton Book Div.

"About That Book . . ."

Writing is difficult or easy, depending upon what you choose to make it. Unless you have written very much, the chief hardship is the uncertainty as to what to do. Your mind dashes ahead trying to visualize the completed book, even before the material has been gathered, an outline completed, or perhaps the theme settled in your mind. Such a lack of method would bring despair to even a professional author.

You must recognize that writing is work, and it should be approached in a workmanlike manner. There is no mystery about writing, and, indeed it can become commonplace, if you will always remember that it is a house of blocks, and each block is one of a definite series of steps. When a builder looks at a house he sees each step of construction clearly. An experienced writer sees each step of construction clearly and moves ahead one step at a time.

There are many books available to help you with the small details of writing. Problems of paragraphs, sentences, words, phrases, points of grammar and style—these are only small parts of the overall picture. Since it is not our purpose here to cover the actual writing process, but rather to try to interest those to write who have something important to say, and have never said it, we will recommend an intensive reading of any good book on creative writing, and go on to the reasons why you should write.

Why Everyone Should Write

Writing, if properly approached, is a great aid to clear thinking, sound planning, a consolidation of thought, that can and often will lead to a vast improvement of your conception of any subject. Whether or not you publish, the simple act of *recording* your thinking clears the air like a thunder storm. If you have said what you intended, and upon re-reading cannot improve it, you have at least accomplished what can be the most rewarding activity of man—capturing forever the subtle thoughts of the human brain for other men to use. Writing is to thought what the finishing touches are to our house of blocks—it enables everyone to see the finished product. How well it looks, of course, will depend upon how sound a foundation of research and thinking you put under it. What it will mean to you economically will depend upon the value the market-place fixes on your subject and the way you developed it.

What are Publishers?

Publishers are neither philanthropists or rogues. Nor is it true, as stated in the malignant epigram, that they have a habit of drinking out of authors' skulls. Regard them as ordinary human beings trying to earn their living at an unusually difficult occupation. The source of profit is the difference between what a book costs to manufacture and what booksellers pay the publisher for it, and from this income must be paid the costs of selling, advertising and promotion, overhead, etc. The laws of arithmetic apply to all publishers. So do not expect to make a fortune from your writing, unless the public is willing to pay a fortune to read you. This is especially true in the field of technical books where, with certain exceptions, a limited market awaits your work. There are standard royalty rates that most reputable publishers pay their authors today, and these usually are 10% on the first 2500 copies sold, 12½% on the next 2500 copies sold, and 15% on all sold thereafter. This is computed on the net proceeds of sale. On this basis an average edition of an average technical book might bring the author the sum of $1,500 in cash and an untold value in prestige—that will pay off in advancement with your firm or school, and another chance to write a book that will enjoy a better sale, perhaps, than your first one.

Securing a Publisher

The problem of securing a publisher can be divided into two parts. What you should look for in a publisher, and what the publisher is looking for in you.

Starting with you at the point of having completed your research, and having a definite theme or subject, it is usually best to prepare a complete outline of your proposed book, and a sample chapter, to give the publisher an idea of the treatment. Send these with a letter covering the essentials of your book, its purpose, the market you have in mind, and if you are familiar with it, the competitive titles in the field—their weaknesses or strong points if applicable.

It is somewhat easier in the technical field to select a publisher that will have some interest in your subject, because it is possible to go through various cata-

(*Continued on page* 126)

B.F.Goodrich

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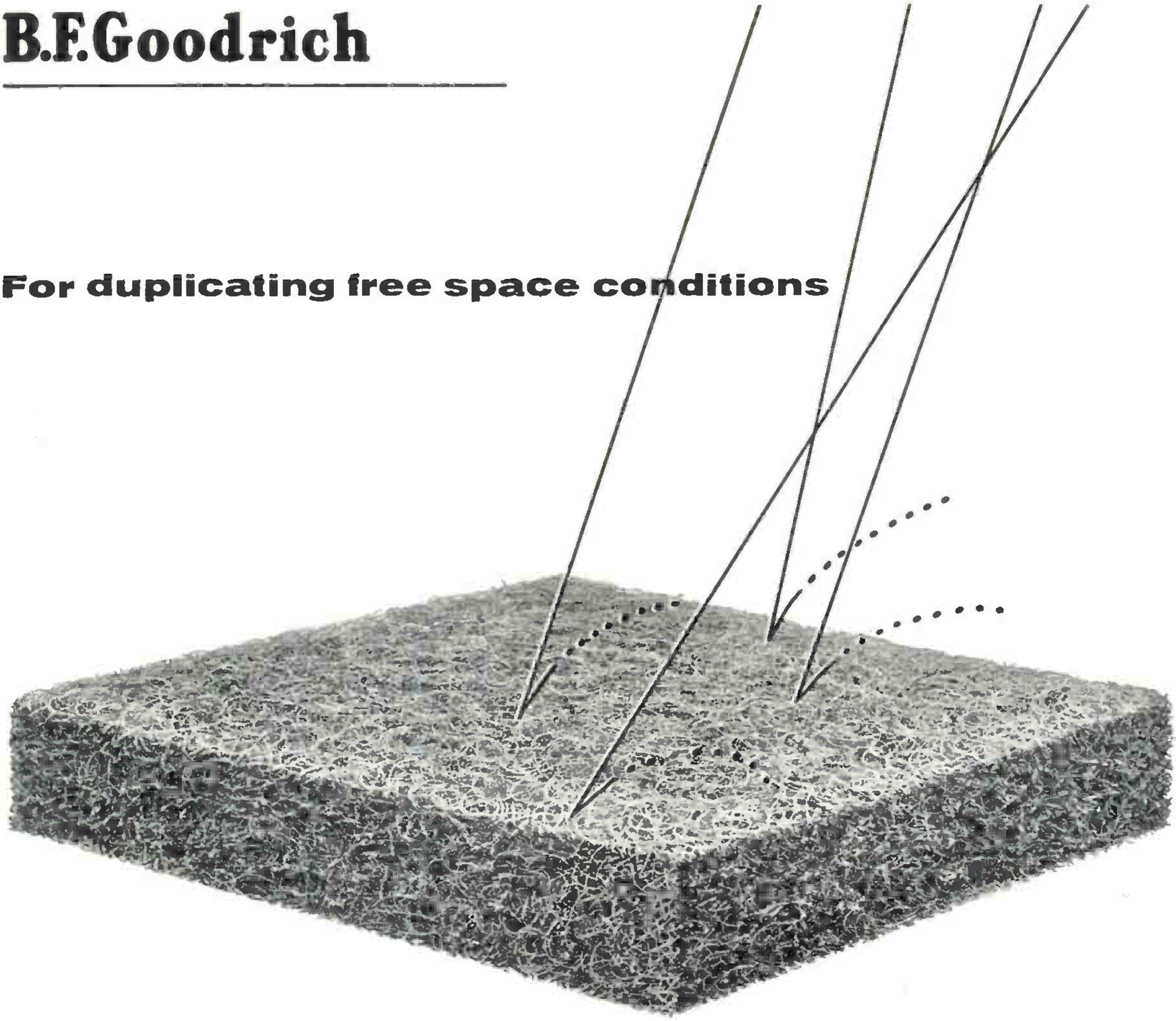

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SPONGE PRODUCTS DIVISION **B.F.Goodrich** 279 DERBY PLACE, SHELTON, CONNECTICUT

Electronic Industries 1957 Transistor Specifications

Latest technical specifications on the 317 transistors now being commercially marketed. Grouping is by manufacturer and for the convenience of circuit designers the suggested areas of application are indicated under the headings: audio, push-pull audio output, power, r-f and switching and computers.

								TYPICAL OPERATION								MAXIMUM RATINGS				
TYPE No.	**CLASS**	Audio	B.Amp.	Pwr.	if-rf	Sw.	Gen.	E_{COLL} v	I_{COLL} ma	I_{EM} ma	PG db	P_{OUT} mw	T_{OP} °C	F_{OP} mc	α or β	E_{COLL} v	I_{COLL} ma	P_{COLL} mw	T_{MAX} °C	F_{CO} mc
AMPEREX ELECTRONIC CORP., 230 Duffy Ave., Hicksville, L.I., N.Y.																				
OC44	pnp				x			-5.8	-.4	.4	28		25	1	100	-15	-10	20	65	15
OC45	pnp				x			-6	-1	1	59		25	.455	40	-15	-10	20	65	6
OC65	pnp	x						-6	-2	2	45	2	25	.01	30	-10	-10	50	65	.45
OC66	pnp	x						-6	-1.7	1.7	40	1.5	25	.01	47	-10	-10	50	65	.47
OC70	pnp	x						-9	-2	2	45	2	25	.01	30	-30	-10	50	60	.3
OC71	pnp	x						-9	-2	2	40	2	25	.01	47	-30	-10	50	60	.3
2-OC72	pnp	x	x					-12	-85	85	32	500	25	.01	50	-32	-125	167	75	.6
OC73	pnp	x				x		-4.5	-10	10			25	.01	40	.32	-10	100	65	.5
OC76	pnp					x		-6	-150	150		710	25	.01	45	-32	-250	100	75	.16
BENDIX AVIATION CORP., Red Bank Div., 201 Westwood Ave., Long Branch, N.J.																				
2N235	pnp	x		x				-14	-420		>30	>2000[2]	25			-40	-2000	5000	85	.005
2N235A	pnp	x	x	x		x		-14	-420		35	>2000[2]	25			-40	-2000	5000	85	.007
B-112	pnp			x				-14	-420		40	>2000[2]	25			-40	-2000	5000	85	.008
X-110[1]	pnp			x		x										-40	-5000	10000	100	
1. Rise time 100 μsec., fall time 200 μsec. 2. Class A operation.																				
CBS-HYTRON, Danvers, Mass.																				
2N155	pnp	x		x				-14	-360	368	33	2000	25		48	-30	-3000	6250[1]	85	.3
2N156	pnp	x		x				-14	-360	368	33	2000	25		48	-30	-3000	6250[1]	85	.3
2N158	pnp	x		x				-28	-180	184	36	2000	25		45	-60	-3000	6250[1]	85	.3
2N180	pnp	x						-9	-15	15	37	65	25		60	-30		150	75	.7
2N181	pnp	x						-12	-20	20	34	110	25		60	-30		250	75	.7
2N182	npn					x		6	1	-1	30		25	.455	25	25		100	75	2.5-5
2N183	npn					x		6	1	-1	33		25	.455	40	25		100	75	5-10
2N184	npn					x		6	1	-1	36		25	.455	60	25		100	75	10
2N255	pnp	x		x				-7	-500	516	22	1000	25		30	-15	-3000	6250[1]	85	.2
2N256	pnp	x		x				-14	-500	516	25	2000	25		30	-30	-3000	6250[1]	85	.2
1. With heat sink, 6 x 6 x 1/8 in. aluminum sheet.																				
CLEVITE TRANSISTOR PRODUCTS, 241 Crescent St., Waltham 54, Mass.																				
2N257	pnp	x		x		x		-14	500		30		25			-40		25000	85	.007
2N260	pnp-si	x			x	x		-6	1		38		25	.001	16	10	50	200	150	1.8
2N260A	pnp-si	x			x	x		-6	1		38		25	.001	16	30	50	200	150	1.8
2N261	pnp-si	x			x	x		-6	1		36		25	.001	10	75	50	200	150	1.8
2N262	pnp-si	x			x	x		-6	1		40		25	.001	20	10	50	200	150	6
2N262A	pnp-si	x			x	x		-6	1		40		25	.001	20	30	50	200	150	6
2N268	pnp	x		x		x		-14	500		28		25			-80		25000	85	.006
CTP1032	pnp	x			x	x		-6	1		>38		25	.001	13	-25	-40	75	75	.6
CTP1033	pnp	x			x	x		-6	1		>40		25	.001	25	-25	-40	75	75	.8
CTP1034	pnp	x			x	x		-6	1		>42		25	.001	45	-25	-40	75	75	1
CTP1035	pnp	x			x	x		-6	1		>42		25	.001	65	-25	-40	75	75	1.2
CTP1036	pnp	x			x	x		-6	1		>42		25	.001	85	-25	-40	75	75	1.5
CTP1104	pnp	x		x		x		-14	500		23		25			-40		25000	85	.004
CTP1108	pnp	x		x		x		-7	500		20		25			-20		25000	85	.004
CTP1109	pnp	x		x		x		-7	500		27		25			-20		25000	85	.006
CTP1111	pnp	x		x		x		-14	500		23		25			-80		25000	85	.004
CTP1320	pnp	x						-6	1		>38		25	.001	13	-25	-40	50	75	.6
CTP1330	pnp	x						-6	1		>40		25	.001	25	-25	-40	50	75	.8
CTP1340	pnp	x						-6	1		>42		25	.001	45	-25	-40	50	75	1
CTP1350	pnp	x						-6	1		>42		25	.001	65	-25	-40	50	75	1.2
CTP1360	pnp	x						-6	1		>42		25	.001	85	-25	-40	50	75	1.5
CTP1390	pnp				x	x		-6	1		31		25	.455		-10		50	55	3.5
CTP1400	pnp				x	x		-6	1		34		25	.455		-10		50	55	7
CTP1410	pnp				x	x		-6	1				25			-10		50	55	>10

(Continued on Page 54)

Key to Chart Symbols: B-Amp.—used in push-pull class B amplifiers; Pwr.—used in high power audio output, servo, or power converter circuits; if-rf—262 KC and above; Sw.—switching, computer, and converter applications; and Gen.—not otherwise specified by the mfr.

Transistors are germanium unless class designation is followed by si—silicon. Classes include pnp, npn, pc—point contact, sbt—surface barrier transistor, and mat—micro-alloyed transistor. Other symbols used are: E_{COLL}—collector voltage; I_{COLL}—collector current, I_{EM}—emitter current, PG—power gain, P_{OUT}—output power, T_{OP}—typical operating temperature, F_{OP}—typical operating frequency, α or B—current amplification, T_{MAX}—maximum temp., and F_{CO}—α cutoff frequency (3 db down).

TYPE No.	CLASS	Audio	B. Amp.	Pwr.	if-rf	Sw.	Gen.	TYPICAL OPERATION								MAXIMUM RATINGS				
								E_{COLL} v	I_{COLL} ma	I_{EM} ma	PG db	P_{OUT} mw	T_{OP} °C	F_{OP} mc	α or β	E_{COLL} v	I_{COLL} ma	P_{COLL} mw	T_{MAX} °C	F_{CO} mc
DELCO RADIO DIV., General Motors Corp., Kokomo, Indiana																				
2N173	pnp	x		x		x		-12	1200	1200	28[1]	30000	25	.0004	90[2]	-60	12000	55000	95	
2N174	pnp	x		x		x		-28	1200	1200	25[1]	40000	25	.0004	72[2]	-80	12000	55000	95	
1. Class AB push-pull, common emitter. 2. Collector current = 1.2 amp.																				
FRETCO INC., 406 N. Craig St., Pittsburgh 13, Pa.																				
2N32	pc					x		-25			21		30		2.2	-40	-8	50	60	
2N33	pc				x			-8			22	1	30	40		-85	-7	30	60	
2N34	pnp	x						-6			40		30		.98	-25	+8	50	60	
2N35	npn	x						+6			40		30		.98	+25	-8	50	60	
2N36	pnp	x						-6			40		30		45	-25	+8	50	60	
2N37	pnp	x						-6			36		30		30	-25	+8	50	60	
2N38	pnp	x						-6			32		30		15	-25	+8	50	60	
2N39	pnp-si				x			-5	-1	1			30		40	-42	-5.5	32	70	
2N40	pnp-si				x			-6	-1	1			30		30	-42	-5.5	32	70	
2N42	npn-si				x			6	1	-1			30		15	+32	+5.5	32	70	
2N43	pnp-si				x			-6	-1	1			30		40	-35	-8	35	70	
2N63	pnp-si				x			-6	-1	1			30		22	-35	-8	35	70	
2N64	pnp-si				x			-6	-1	1			30		40	-35	-8	35	70	
2N65	pnp-si				x			-6	-1	1			30		90	-35	-8	35	70	
GENERAL ELECTRIC CO., Electronics Park, Syracuse, N.Y.																				
2N43	pnp	x						-5		5	39		25		.98[1]	-45	-50	150	100	1[1]
2N43A	pnp	x						-5		1	39		25		.9775	-45	-50	150	100	1
2N44	pnp	x						-5		1	38		25		.955	-45	-50	150	100	1
2N45	pnp	x						-5		1	36		25		.92	-45	-50	150	100	1
2N76	pnp	x						-5		1	42		25		.95	-20	-10	50	60	1
2N78	npn				x			5		1	25			1.6	50	15	20	65	85	6
2N81	pnp	x						-5		1	39		25		60	-20	-15	50	100	1
2N107	pnp						x	5		1	38		25	.001	19[1]	-12	-10		60	1
2N123	pnp					x		-5		1			25		150[1]	-20	125[2]	100[2]	85	8
2N135	pnp				x			-5		1	29		25	.455	20	-20	-50	100	85	3
2N136	pnp				x			-5		1	31		25	.455	40	-20	-50	100	85	5
2N137	pnp				x			-5		1	33		25	.455	60	-10	-50	100	85	7
2N167	npn					x		5		1			25		.975	30	75	65	85	8
2N168	npn				x			5		1	80		25	.455	20	15	20	55	75	6
2N169	npn				x			5		1	24		25	.455	40	15	20	55	75	4
2N169A	npn				x			5		1	27		25	.455	30	25	20	55	75	5
2N170	npn				x			5		1	12		25	1.6	.952	6	20	25	50	2.5
2N186	pnp	x	x					-12			28[3]	300[4]	25		24[1]	-25	200	75	85	.8[1]
2N186A	pnp	x	x					-12			28[3]	750[4]	25		24	-25	200	180	85	.8
2N187	pnp	x	x					-12			30[3]	300[4]	25		36	-25	200	75	85	1
2N187A	pnp	x	x					-12			30[3]	750[4]	25		36	-25	200	180	85	1
2N188	pnp	x	x					-12			32[3]	300[4]	25		54	-25	200	75	85	1.2
2N188A	pnp	x	x					-12			32[3]	750[4]	25		54	-25	200	180	85	1.2
2N189	pnp	x						-12			37[3]		25		24[1]	-25	50	75	85	.8[1]
2N190	pnp	x						-12			39[3]		25		36	-25	50	75	85	1
2N191	pnp	x						-12			41[3]		25		54	-25	50	75	85	1.2
2N192	pnp	x						-12			43[3]		25		75	-25	50	75	85	1.5
1. Design center. 2. Peak value = 500 ma. 3. Minimum value. 4. Two transistors Class B.																				
GENERAL TRANSISTOR CORP., 130 90th Ave., Richmond Hill 18, N.Y.																				
GT14	pnp	x						-4.5		1	36		25	.001	28	-25	100	125	85	
GT14H	pnp	x						-4.5		1	36		25	.001	28	-12	50	100	75	
GT20	pnp	x			x			-4.5		1	40		25	.001	42	-25	100	125	85	
GT20H	pnp	x						-4.5		1	40		25	.001	42	-12	50	100	75	
GT34	pnp	x						-4.5		1	32		25	.001	15	25	100	125	85	
GT34HV	pnp	x				x		-4.5		1	32		25	.001	18	-50	100	125	85	
GT34S[1]	pnp	x				x		-4.5		1	32		25	.001	15	-25	100	125	85	
GT66[2]	pnp							-4.5		1			25	.001		-12	20	100	75	
GT81	pnp	x			x			-4.5		1	42		25	.001	80	-25	100	125	85	
GT81H	pnp	x						-4.5		1	42		25	.001	80	-12	50	100	75	
GT81HS	pnp	x				x		-4.5		1	42		25	.001	120	-25	200	125	85	
GT83	pnp	x				x		-4.5		1	40		25	.001	42	-25	100	125	85	>.7
GT87	pnp	x				x		-4.5		1	36		25	.001	28	-25	100	125	85	>.5
GT88	pnp	x				x		-4.5		1	42		25	.001	80	-25	100	125	85	>1
GT109	pnp	x			x			-4.5		1	42		25	.001	120	-25	200	125	85	
GT122	pnp	x				x		-4.5		1	42		25	.001	90	-25	100	125	85	>1.5
GT222	pnp	x						-4.5		1	30		25	.001		-12	100	125	75	
GT759	pnp	x			x	x		-4.5		1	24		25	.455	25	-15	100	100	75	3
GT760	pnp	x			x	x		-4.5		1	28		25	.455	40	-15	100	100	75	5
GT761	pnp	x			x	x		-4.5		1	32		25	.455	70	-10	100	100	75	10
GT762	pnp	x			x	x		-4.5		1	34		25	.455	150	-10	100	100	75	20
GT763	pnp	x			x	x		-4.5		1	35		25	.455	200	-10	100	100	75	30
1. Symmetrical - ratings for both reversed emitter and reversed collector. 2. Photo transistor.																				
P. R. MALLORY & CO., INC., 42 S. Gray St., Indianapolis 6, Indiana																				
440-C-E	pnp	x		x		x									20	25	1000	16000[1]		.012
441-C-E	pnp	x		x		x									35	30	2000	16000[1]		.012
442-C-E	pnp	x		x		x									40	25	500	3000[1]		.012
1. @20°C.																				
MARVELCO ELECTRONIC DIV., National Aircraft Corp., 3411 Tulare Ave., Burbank, Calif.																				
2N237	pnp	x						-6	-1	1	44	6	25	.001	70-90	-45	-20	150	55	1
MINNEAPOLIS HONEYWELL REGULATOR CO., 2753 Fourth Ave. South, Minneapolis 8, Minn.																				
H5	pnp	x		x		x		28	2000		26	25000[1]	70[3]		45[5]	-60	-3000	20000[4]	95	.0125[7]
H6	pnp	x		x		x		28	2000		29	25000[1]	70[3]		60[5]	-60	-3000	20000[4]	95	.01[7]
H7	pnp	x		x		x		28	2000		32	25000[1]	70[3]		110[5]	-60	-3000	20000[4]	95	.0085[7]
XH10	pnp	x		x		x		28	10000		27	200000[2]	70[3]		26[6]	-60	-10000	45000[4]	95	
1. Two units, class B, push-pull, audio or servo motor applications. 2. Two units, class B, push-pull, power converter. 3. Mounting base temperature. 4. At base temp of 50°C. 5. Measured at I_c=1 amp. 6. Measured at I_c=5 amp. 7. Frequency at which power gain drops to ½ its low frequency value.																				
MOTOROLA INC., 5005 E. McDowell Rd., Phoenix, Arizona																				
2N176	pnp	x		x				-12	-600		25	3000	<80	<.015	70	-30	-3000	10000	90	
2N179	pnp	x						-20	-60		32	300	<80	<.015	50	-40	-1000	4000	90	
XN13A	pnp	x						-20	-15		33	100	<60	<.04	25	-50	-75	350	90	
XN13B	pnp	x						-12	-25		36	100	<60	<.04	39	-36	-150	350	90	
XN13C	pnp	x						-12	-25		39	100	<60	<.04	80	-36	-150	350	90	
LANSDALE TUBE CO., a division of PHILCO CORP., Lansdale, Pa.																				
2N47	pnp	x						-5	-1		40		25		.975	-35	-20	50[4]	65	
2N49	pnp	x						-5	-1		40		25		.975	-35	-20	50[4]	65	
2N128	sbt				x			-3	-.5		25		25	4.3	.96	-4.5	-5	30[4]	85	45[1]
2N129	sbt				x			-3	-.5		35		25	1.0	.935	-4.5	-5	30[4]	85	30[1]
2N207	pnp	x						-5	-1		44		25		.985	-20	-20	55[4]	85	
2N207A	pnp	x						-5	-1		44		25		.985	-20	-20	55[4]	85	

(Continued on Page 57)

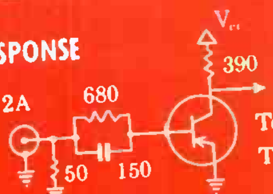
GUARANTEED | CHARACTERISTICS

CHARACTERISTIC	CONDITION	VALUE
"ON"	$I_b = -.3$ ma, $I_c = -2$ ma. $I_b = -2.5$ ma, $I_c = -8$ ma.	$V_{ce} = -0.07$ V. MAX. $V_{ce} = -0.10$ V. MAX.
"OFF"	$V_{be} = -0.10$V., $V_{ce} = -4.5$V.	$I_c = -150$ μa MAX.
h_{fe} (COMMON EMITTER CURRENT GAIN)	$V_c = -3$V., $I_e = -.5$ ma.	16 MIN.
C_{ob} (COMMON BASE OUTPUT CAPACITY)	$V_c = -3$V., $I_e = -.5$ ma.	6 μμf. MAX.
I_{co} (COLLECTOR CUTOFF CURRENT)	$V_{cb} = -5$ V.	3 μa MAX.
I_{eo} (EMITTER CUTOFF CURRENT)	$V_{eb} = -5$ V.	3 μa MAX.

MAXIMUM RATINGS

$V_{ce} = -6$ V. $I_c = -15$ ma. $P_c = 10$ mw @ 40°C.

PULSE RESPONSE



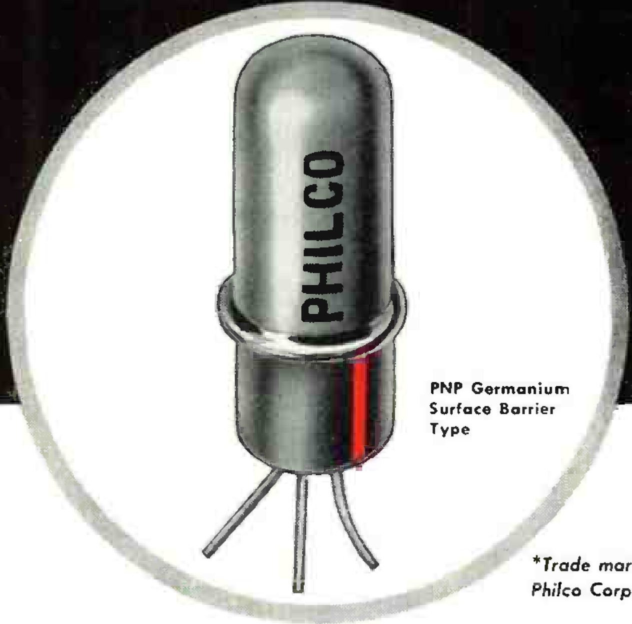
Test Conditions: V_{cc} is set to −6V and pulse input is adjusted until transistor is just in saturation. V_{cc} is then lowered to −1.5V for saturated pulse curve. t_s = hole storage time.

PHILCO

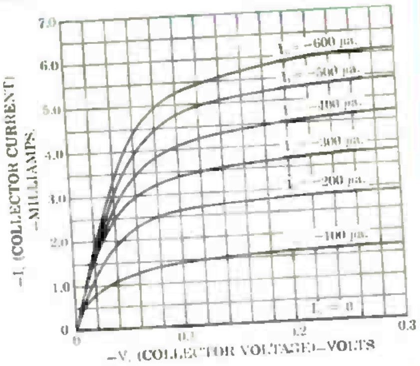
SBT* 2N240

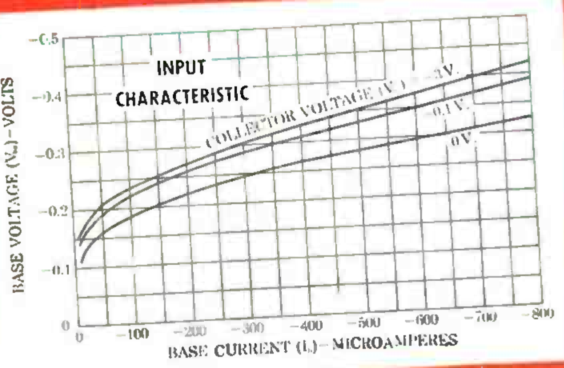
HIGH SPEED SWITCHING TRANSISTOR

with response time in millimicrosecond range



*Trade mark of Philco Corporation





FEATURES

- Low saturation resistance
- Low saturation voltage
- Ideal electrical characteristics for direct coupled circuitry
- Extremely fast rise and fall time
- Absolute hermetic seal
- Available now in production quantities

Proven performance of the Philco Surface Barrier Transistor has made it the basis for design of both military and commercial computers where speed and reliability are the major considerations. And now this transistor goes even farther . . . by giving reliable performance in 20 megacycle switching circuits!

Make Philco your prime source of information for high speed computer transistor applications.

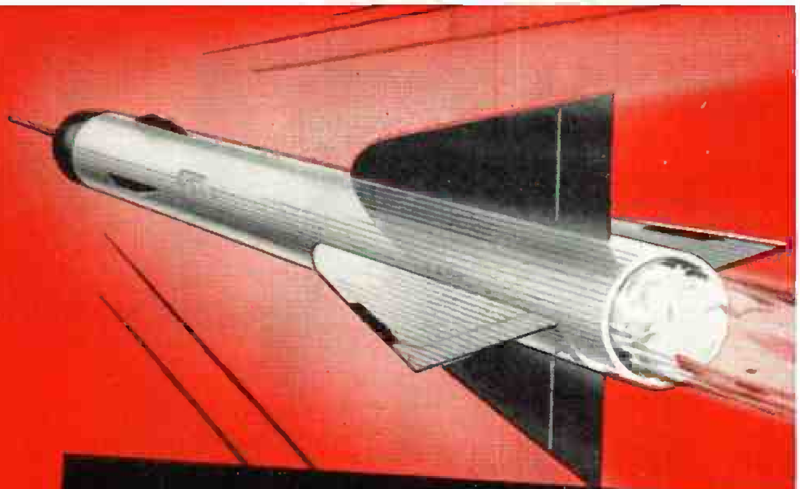
Write to Dept. TT, Lansdale Tube Company Division, Lansdale, Pa.

PHILCO CORPORATION

LANSDALE TUBE COMPANY DIVISION

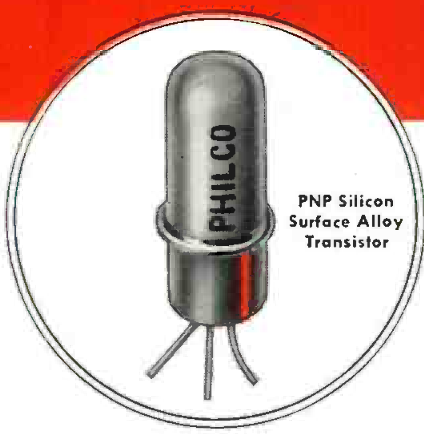
Now Available!

PHILCO Silicon Transistors



With These Outstanding Advantages:

- Excellent performance at Temperatures from −60°C to +140°C
- Collector Saturation Voltage of 0.1 Volt or Under
- Maximum Fr[illegible]quency of Oscillation in the 15 Megacycle Range.

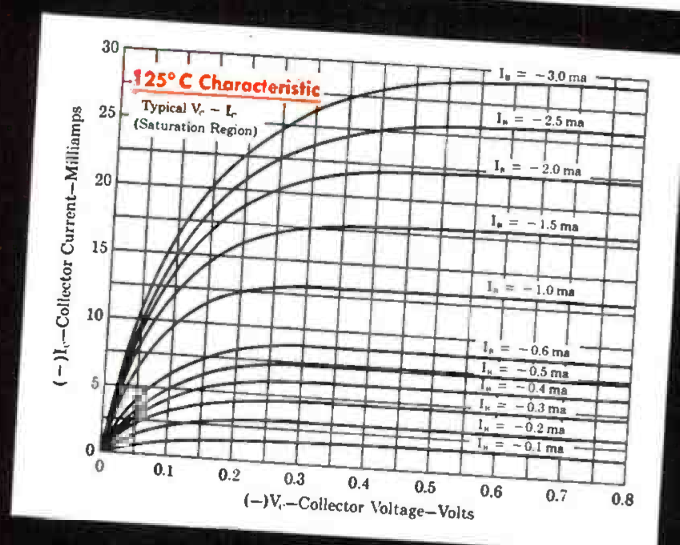


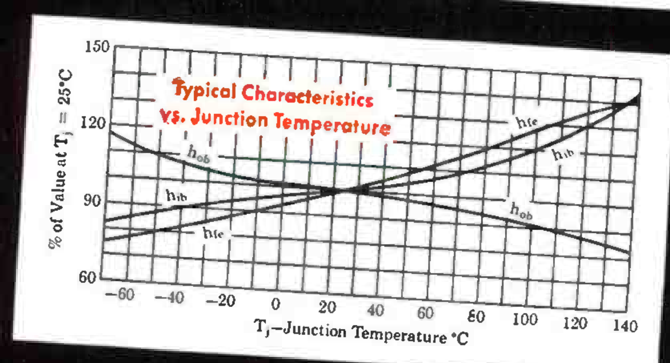
PNP Silicon Surface Alloy Transistor

Characteristics of Types T-1025 and T-1159
(T_a = 25°C)

Characteristic	Condition	Typical Value
Current Amplification Factor, h_{fe}	V_{CE} = −6 v, I_E = 1 ma	18
Output Capacitance, C_{ob}	V_{CB} = −6 v, I_E = 1 ma	7 μμf
Maximum Oscillation Frequency, $f_{max.}$	V_C = −6 v, I_E = 1 ma	15 mc
Cutoff Current, I_{CBO} or I_{EBO}	V_{CB} or V_{EB} = −10 v	.001 μa

Maximum Power Dissipation—150 mw
Maximum Collector Voltage—T-1025-25 v
T-1159-10 v





Unmatched performance and reliability! Characteristics *assured* by extensive life tests under typical operating conditions. Philco PNP Silicon Transistors make practical *complete transistorization* of military and commercial circuits —*where high ambient temperatures are encountered.*

Philco Silicon Transistors are now in pilot production and immediately available for initial design work. Specify Type T-1025 for amplifier, oscillator and low level general purpose applications and Type T-1159 for high speed switching applications.

FEATURES

- HIGH TEMPERATURE PERFORMANCE • VERY LOW LEAKAGE CURRENT • HIGH SPEED • SUITABLE FOR DIRECT COUPLING • LOW SATURATION VOLTAGE • ABSOLUTE HERMETIC SEAL

Make Philco your prime source of information on Silicon Transistor Applications.

Write to Dept. TT, Lansdale Tube Company Division, Lansdale, Penna.

PHILCO CORPORATION

LANSDALE TUBE COMPANY DIVISION

LANSDALE, PENNSYLVANIA

TYPE No.	CLASS	Audio	B.Amp.	Pwr.	if-rf	Sw.	Gen.	TYPICAL OPERATION								MAXIMUM RATINGS				
								E_COLL v	I_COLL ma	I_EM ma	PG db	P_OUT mw	T_OP °C	F_OP mc	α or β	E_COLL v	I_COLL ma	P_COLL mw	T_MAX °C	F_CO mc
2N207B	pnp	x						-5	-1		44		25		.985	-20	-20	55[4]	85	
2N223	pnp	x						-3	-2		34		25		.983	-18	-60	150[4]	65	
2N224	pnp	x						-6	0-100		35		25		.985	-25	-150	150[4]	65	
2N225[5]	pnp	x	x					-12	41[2]		32	300	25		.985					
2N226	pnp	x						-6	0-100		30		25		.972	-25	-150	150[4]	65	
2N227[6]	pnp	x	x					-3	70[2]		22	125	25		.972					
2N231	sbt				x			-3	.2				25		.967	-4.5	-3	35[4]	85	30[1]
2N232	sbt				x			-3	.2				25	.455	.93	-4.5	-3	35[4]	85	20[1]
2N240	sbt					x										-6	-15	30[4]	85	30[1]
SB100	sbt				x	x		-3	-.5		33		25	.455	.95	-4.5	-5	30[4]	85	30[1]
T1025	pnp-si				x	x		-6	-1				25		.948	-25	-50	100[4]	140	8[1]
T1032	sbt				x			-3	-.5		17		25	10	.95	-4.5	-5	30[4]	85	60[1]
T1040	pnp	x		x		x		-13	-500		30	2500	25		.989	-34	-2000	7000[3]	100	
T1041	pnp	x		x		x		-13	-750		30	5000	25		.989	-34	-2000	10000[3]	100	
T1050	sbt				x	x		-3	-.5		22		25	10	.95	-4.5	-3	30[4]	85	90[1]
T1159	pnp-si				x	x		-6	-1						.94	-10	-50	150[4]	140	8[1]
T1166	mat					x		-3	-.5						.97	-6	-50	30[4]	80	40[1]

1. Minimum frequency for power gain of unity. 2. At full power output. 3. At 75°C case temperature. 4. @25°C. 5. Matched 2N224s in push-pull. 6. Matched 2N226s in push-pull.

RADIO CORPORATION OF AMERICA, Semiconductor Div., Somerville, N.J.

TYPE No.	CLASS	Audio	B.Amp.	Pwr.	if-rf	Sw.	Gen.	E_COLL v	I_COLL ma	I_EM ma	PG db	P_OUT mw	T_OP °C	F_OP mc	α or β	E_COLL v	I_COLL ma	P_COLL mw	T_MAX °C	F_CO mc
2N77	pnp	x						-4	-.7	.7	44.1		25		55	-25	-15	35	50	
2N104	pnp	x						-6	-1	1	41		25		44	-30	-50	35	70	
2N105	pnp	x						-1.3	-.3	.3	32.5		25		45	-25	-15	35	50	
2N109	pnp	x	x					-9	-2	2	33[4]	160[4]	25			-25	-70	50	50	
2N139	pnp				x			-9	-.5	.5	27.6[1]		25	.455	45	-16	-15	35	70	
2N140	pnp				x			-9	-.6	.6	30[2]		25		48	-16	-15	35	70	
2N175	pnp	x						-4	-.5	.5	43		25			-10	-2	20	50	
2N206	pnp	x						-5	-1	1	46		25		47	-30	-50	75[5]		
2N215	pnp	x						-6	-1	1	41		25		44	-30	-50	35	70	
2N217	pnp	x	x					-9	-2	2	33[4]	160[4]	25			-25	-70	50	50	
2N218	pnp				x			-9	-.5	.5	27.6[1]		25	.455	45	-16	-15	35	70	
2N219	pnp				x			-9	-.6	.6	30[2]		25		48	-16	-15	35	70	
2N220	pnp	x						-4	-.5	.5	43		25			-10	-2	20	50	
2N247	pnp				x			-9	-1	1	45		25	1.5	60	-35	-10	35	70	

1. Includes transformer insertion loss. 2. Useful conversion. 3. Alpha or Beta measured at 1KC. 4. For two transistors class B push-pull. 5. @25°C.

RADIO DEVELOPMENT & RESEARCH CORP., 100 Pennsylvania Ave., Patterson 3, N.J.

TYPE No.	CLASS	Audio	B.Amp.	Pwr.	if-rf	Sw.	Gen.	E_COLL v	I_COLL ma	I_EM ma	PG db	P_OUT mw	T_OP °C	F_OP mc	α or β	E_COLL v	I_COLL ma	P_COLL mw	T_MAX °C	F_CO mc
2N97	npn	x			x	x		4.5		-1	20		25	.455	.93	30		50	75	1
2N97A	npn	x			x	x		4.5		-1	20		25	.455	.93	40		50	85	1
2N98	npn	x			x	x		4.5		-1	22		25	.455	.975	40		50	75	2.5
2N98A	npn	x			x	x		4.5		-1	22		25	.455	.975	40		50	85	2.5
2N99	npn	x			x	x		4.5		-1	22		25	.455	.975	40		50	75	3.5
2N100	npn	x			x	x		4.5		-1	23		25	.455	.993	25		25	50	5
2N103	npn	x			x			4.5		-1	15		25	.455	.80	35		50	75	.75
2N160	npn-si				x			4.5	5	1	34		25		.93	40	25	150	150	4
2N160A	npn-si					x		4.5	5	1	34		25		.93	40	25	150	150	4
2N161	npn-si				x			4.5	5	1	37		25		.965	40	25	150	150	5
2N161A	npn-si					x		4.5	5	1	37		25		.965	40	25	150	150	5
2N162	npn-si				x			4.5	5	1	38		25		.975	40	25	150	150	>8
2N162A	npn-si					x		4.5	5	1	38		25		.975	40	25	150	150	>8
2N163	npn-si				x			4.5	5	1	40		25		.98	40	25	150	150	6
2N163A	npn-si					x		4.5	5	1	40		25		.98	40	25	150	150	6
3N23	npn				x			4.5	-1		10		25	5		30	5	50		10-20[1]
3N23A	npn				x			4.5	-1		12		25	5		30	5	50		20-35[1]
3N23B	npn				x			4.5	-1		13		25	5		30	5	50		35-50[1]
3N23C	npn				x			4.5	-1		15		25	5		30	5	50		50-80[1]

1. Maximum oscillation frequency.

RAYTHEON MANUFACTURING CO., 55 Chapel St., Newton 58, Mass.

TYPE No.	CLASS	Audio	B.Amp.	Pwr.	if-rf	Sw.	Gen.	E_COLL v	I_COLL ma	I_EM ma	PG db	P_OUT mw	T_OP °C	F_OP mc	α or β	E_COLL v	I_COLL ma	P_COLL mw	T_MAX °C	F_CO mc
2N63	pnp	x						-6		1	39		25		22	-22	-10	100	85	
2N64	pnp	x						-6		1	41		25		45	-15	-10	100	85	
2N106	pnp	x						-1.5		5	36		25		45	-6	-10	100	85	
2N111	pnp				x			-6		1	33		25	.455	25	-30	-200	130	85	3
2N111A	pnp				x			-6		1	33		25	.455	25	-30	-200	130	85	3
2N112	pnp				x			-6		1	35		25	.455	30	-30	-200	130	85	5
2N112A	pnp				x			-6		1	35		25	.455	30	-30	-200	130	85	5
2N113	pnp				x			-6		1	36		25	.455	45	-30	-200	130	85	10
2N114	pnp				x			-6		1	36		25	.455	15	-30	-200	130	85	20
2N130	pnp	x						-6		1	39		25		22	-22	-10	80	85	
2N131	pnp	x						-6		1	41		25		45	-15	-10	80	85	
2N132	pnp	x						-6		1	42		25		90	-12	-10	80	85	
2N133	pnp	x						-1.5		.5	36		25		45	-15	-10	80	85	
2N138A	pnp	x						-6		50	42		25		140	-12	-100	130	85	
CK751	pnp	x						-6		50	30		25		140	-12	-100	240	85	
CK766	pnp				x			-6		1	33		25	.455	45	-30	-200	130	85	5
CK766A	pnp				x			-6		1	33		25	.455	45	-30	-200	130	85	5
CK768	pnp				x			-6		1	27		25	.455	20	-30	-100	130	85	2.5
CK790	pnp	x						-6		1	32		25		14	-15	-50	200	135	
CK791	pnp	x						-6		1	34		25		24	-30	-50	200	135	
CK793	pnp	x						-6		1	30		25		16	-30	-50	200	135	
CK870[1]	pnp					x		-6		1			25		10	-25	-100	100	85	.3
CK871[1]	pnp					x		-6		1			25		15	-20	-100	100	85	.3
CK882	pnp	x						-6		1	42		25		90	-12	-10	100	85	
CK888	pnp	x						-6		50	30		25		30	-12	-20	100	85	

1. Symmetrical.

SPRAGUE ELECTRIC CO. Marshall St., North Adams, Mass.

TYPE No.	CLASS	Audio	B.Amp.	Pwr.	if-rf	Sw.	Gen.	E_COLL v	I_COLL ma	I_EM ma	PG db	P_OUT mw	T_OP °C	F_OP mc	α or β	E_COLL v	I_COLL ma	P_COLL mw	T_MAX °C	F_CO mc
2N159	pc					x		-15	3	1			25	2	>2	-50	-10	80	80	5[3]
2N240	sbt					x							25		>16	-6	-15	10[1]	50	30[3]
SP1	sbt				x			-3	-.5		30		25	.455	10-20	-5	-15	10[1]	50	15[3]
SP2	sbt				x			-3	-.5		35		25	.455	20-30	-5	-15	10[1]	50	30[3]
SP3	sbt				x			-3	-.5		40		25	.455	30-90	-5	-15	10[1]	50	50[3]
SP8A	pnp	x						-15	-5		30		25	1.5	40	-45	-50	100[2]	80	2
SP8B	pnp	x						-15	-5		33		25	1.5	60	-45	-50	100[2]	80	2
SP8C	pnp	x						-6	-1		42		25	1.5	100	-45	-50	100[2]	80	2

1. At 40°C. 2. At 25°C. 3. Minimum oscillation limit.

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

TYPE No.	CLASS	Audio	B.Amp.	Pwr.	if-rf	Sw.	Gen.	E_COLL v	I_COLL ma	I_EM ma	PG db	P_OUT mw	T_OP °C	F_OP mc	α or β	E_COLL v	I_COLL ma	P_COLL mw	T_MAX °C	F_CO mc
2N34	pnp	x	x			x		-6		1	40		25		.975	-40	-10	50		.6
2N35	npn	x	x			x		6		-1	40		25		.975	40	10	50		.8
2N68	pnp	x	x	x		x		-12	-150		23	600	25		.975	-25	-1500	4000		.4
2N94	npn					x		6	.5	-.5	40		25		.97	20	10	50		3.5
2N94A	npn					x		6		-.5	35		25			20	10	50		6
2N95	npn	x	x	x		x		12	150		23	600	25		.975	25	1500	4000		.4
2N101	pnp	x	x	x		x		-12	-150		23	600	25		.975	-25	-1500	4000		.4
2N102	npn	x	x	x		x		12	150		23	600	25		.975	25	1500	4000		.4

(Continued on Page 58)

SYLVANIA ELECTRIC PRODUCTS INC. Continued

TYPE No.	CLASS	Audio	B. Amp.	Pwr.	i f-r f	Sw.	Gen.	TYPICAL OPERATION E_{COLL} v	I_{COLL} ma	I_{EM} ma	PG db	P_{OUT} mw	T_{OP} °C	F_{OP} mc	α or β	MAXIMUM RATINGS E_{COLL} v	I_{COLL} ma	P_{COLL} mw	T_{MAX} °C	F_{CO} mc
2N141	pnp	x	x	x	x			-24	-75		26	600	25		.975	-60	-800	4000		.4
2N142	npn	x	x	x	x			24	75		26	600	25		.975	60	800	4000		.4
2N143	pnp	x	x	x	x			-24	-75		26	600	25		.975	-60	-800	4000		.4
2N144	npn							24	75		26	600	25			60	800	4000		.4
2N193	npn				x			6	1				25	3	7.5	15	50	50	75	10
2N194	npn				x			6	1		15		25	3	8	15	50	50	75	>3
2N211	npn				x			6	1				25	3	5.5	10	50	50	75	10
2N212	npn				x			6	1		22		25	6	10	10	50	50	75	>6
2N214	npn	x	x					6	1				25		70	25	50	70	75	1
2N229	npn						x	6	1				25	1.6	.96	10	40	50	75	>1.6
2N242	pnp	x						-12	-500		30		25		30	-45	-2000		100	.6

TEXAS INSTRUMENTS, INC., 6000 Lemmon Ave., Dallas 9, Texas

TYPE No.	CLASS	Audio	B. Amp.	Pwr.	i f-r f	Sw.	Gen.	TYPICAL OPERATION E_{COLL} v	I_{COLL} ma	I_{EM} ma	PG db	P_{OUT} mw	T_{OP} °C	F_{OP} mc	α or β	MAXIMUM RATINGS E_{COLL} v	I_{COLL} ma	P_{COLL} mw	T_{MAX} °C	F_{CO} mc
2N117	npn-si						x	20	2	-2	34		100.		.9-.95	30	25	150	150	
USN2N117	npn-si						x	20	2	-2	34		100		.9-.95	30	25	150	150	
2N118	npn-si						x	20	2	-2	38		100		.95-.975	30	25	150	150	
2N118A	npn-si						x	20	2	-2	38		100		.95-1	30	25	150	150	
USN2N118	npn-si						x	20	2	-2	38		100		.95-.975	30	25	150	150	
2N119	npn-si						x	20	2	-2	40		100		.975-1	30	25	150	150	
2N124	npn					x		6	5	-5			25	.1	12-24	10	8	50	75	.25
2N125	npn					x		6	5	-5			25	.1	24-48	10	8	50	75	.25
2N126	npn					x		6	5	-5			25	.1	48-100	10	8	50	75	.25
2N145	npn				x			9	.5	-.5	30-33		25	.455		20	5	65	75	
2N146	npn				x			9	.5	-.5	33-36		25	.455		20	5	65	75	
2N147	npn				x			9	.5	-.5	36-39		25	.455		20	5	65	75	
2N148	npn				x			12	.5	-.5	32-35		25	.262		16	5	65	75	
2N148A	npn				x			12	.5	-.5	32-35		25	.262		16	5	65	75	
2N149	npn				x			12	.5	-.5	35-38		25	.262		16	5	65	75	
2N149A	npn				x			12	.5	-.5	35-38		25	.262		32	5	65	75	
2N150	npn				x			12	.5	-.5	38-41		25	.262		32	5	65	75	
2N150A	npn				x			12	.5	-.5	38-41		25	.262		32	5	65	75	
2N172	npn				x			9	.5	-.5	25		25	1.8		16	5	65	75	
2N185	pnp	x	x					-9	-100	100	-29[1]	-250[1]	25	.001	> 35	-20	-150	150	60	
2N238	pnp	x						-9	-3	3	39	2	25	.001	> 25	-20	-10	50	60	
2N243	npn-si						x	28	20	-20	34	100	100		.9-.968	60	60	750	150	
2N244	npn-si						x	28	20	-20	36	100	100		.961-.989	60	60	750	150	
2N248	pnp				x			-12	-2	2	12		25	18		-25	-5	50	55	>50
2N249	pnp	x	x					-12[1]	-100[1]	100[1]	24[1]	500[1]	25	.001	> 30[1]	-25	-200	350	75	
2N250	pnp	x	x	x				-12	-500	500	30-40	10000[1]	25	.001	> 30	-30	-2000	12000	80	
2N251	pnp	x	x	x				-24	-500	500	30-40	10000[1]	25	.001	> 30	-60	-2000	12000	80	
2N252	pnp				x			-9	-.5	.5	34		25	1.8		16	-5	30	55	
2N253	npn				x			9	.5	-.5	28-32		25	.455		12	5	65	75	
2N254	npn				x			9	.5	-.5	32-36		25	.455		20	5	65	75	
2N263	npn-si					x		20	2	-2	40		100		.975	40	20	125	150	20
3N25/501	pnp				x			-12	-.5	.5	12		25	100		-15	-2	25	55	>250
3N26/925	npn-si				x			20	1	-1	15		100	12.5		30	10	125	150	>12.5
3N27/926	npn-si				x			20	1	-1	14		100	30		30	10	125	150	>30.0
200A	npn						x	12	1	-1			25	.1	.9-.95	30	50	150	75	
201A	npn						x	12	1	-1			25	.1	.95-.98	30	50	150	75	
202A	npn						x	12	1	-1			25	.1	.98-1	30	50	150	75	
300	pnp						x	-12	-20	20			25	.001	9-19	-30	-50	100	60	
301	pnp						x	-12	-20	20			25	.001	19-49	-30	-50	100	60	
302	pnp						x	-12	-20	20			25	.001	> 49	-30	-50	100	60	
800[2]	npn							10	.1	-.1			25	.003		20	5	65	75	
903	npn-si						x	20	2	2	34		100		.9-.95	30	25	150	150	
904	npn-si						x	20	2	2	38		100		.95-.975	30	25	150	150	
904A	npn-si						x	20	2	2	38		100		.95-1	30	25	150	150	
905	npn-si						x	20	2	-2	40		100		.975-1	30	35	150	150	
951	npn-si						x	28	20	-20	34	100	100		.9-1	50	60	750	150	
952	npn-si						x	45	15	-15	34	100	100		.9-1	80	50	750	150	
953	npn-si						x	67.5	10	-10	34	100	100		.9-1	120	40	750	150	
970	npn-si			x				67.5	50	-50	30	1000	100		> 3	120	140	8750	150	

1. Operated as class B amplifier. 2. Photo transistor.

TRANSITRON ELECTRONIC CORP., Wakefield, Mass.

TYPE No.	CLASS	Audio	B. Amp.	Pwr.	i f-r f	Sw.	Gen.	TYPICAL OPERATION E_{COLL} v	I_{COLL} ma	I_{EM} ma	PG db	P_{OUT} mw	T_{OP} °C	F_{OP} mc	α or β	MAXIMUM RATINGS E_{COLL} v	I_{COLL} ma	P_{COLL} mw	T_{MAX} °C	F_{CO} mc
2N43	pnp	x						-5	1	1	40		25	.8	50	-30	-50	150	85	
2N44	pnp	x						-5	1	1	37		25	.5	22	-30	-50	150	85	
2N45	pnp	x						-5	1	1	33		25	.4	12	-30	-50	150	85	
2N83	pnp	x	x	x				-1.5	500	500	20			.35		-60	-2000	10000	85	
2N83A	pnp	x	x	x				-1.5	1000	1000	30			.4		-60	-3000	10000	85	
2N84	pnp	x	x	x				-1.5	500	500	20			.4		-45	-2000	10000	85	
2N84A	pnp	x	x	x				-1.5	1000	1000	30			.45		-45	-3000	10000	85	
2N195	pnp	x						-5	1	1	41		25	1	300	-12	30	200	75	
2N196	pnp	x						-5	1	1	40		25	.8	65	-25	30	200	85	
2N197	pnp	x						-5	1	1	39		25	.7	50	-25	30	200	85	
2N198	pnp	x						-5	1	1	38		25	.6	40	-25	30	200	85	
2N199	pnp	x						-5	1	1	37		25	.5	25	-25	30	200	85	
2N200	pnp	x						-5	1	1	40		25	1	60	-30	-100	200	85	
2N204	pnp	x						-5	1	1	41		25	1.2	120	-30	-100	350	85	
2N205	pnp	x						-5	1	1	37		25	.6	35	-30	-100	350	85	

WESTERN ELECTRIC CO., 195 Broadway, New York 7, N.Y.

TYPE No.	CLASS	Audio	B. Amp.	Pwr.	i f-r f	Sw.	Gen.	TYPICAL OPERATION E_{COLL} v	I_{COLL} ma	I_{EM} ma	PG db	P_{OUT} mw	T_{OP} °C	F_{OP} mc	α or β	MAXIMUM RATINGS E_{COLL} v	I_{COLL} ma	P_{COLL} mw	T_{MAX} °C	F_{CO} mc
1N85[1, 2]													25			90	1	50	85	
2N21[1]	pc					x							25	2	10	-100	±40	120	85	7
2N21A[1]	pc					x							25	2	10	-100	±40	120	85	7
2N27[1]	npn	x				x							25	2	.995	35	100	50	85	
2N29[1]	npn	x				x							25	2	.995	35	100	50	85	
2N66[1]	pnp	x		x									25	.2	80	-60	-800	2000	80	
2N67[1]	pc					x							25			-100	±40	100	85	
2N110[1]	pc					x							25			-100	-50	200	85	
3N22[1]	npn				x								25	15		10		30	60	
GA52829[1]	pnp	x				x							25	2.8	.98	-30	-50	30	85	
GA52830[1]	pnp				x	x							25	4	100	-40	-500	500	80	
GA52837[1]	pc					x							25		10	-100	-40	120	85	10
GA52996[1]	pc					x							25		10	-100	-50	250	85	
GA53080[1]	pc					x							25	10	10	-100	-50	250	85	
GA53104[1]	pc	x				x							25			-10	-50	30	85	
GA53270[1]	npn	x				x							25	3	100	30	30	50	85	

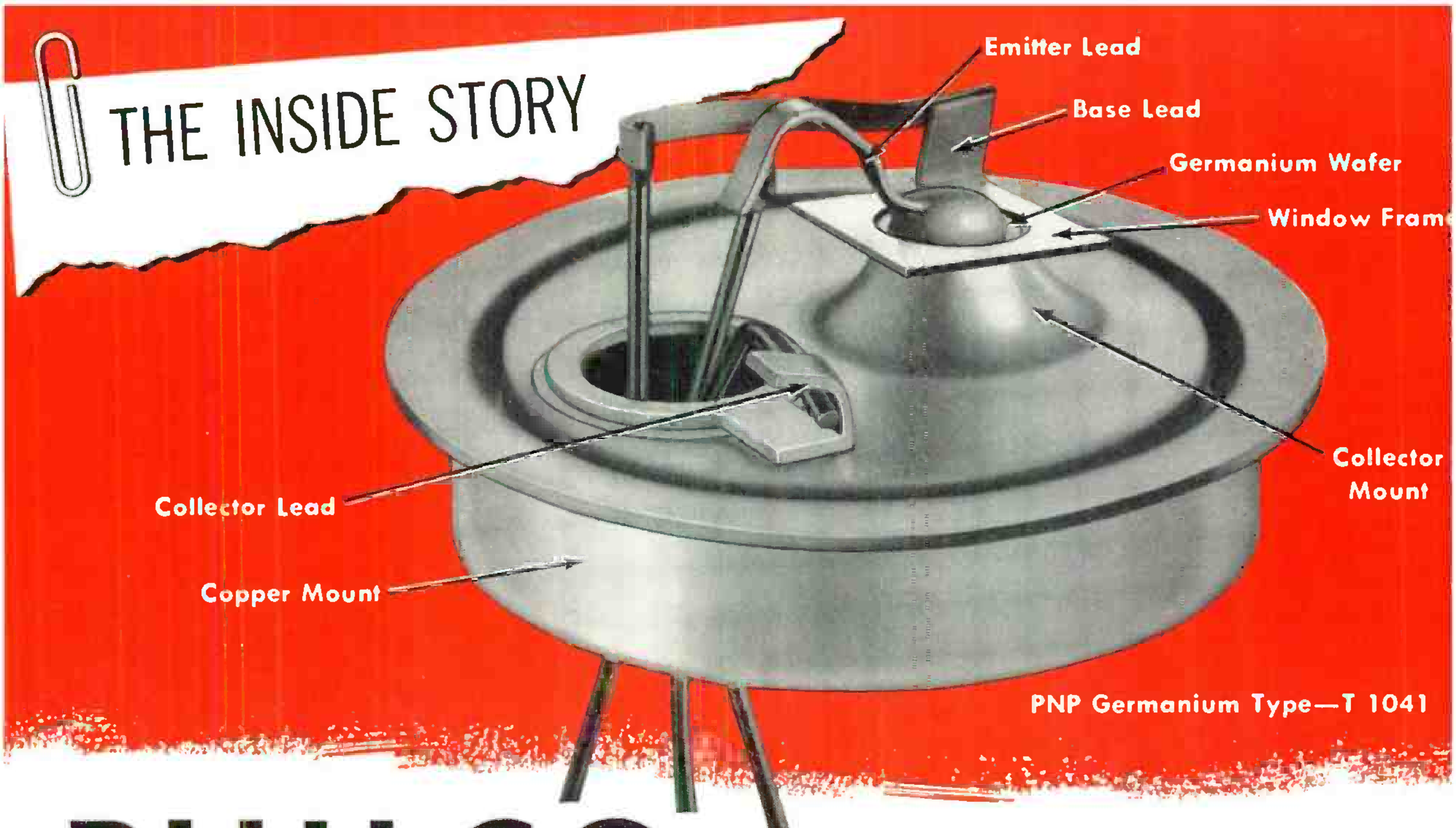
1. Western Electric advises these products are available only to U.S. Govt. military agencies or their contractors. 2. Photo transistor.

WESTINGHOUSE ELECTRIC CORP., Youngwood, Pa.

TYPE No.	CLASS	Audio	B. Amp.	Pwr.	i f-r f	Sw.	Gen.	TYPICAL OPERATION E_{COLL} v	I_{COLL} ma	I_{EM} ma	PG db	P_{OUT} mw	T_{OP} °C	F_{OP} mc	α or β	MAXIMUM RATINGS E_{COLL} v	I_{COLL} ma	P_{COLL} mw	T_{MAX} °C	F_{CO} mc
XD5081	pnp	x						-12	-500		35	2500	25	>.001	48[1]	35	2000		85	.01
XD5082	pnp	x						-12	-500		35	2500	25	>.001	48[1]	35	2000		85	.01
XD5083	pnp					x		-35	-1000			31000	60	.001	40[2]	35	2000		85	.01
XD5084	pnp					x		-35	-1000			31000	60	.001	40[2]	35	2000		85	.01

1. At I_c=1.5 amp. 2. At I_c=2 amp.

★ ★ ★



PHILCO® POWER TRANSISTOR

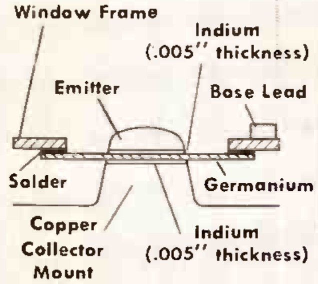
THERMAL DROP 1½°C PER WATT TYPICAL

The advanced design of Philco Power Transistors gives a new high in reliability. Superior thermal drop is achieved by placing the collector junction in intimate contact with the copper base—and the copper mount is assured maximum dissipator contact by "knee action" of the aluminum mounting clamp. The Philco exclusive cold weld gives freedom from contamination—for *long life!* Long, flexible, insulated leads assure optimum electrical connection in printed circuitry—without disturbing the hermetic seal. Available in production quantities and specifically built for the audio output stage of auto radios, Philco Power Transistors are ideally suited to high power amplifiers, servo-amplifiers, power converters and low-speed switches.

FEATURES

High beta at high currents • 100° C storage temperature • Improved alpha cut-off • Absolute hermetic seal
Low surface leakage currents • Superior thermal drop • Low distortion • Low saturation resistance

Actual Size



Junction Cross Section

Complete Transistor Assembly

Specifications

Power Gain (5W—Class A) — 35 db (typical)

D. C. Current Gain (I_c = —1a, V_c = —1.5V) — 40—120

Sat. Voltage (I_c = 1a) — 0.8V Max.

Maximum Ratings

Collector Dissip. @ 75° C Ambient — 10W.

Collector Voltage — 40V.

Make Philco your prime source of information for Power Transistor applications.
Write to Dept. TT, Lansdale Tube Company, Lansdale, Pa.

PHILCO CORPORATION

LANSDALE TUBE COMPANY DIVISION

Now Available...

FIRST HF TRANSISTORS

now in production, meeting

Army Signal Corps Standards

A wide variety of military equipment, once impossible to transistorize due to frequency limitations of available transistors, is now being developed with Philco Surface Barrier Transistors.

PHILCO SBT

SURFACE BARRIER TRANSISTORS

(Type 2N128 and 2N129)

Meet MIL-T-12679A Military requirements

Check These Features

- **High frequency performance**
- **Extreme reliability**
- **Uniformity of characteristics**
- **Rigid quality control**
- **Minimum battery drain**
- **Low leakage currents**
- **Low operating voltage**
- **Absolute hermetic seal**
- **Meet MIL-T-12679A Military requirements**

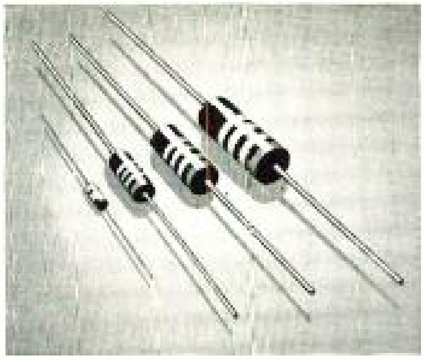
Now available for large volume military and industrial applications . . . the high frequency Philco Surface Barrier Transistors that were developed for the Army Signal Corps to meet the stringent requirements of field use in military electronics equipment. Advanced precision techniques used in fabricating the Philco Surface Barrier Transistors make possible rigidly controlled automatic manufacture with its resultant uniformity, reliability and high volume production. These reliable transistors point the way to new fields in transistorization. Make these reliable high frequency Philco Surface Barrier Transistors part of your forward looking plans.

For complete technical information on these High Frequency transistors write Dept. TT, LANSDALE TUBE CO., Lansdale, Pa. A DIVISION OF PHILCO CORP.

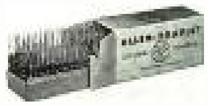
PHILCO CORPORATION

LANSDALE TUBE COMPANY DIVISION

LANSDALE, PENNSYLVANIA

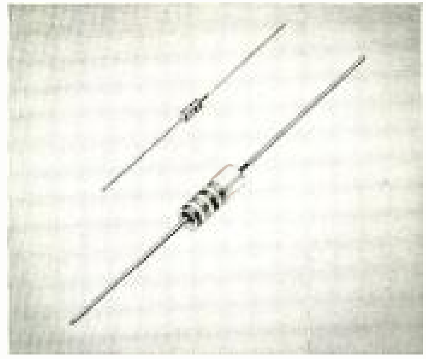


FIXED MOLDED RESISTORS—In 1/10, 1/2, 1, and 2 watt ratings at 70C ambient. Available in standard RETMA values.



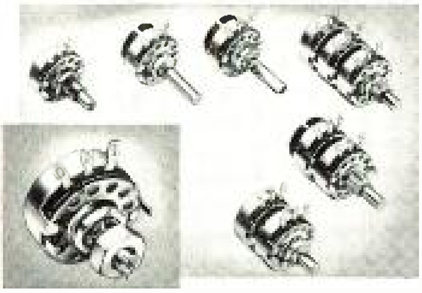
The Allen-Bradley type of packaging prevents leads from tangling or bending.

Reel packaging on pressure sensitive tape for automatic assembly lines.



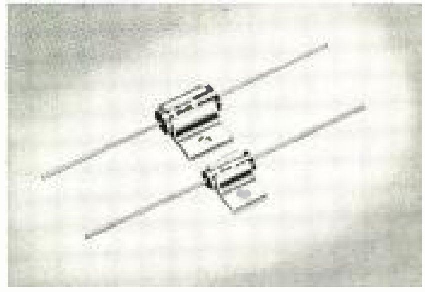
HERMETICALLY SEALED RESISTORS—Composition resistors sealed in a ceramic tube. 1/8 And 1 watt, 10 ohms to 500,000 megohms.

WHERE ELECTRONIC RELIABILITY IS A "MUST" ... STANDARDIZE ON THESE ALLEN-BRADLEY COMPONENTS



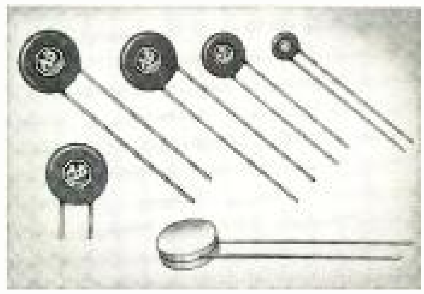
VARIABLE RESISTORS— Type J molded resistors, rated at 2 watts at 70C ambient. Total resistance values from 50 ohms to 5 megohms. Outstanding for low noise characteristics. Taps can be provided at 40, 53, and 68% of effective rotation. Metal parts are corrosion-resistant. Have solid molded resistor element.

COPPER-CLAD FIXED RESISTORS—Type GM rated at 3 watts at 70C and 4 watts at 40C. Type HM rated at 4 watts at 70C and 5 watts at 40C. Mounted in heavy copper clamps. Must be mounted on steel panel to radiate heat. Will not open circuit or exhibit erratic changes in resistance. Send for Bulletin 5002.



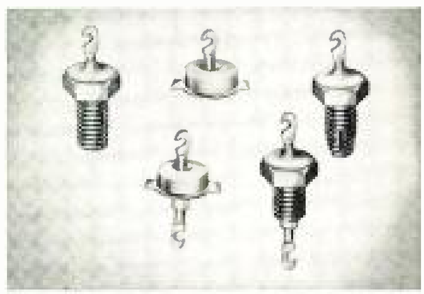
VARIABLE RESISTORS— Types G and F molded resistors are ½ inch in diameter. Total resistance from 100 ohms to 5 megohms. Ideal for use in printed circuits. The Type G all metal variable control is rated ½ watt; Type F control with molded end is rated ¼ watt. Standard tapers.

CERAMIC CAPACITORS— Available in nominal capacitance values from 10 mmfd to .022 mfd in continuous d-c voltage ratings of 500, 1000, 2500, and 5000 volts. Also available in ceramic enclosures for greater mechanical strength and higher insulation dielectric strength. Operate up to 150C ambient temp.



VARIABLE RESISTORS— Type T solid molded resistors for rheostat and potentiometer applications. The molded plastic actuator serves also as the cover which makes this unit extremely flat and compact. Rated at ½ watt at 70C ambient. Available in maximum resistance values from 100 ohms up to 5 megohms.

FEED-THRU & STAND-OFF CAPACITORS—These rugged capacitors exhibit no parallel resonance effects normally encountered with tubular capacitors in the VHF and UHF frequency ranges. Available in standard nominal values from 4.7 mmf to 1000 mmf with solder tabs or with screw-thread mountings.



INDUSTRIAL POTENTIOMETERS—Type H rated at 5 watts at 40C ambient. Resistance range 50 ohms to 2 megohms. Good for 100,000 cycles with less than 10% resistance change. Derate to zero at 120C. Maximum voltage 750 v, d-c. After 100 hrs. at 40C and 98% humidity, resistance change not more than 5%.

FERRITE CORES—In various shapes and sizes to fit needs of black and white, color television and general applications. There are U and L cores for color convergence and O cores for color convergence shields; also U and E cores for flyback transformers, and QR cores for deflection yokes. Many other shapes available.

ALLEN-BRADLEY
RADIO & TELEVISION COMPONENTS
QUALITY

Allen-Bradley Co.
1342 S. Second St., Milwaukee 4, Wis.

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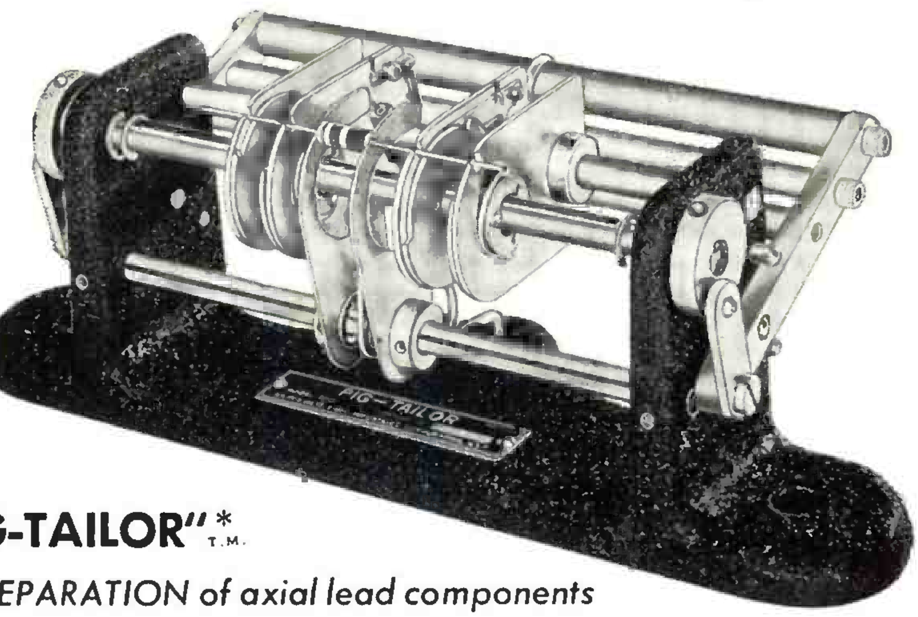
For product information, use inquiry card on page 105.

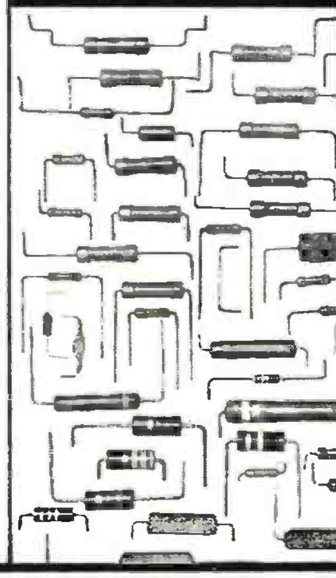
PROVEN- on the assembly line!



"PIG-TAILOR"* T.M.

For PREPARATION of axial lead components

PREPARED COMPONENTS IN SECONDS WITH THE "PIG-TAILOR"



"PIG-TAILORING"

. . . . a revolutionary new mechanical process for higher production at lower costs. Fastest PREPARATION and ASSEMBLY of Resistors, Capacitors, Diodes and all other axial lead components for TERMINAL BOARDS, PRINTED CIRCUITS and MINIATURIZED ASSEMBLIES.

The "PIG-TAILOR" plus "SPIN-PIN"—accurately MEASURES, CUTS, BENDS, EJECTS & ASSEMBLES both leads simultaneously to individual lengths and shapes—3 minute set-up—No accessories—Foot operated—1 hour training time.

PIG-TAILORING provides:

1. Uniform component position.
2. Uniform marking exposure.
3. Miniaturization spacing control.
4. "S" leads for terminals.
5. "U" leads for printed circuits.
6. Individual cut and bend lengths.
7. Better time rate analysis.
8. Closer cost control.
9. Invaluable labor saving.
10. Immediate cost recovery

PIG-TAILORING eliminates:

1. Diagonal cutters!
2. Long-nose pliers!
3. Operator judgment!
4. 90% operator training time!
5. Broken components!
6. Broken leads!
7. Short circuits from clippings!
8. 65% chassis handling!
9. Excessive lead tautness!
10. Haphazard assembly methods!

"SPIN-PIN"* T.M.

Close-up views of "SPIN-PIN" illustrate fast assembly of tailored-lead wire to terminal.

* PATENT PENDING

Write for illustrated, descriptive text on "PIG-TAILORING" to Dept. TT-12P

BRUNO-NEW YORK INDUSTRIES CORPORATION

DESIGNERS AND MANUFACTURERS OF ELECTRONIC EQUIPMENT

460 WEST 34th STREET • NEW YORK 1, N. Y.

For product information, use inquiry card on page 105.

WASHINGTON
News Letter

Latest Radio and Communication News, from The National Capital, and Previews of Things to Come

INVASION OF TV—Television interests are aroused over the proposal of four major land mobile radio communications user organizations for the use of the 25-60 megacycle frequency band, and particularly, the recommendation of the American Trucking Associations for the reallocation of television channel 2 for fixed scatter uses by mobile radio services. The trucking organization, stressing the overcrowded spectrum situation for mobile radio services, pointed out to the FCC that it had established a precedent for moving TV channel 2 service into UHF in its previous elimination of TV channel one for mobile radio occupancy. While not joining directly in the ATA proposal, the other major mobile radio user groups—petroleum, utilities and special industrial—urged the FCC to grant frequency space relief through scatter techniques and through split-channel operation. The user groups contended the FCC should grant split-channel operation despite potential foreign interference.

PROMOTE TWO-WAY RADIO VALUE—Under the sponsorship of the Radio-Electronics-Television Manufacturers Association, a comprehensive program to promote greater public interest in the value of mobile radio communications to the nation's economy and the overall welfare of the public will be spearheaded in full scale early next year, it was authoritatively learned by ELECTRONIC INDUSTRIES' Washington news bureau. The leading manufacturers of mobile radiocommunications equipment—General Electric, RCA, Motorola, Du Mont and Bendix—are actively and strongly supporting the RETMA program. One meeting to outline the campaign to the FCC Commissioners and top staff officials was held in Washington in late October between leading representatives of RETMA and the manufacturing companies. Another session of solely industry officials to make specific plans for the unified approach is slated to be staged in New York in December. The program is to stress that the nation and its economy can not function efficiently without "this modern communications device."

RADIO ASTRONOMY NEEDS—The FCC proposal to give interference protection to frequencies for radio astronomy has received strong support by research organizations and universities, banded into the Commission by Associated Universities Inc., but has precipitated concentrated opposition from the aviation radio interests, headed by Aeronautical Radio Inc. The National Science Foundation has allocated $4 million for a national radio astronomy observatory at Green Bank, West Viriginia, and has entered into a five-year contract with Associated Universities for the establishment and operation of the observatory which will engage in research of radiation of energy from the planets, stars and galaxies and other information useful in radio propagation research. Six institutions, Carnegie of Washington, Cornell, Harvard, Naval Research Laboratory, Ohio State and Stanford—are engaged in radio astronomy and several other universities such as California Institute of Technology and Michigan are planning radio astronomy projects. Arinc is challenging the FCC proposal to have "quiet" frequencies for radio astronomical observations as harmful to aviation safety.

TAXI INDUSTRY LAUDED—FCC Commissioner Robert E. Lee recently commended the taxicab industry for their "high degree of channel usage" in the two-way mobile radio field. He pointed out that the taxicab industry with 5000 land stations and nearly 100,000 mobile units is using only four channels in the 152-162 megacycle band. The progress in channel usage in the taxicab industry is "unexcelled by other user industries" in mobile radio, he stated.

LONG-RANGE INTERFERENCE—Increasing reports of long-range interference to non-broadcast radio operations in this country, especially mobile radio services, from foreign radio stations have reached the FCC. The interference chiefly affects the use of frequencies below 50 megacycles, FCC engineering officials reported, The 11-year peak of the sunspot cycle which last December was forecast to be reached in the winter of 1957-58, it was cited, now appears to be likely at an earlier time.

COMMUNITY ANTENNA TV NOT FOR REGULATION—A community antenna television system is not subject to regulation like a telephone or telegraph company, the California Supreme Court recently ruled in reversing the state public utilities commission. This decision, unanimously ruled by California's highest tribunal, is precedent-making and is expected to stimulate the growth of community antenna television in other parts of the nation. It also is a guide post to the FCC in its actions in this TV service.

National Press Building
Washington 4

ROLAND C. DAVIES
Washington Editor

ELECTRONIC INDUSTRIES & TELE-TECH

International ELECTRONIC SOURCES®

ABSTRACTS & REVIEWS of WORLDWIDE ELECTRONIC ENGINEERING

PUBLICATIONS REVIEWED IN THIS ISSUE

Abbreviation	Publication Name	Abbreviation	Publication Name	Abbreviation	Publication Name
Arc. El. Uber	Archiv der elektrischen Ubertragung	El. Ind.	ELECTRONIC INDUSTRIES & Tele-Tech	NBS J.	Journal of Research of the National Bureau of Standards
Auto. Con.	Automatic Control	El. Mfg.	Electrical Manufacturing	Onde.	L'Onde Electrique
Av. Wk.	Aviation Week	Eric. Rev.	Ericsson Review	Proc. BIEE.	Proceedings of the Institution of Electrical Engineers (British)
Avto. I Tel.	Avtomatika I Telemekhaniko	Freq.	Frequenz		
AWA Tech. Rev.	AWA Technical Review	GE Rev.	General Electric Review	Proc. IRE.	Proceedings of the Institute of Radio Engineers
		Hochfreq.	Hochfrequenz-technik und Elektroakustik		
Bell Rec.	Bell Laboratories Record	Insul.	Insulation	Radiotek.	Radiotekhnika
Bul. Fr. El.	Bulletin de la Societe Francaise des Electriciens	J BIRE.	Journal of the British Institution of Radio Engineers	Rev. Sci.	Review of Scientific Instruments
El.	Electronics	J IT&T.	Electrical Communication	Syl. Tech.	The Sylvania Technologist
El. Des.	Electronic Design	Nach. Z.	Nachrichtentechnische Zeitschrift	Tech. Rev.	Western Union Technical Review
El. Eng.	Electronic Engineering			Toute R.	Toute la Radio
El. Eq.	Electronic Equipment	NBS Bull.	NBS Technical News Bulletin	Wirel. Eng.	Wireless Engineer

Also see government reports and patents under "U. S. Government."

ANTENNAS, PROPAGATION

Small Horn Antenna with Improved Area Efficiency, by A. Knopf. "Nach. Z." Sept. 1956. 3 pp. The field distribution was measured and a small metal structure proved efficient in delaying the central radiation: this resulted in a doubling of the area efficiency of the antenna.

Distortion in Frequency-Modulation Systems Due to Small Sinusoidal Variations of Transmission Characteristics, by R. G. Medhurst and G. F. Small. "Proc. IRE." Nov. 1956. 5 pp. A technique is reported for the evaluation of the distortion generated in FM systems by small sinusoidal ripples on either group delay or amplitude characteristics on the basis of distortion due to a single echo.

Microwave Aerial Testing at Reduced Ranges, by D. K. Cheng. "Wirel. Eng." Oct. 1956. 4 pp. It is a general practice to defocus the primary source along the principal axis of the reflector by a small distance so that Fraunhofer patterns may be simulated in the Fresnel zone. This article presents three different approaches with which the proper amount of defocus may be determined.

Investigations of the Propagation in the 100 MC Band, by J. Grosskopf. "Nach. Z." Sept. 1956. 4 pp. Signal strength observations over the paths Bielstein/Teutoburger Wald—Darmstadt (90.6 MC, distance 226 km) and Wrotham/London—Krefeld (93.5 MC, distance 430 km) have been made over a long period of time. This is an intermediate report.

Transosonde Monitors Inaccessible Areas, by H. D. Cubbage. "El." Nov. 1956. 2 pp. Triple frequency transmission and multi-frequency antenna are main features.

Aerial Pattern Synthesis, by H. E. Salzer "Wirel. Eng." Oct. 1956. 5 pp. Although optimum patterns are obtained from the Dolph-Tschebyscheff distributions, the numerical work in determining the feeding coefficients mounts as the number of sources increases. This article indicates an entirely independent method of finding feeding coefficients, which uses only one very special case of a general formula due to Poisson, to obtain extremely sharp patterns for broadside arrays.

Low-Frequency Ground Waves, by G. E. Ashwell and C. S. Fowler. "Wirel. Eng." Oct. 1956. 6 pp. The equipment described was developed to investigate the phase change with distance of a low-frequency wave passing over ground of finite conductivity and, in particular, the changes that occur near a boundary between grounds of different conductivities or across a coastline.

Change of Phase with Distance of a Low-Frequency Ground Wave Propagated Across a Coast-Line, by B. G. Pressey, G. E. Ashwell, and C. S. Fowler. "Proc. BIEE." July 1956. 8 pp. Observations of the change of phase with distance have been made on a frequency of 127.5 KC along a number of paths radiating from a transmitter and crossing the coast. The results confirm the existence of a phase-recovery effect which, in accordance with theoretical considerations, should be experienced by a wave passing from low to high conductivity ground. Other phenomena related to geological boundaries are reported.

The Deviation of Low-Frequency Ground Waves at a Coast-Line, by B. G. Pressey and G. E. Ashwell. "Proc. BIEE." July 1956. 7 pp. After a consideration of the methods which have been suggested for computing the deviation of ground waves at a coast-line, the phenomenon is re-examined in the light of recent experimental and theoretical work on the phase disturbances at such a boundary.

The Propagation of a Radio Atmospheric, by C. M. Srivastava. "Proc. BIEE." July 1956. 4 pp. On the assumption that the space between the earth and the ionosphere acts as a waveguide, the mechanism of propagation of an atmospheric disturbance (Lightning-originated) is considered from the viewpoint of plane-wave reflections. The nature and frequency composition of the originating pulse is described.

FOR MORE INFORMATION ON SUBJECTS REVIEWED HERE

To obtain copies of any articles or complete magazines reviewed here, contact the respective publishers directly. Names and addresses of publishers may be obtained upon request, stating publications of interest, by writing to: "Electronic Sources" Editors, ELECTRONIC INDUSTRIES & Tele-Tech, Chestnut & 56th Sts., Philadelphia 39. The editors can recommend translation agencies.

In order to obtain copies of the U. S. patents and research reports on military and government projects reviewed in this issue, send payment indicated directly to the federal agency as instructed in the section entitled "U. S. Government."

International ELECTRONIC SOURCES

On the Deflection of VHF Waves, by G. Megla. "Hochfreq." July 1956. 20 pp. The effects of diffraction and refraction in the atmosphere and of additional antennas and mirrors on the deflection of short waves and an increase in their effective range are considered. Field strength measurements are reported for various set ups and conditions, and the practical possibilities are outlined.

On Affecting the Correlation Conditions in Space-Charge Waves, by H. W. Koenig. "Arc. El. Uber." August 1956. 4 pp. The correlation conditions between the current fluctuations of an electron beam and the kinetic potential can be described by the "correlation determinant." The conditions for an electron beam passing a linear four-terminal network are considered; coherence conditions are derived.

Wave Scattering and the Effects of Meteors on Short and Adjacent Ultra-Short Waves, by H. Wisbar. "Arc. El. Uber." August 1956. 9 pp. For frequencies more than 30 MC beyond the limit frequency for grazing incidence the only reflections of scatter waves are attributed to sporadic meteors. Effects of the turbulence of the ionosphere, of the very minute ionization due to meteoric dust, of steady, though weak, corpuscular radiation at the poles and magnetic equator are investigated.

The Prediction of Maximum Usable Frequencies for Radiocommunication Over a Transequatorial Path, by G. McK. Allcock. "Proc. BIEE." July 1956. 6 pp. Discrepancies in maximum-usable-frequencies have led to attempts to predict on the basis of a transmission mechanism involving multiple geometrical reflections instead of the forward-scattering mechanism implied by the control-point method. Improved predictions are reported.

Methods for Raising the Effectiveness of Simple Broad-Band Antennas, by S. I. Nadenenko. "Radiotek." Aug. 1956. 6 pp. It is shown that the effectiveness of the widely used symmetrical broad-band dipole can be appreciably increased by using a plane reflector consisting of a wire grid which is parallel to the dipole and is mounted upon the same masts. A comparison between an antenna consisting of two broad-band dipoles with a grid reflector, and a rhombic antenna, shows that the engineering-economic figures of merit are higher for the former in the specified frequency band.

AUDIO

The Preamplifier "R.S.L. 12-25," the Amplifier "SymphonieII" and the Amplifier "Pansonic," by J. Brisset. "Toute R." Oct. 1956. 6 pp. Design details including circuit diagrams and component values for one preamplifier and two alternative amplifiers for phonographs are presented.

A Proposal for the Definition and Measurement of the Distinctness of Sounds on a Subjective Basis, by H. Niese. "Hochfreq." July 1956. 12 pp. The subjective effect of reflections arriving after the original sound wave is studied as a function of the time delay and of the relative amplitude of the reflected wave. The results obtained lead to an evaluation of the useful and disturbing contributions to the original sound wave. An instrument based on these results is suggested.

Audio Amplifier Delivers 3000 Watts, by A. B. Bereskin. "El." Nov. 1956. 2 pp. An audio amplifier for military air-to-ground applications is described. System uses two 4-1000A tubes operating class B_1.

CIRCUITS

Attenuators with Mismatched Terminations, by J. Altshuler. "Wirel. Eng." Nov. 1956. 2 pp. A formula for the attenuation introduced by an attenuator under non-nominal conditions is developed.

Optimum RC Filters, by J. W. R. Griffiths. "Wirel. Eng." Nov. 1956. 3 pp. A method for separating sinusoidal signals from noise has been devised for use in the detection of a noise source, such as a radio star, by interferometer techniques.

Quality Control in Electronics, by M. N. Torrey. "Proc. IRE." Nov. 1956. 10 pp. This article is a review of two types of literature on quality control: descriptions of quality control and the role of statistics, and published examples of the use of quality control and statistical techniques in the electronics industry.

Synchronizing Low Frequency Pulses with a High Frequency Free-Running Time-Base, by M. V. L. Bennett. "El. Eng." Nov. 1956. 8 pp. A gating circuit is described which allows a pulsing unit driven by a low frequency oscillator to be synchronized with a high frequency free-running time-base. The device is particularly useful in electrophysiological applications where a stimulus may be applied only at intervals very long compared to response time. A new type of bistable trigger is included in the circuit.

A Wide Band Differential Amplifier of Unity Gain, by J. C. S. Richards. "El. Eng." Nov. 1956. 3 pp. The instrument described is designed to convert an input from a source neither terminal of which is grounded to a single-ended output. Rejection ratio is greater than 500 and gain, stabilized, is $1 \pm 5\%$ from 5 CPS to 500 KC.

Frequency Control in the 300-1200 MC Region, by D. W. Fraser and E. G. Holmes. "Proc. IRE." Nov. 1956. 11 pp. Main points of interest in this paper concern the improvement of frequency stability of a coaxial-cavity oscillator by means of a small capacitor in series with the frequency-controlling device, and a tunable compensated coaxial cavity.

A High-Voltage Pulse Generator and Tests on an Improved Deflecting System of a Cold-Cathode Oscillograph, by H. N. Cones. "NBS J." Sept. 1956. 10 pp. An improved deflecting system for a cold-cathode oscillograph is described. This deflecting system reduces transit-time errors and eliminates errors due to impedance mismatch between the signal coaxial cable and the deflector. A high-voltage pulse generator for producing single pulses in the millimicrosecond range and its use in testing the deflecting system is explained.

Precision Electronic Switching with Feedback Amplifiers, by C. M. Edwards. "Proc. IRE." Nov. 1956. 8 pp. In an attempt to minimize the differences and nonlinearities in the electronic elements used to switch transmission paths, switches utilizing a high gain feedback amplifier are used.

Design Techniques Using Conductance Curves, by K. A. Pullen, Jr. "El. Des." Oct. 1, 1956. 4 pp. Design of the pentode degenerative amplifier and cathode follower is discussed, with examples.

Modern Synthesis Network Design From Tables—III, by L. Weinberg. "El. Des." Oct. 15, 1956. Tables are presented giving the element values for the normalized low-pass network with Butterworth, Tschebyscheff, or Bessel-polynomial characteristics.

Designing Deflection Systems Around Available Tubes, by W. F. Massey. "El. Des." Oct. 15, 1956. The article discusses the various factors that tubes impose on design of TV receivers and gives some suggestions for satisfactory circuit development.

By-Pass Filters, by R. O. Rowlands. "Wirel. Eng." Oct. 1956. 3 pp. By-pass filters are described having three pairs of terminals, all frequencies are passed, without distortion, between two of the pairs, but only a limited band of frequencies is transmitted between either of these pairs and the third pair of terminals.

An Analysis of Pulse-Synchronized Oscillators, by Gaston Salmet. "Proc. IRE." Nov. 1956. 13 pp. An "Impulse Governed Oscillator" system using a variable oscillator, frequency synchronized on pulse harmonics issued by a quartz oscillator is described. The author gives a mathematical analysis of the system together with its circuits. Chief difficulties met in its design, and the remedies, are examined.

Progress of Synthesis between the Mechanical and Electronic Art, by M. Ponte. "Onde." July 1956. 7 pp. The contribution of the concepts and theory developed in connection with electronics, such as the theory of non-linear circuits, to mechanics is pointed out. Historically a mechanical stage, an electronic stage and a combined mechanical-electronic stage overlapping with an atomic stage may be distinguished.

Simple Apparatus for the Study of Coupled Resonant Circuits, by Ch. Guilbert. "Toute R." Oct. 1956. 3 pp. A tunable master oscillator is followed by an output stage operating as a frequency doubler to prevent undesirable effects on the oscillator. A voltmeter is also described.

Charbonnier's Oscillator, by P. Ramain. "Toute R." Oct. 1956. 2 pp. Starting from the double-triode, resistance-capacitance coupled multivibrator, a multivibrator generating a series of pulses of predetermined pulse-length and adjustable recurrence frequency is derived. Detailed circuit diagrams including component values and performance data are included.

The Effect Upon Pulse Response of Delay Variation at Low and Middle Frequencies: with Special Application to Vestigial-Sideband Systems, by M. V. Callendar. "Proc. BIEE." July 1956. 4 pp. Calculations are given for the magnitude and form of the distortion introduced into a square wave by a network or system which exhibits uniform transmission except for increasing (or decreasing) phase delay in the low-mid-frequency region.

Three New Transistor Circuits, by N. Hekimian. "El." Nov. 1956. 4 pp. A transistorized flip-flop with temperature stabilization and improved high-frequency operation is described, with a tone keyer and an a-f meter.

Reliability of Military Electronic Equipment, by Lewis M. Clement. "J BIRE." Sept. 1956. 8 pp. Reliability is defined and steps for ensuring the design and production of reliable equipment are described.

DC Amplifiers with Photo Compensation, by B. A. Seliber, S. G. Rabinovich. "Avto. i Tel." Aug. 1956. 18 pp. The theory of photocompensated amplifiers is examined. Basic circuit variants are given. The paper also investigates the errors which arise in the amplifiers and the methods for eliminating these errors. The operation of photoelements is analyzed, and recommendations are given with respect to their types and operating regimes.

Frequency Multiplication and Division of Unmodulated and Modulated Waves, by I. T. Turbovich. "Radiotek." Aug. 1956. 11 pp. The paper examines the processes which go on during the frequency multiplication and division of both unmodulated waves and waves which are amplitude or phase modulated. Certain ideas are presented concerning a narrow-band system for the transmission of speech which is realized with the aid of frequency dividers.

On the Variation of the Noise Power Spectrum in Electron Beams, by H. Poetzl. "Arc. El. Uber." Sept. 1956. 7 pp. The transformation equations given by Haus for the interdependence of the noise power spectra at two spaced points in an electron beam are developed in matrix notation. A simple transformation equation is then derived from the determinant of correlation, which equation leads to performance figures.

Contribution to the Theory of Nonlinearities, by E. Henze. "Arc. El. Uber." August 1956. 13 pp. Tube characteristics are investigated on a large scale and particular attention is given to heterodyning effects. Cross-modulation and resulting whistling is studied as a function of the i-f amplitude and on the operating point on the tube characteristic. An extensive mathematical treatment of these problems is presented.

The Partial Equivalence of Two-Terminal Networks, by K. E R. Weber. "Hochfreq." July 1956, 4 pp. In equivalent two-terminal networks, the complex impedance is identical over the total frequency range from zero to infinity for specified values of the circuit components. This partial equivalence occurs only for circuits including all three types of components and each having at least four components. An example is discussed in detail.

The H. F. Power—Application of the Theory to a Mixer with Known Non-Linear Characteristic. "Freq." Sept. 1956. 3 pp. The expression of the current in a mixer diode with arbitrary characteristic expressed as a power series is multiplied with the applied voltage and the result evaluated. A series of curves and a table for easy evaluation in a practical instance is included.

Regulated Transistor Power Supply Design, by J. W. Keller, Jr. "El." Nov. 1956. 4 pp. The theory of series and shunt regulator design is explored.

Mechanics and Electronics in the Modern Evolution of Non Linear Mechanics, by N. Minorsky. "Onde." July 1956. 8 pp. Non linear oscillations are common to electronic and to mechanical circuits and thus their theory is of interest to both electronic and mechanical engineers. The joint studies concerned with this subject are briefly outlined.

A Method of Multivibrator Timing Stabilisation, by B. R. Johnson. "AWA Tech. Rev." July 1956. 8 pp. The possibilities of improving the timing accuracy and stability of a monostable multivibrator by adding a sinusoidal voltage to its exponential timing waveform are discussed. A multivibrator stabilized by this method and having a warm-up drift of less than 0.1 μsec in a total delay of 30 μsec compared with a drift of 1.3 μsec in an unstabilized multivibrator is described.

The Dual-Input Describing Function and Its Use in the Analysis of Non-Linear Feedback Systems, by J. C. West, J. L. Douce, and R. K. Livesley. "Proc. BIEE." July 1956. 12 pp. A new method is presented for the frequency-response analysis of non-linear elements. This involves evaluating the gain of one of the frequency components in passing through the non-linear element when the input to the element consists of two sinusoidal waves of differing amplitudes, phases, and frequencies. A cubic characteristic is analysed fully as an example.

Approximate Theory of Magnetically Modulated Detectors, by M. D. Ageev. "Avto. i Tel." Aug. 1956. 13 pp. The paper theoretically investigates magnetically modulated detectors which have no initial magnetization.

Calculation of Parasitic Capacitances When Mounting Printed-Circuit Radio Equipment, by L. M. Kononovich. "Radiotek." Aug. 1956. 7 pp. The paper develops a method for calculating the intrinsic capacitances of printed conductors.

A Transitron Oscillator as a Feedback Device, by A. A. Kulikovsky. "Radiotek." Aug. 1956. 3 pp. The basic characteristic of a pentode (or pentagrid) in the transitron regime is a curve depicting the dependency of the No. 2 grid current upon the No. 3 grid voltage. When the plate voltage is lowered, this characteristic has a drooping sector which is utilized in transitron circuits. On the basis of the usual assumptions, an equivalent circuit for such a tube is derived. The resulting equivalent circuit is an active fourpole of conductances connected to a current generator. On the basis of this circuit, it is shown that a "transitron" tube can be used in various circuits in a manner similar to an ordinary tube.

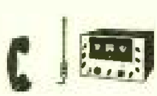
Basic Magnetic Switching Circuits, by Robert W. Durkee. "El. Mfg." Oct. 1956. 5 pp. A basic discussion of the principles of magnetic switches is presented.

Theory and Design of a Magnetic Modulator Which Operates According to the Frequency-Doubler Principle, by M. A. Rozenblat. "Radiotek." Aug. 1956. 16 pp. The operation of the modulator is examined in both the load and no-load regimes.

Neutralization of Selective Transistor Amplifiers, by G. Meyer-Broetz. "Arc. El. Uber." Sept. 1956. 7 pp. A survey of neutralization circuits leads to a selection of circuits suitable for transistors on the basis of simplicity, frequency dependence, and operating point.

Staggered Low-Pass Amplifiers with High Cut-Off Frequency, by G. Mahler. "Freq." Sept. 1956. 8 pp. The maximum product of bandwidth times amplification factor for a prescribed frequency characteristic is determined and methods for its realization are investigated.

The Astable Cathode-Coupled Multivibrator, by B. R. Johnson. "AWA Tech. Rev." July 1956. 9 pp. The operation of the cathode-coupled astable multivibrator is analyzed and expressions derived which enable calculation of its period and its various waveforms. Timing stability and some applications of the multivibrator are discussed.



COMMUNICATIONS

Transmitting System Uses Delta Modulation, by T. B. Watson and O. K. Hudson. "El." Oct. 1956. 3 pp. Similar in many respects to any pulse-coded modulation system, the delta modulation system offers simplified encoding and decoding. Possible application as a modification to radar equipment to provide communication channels is suggested.

A General-Purpose Communication Receiver, by J. R. Rudd and J. B. Stacy. "AWA Tech. Rev." July 1956. 22 pp. Originally designed to meet the marine receiver specification set out in the Merchant Shipping (Radio) Rules, 1952, this receiver is a 14 tube superheterodyne for the reception of CW, MCW, and Telephony in the range 12 to 60 KC and 100 KC to 30 MC. The bandwidth is adjustable between 500 and 8,000 cps in four steps.

A Sideband-Mixing Superheterodyne Receiver, by M. Cohn and W. C. King. "Proc. IRE." Nov. 1956. 5 pp. An alternative to the traveling-wave tube approach to wide bandwidth microwave receivers is the sideband mixing system which achieves comparable sensitivity and bandwidth by means of an unconventional connection of conventional components. R-F bandwidths of 700 MC and sensitivities in excess of —70 dbm seem reasonable with well-designed 50 MC i-f amplifiers.

New 6- and 8-channel Carrier Telephone Systems for Open-Wire Lines, by H. J. B. Nevitt and P. H. Odland. "Eric. Rev." #2, 1956. 6 pp. A short description of the construction and applications of L. M. Ericsson carrier frequency equipment is given.

Generation of Harmonics by the 50 cycle Electric Locomotive, by M. F. Nouvion, M. M. Tessier, M. M. Demontvignier, M. J. Augier, MM. L. Leroy, and M. Ch. Caussin. "Bul. Fr. El." August 1956. 66 pp. The six related articles deal with the analysis of the harmonic waves generated by a single-phase locomotive using rectifiers, the disturbances introduced into telephone, radio and television circuits as well as into the power supply, and circuits and coupling methods to reduce such harmonics. Extensive experimental material is supplied.

Pulse Techniques with Particular Reference to Line and Radio Communication, by E. M. Deloraine. "J IT&T." Sept. 1956. 12 pp. An historical and technical outline of the development of pulse and multiplexing techniques is presented. The conflicting requirements of pulse and speech transmission in telephony are emphasized.

AN/TRC-24 Transmitter—RF Power Stages, by E. L. LeBright and P. H. Bearer. "Bell Rec." Oct. 1956. 4 pp. Simplified tuning over the range of 100 to 400 MC is a feature of the military radio transmitter described by the authors. Principal feature of the article is the description, drawings, and pictures of the tuning unit.

Discovery May Triple UHF-VHF Range, by P. J. Klass. "Av. Wk." Nov. 5, 1956. 4 pp. Experimental work in ground-air communications by means of tropospheric scatter phenomena is summarized and explained.

Transistorized Receiver for Mobile F-M, by A. M. Booth. "El." Nov. 1956. 4 pp. The complete receiver described has been transistorized with the exception of the r-f tuner.

Interference Rejection and Effectiveness of Wirephoto Radio-Communication When Fluctuating Interference Is Present, by A. G. Ziuko. "Radiotek." Aug. 1956. 11 pp. The paper determines the potential interference stability and communication effectiveness of modulation systems which are utilized for the radio transmission of phototelegraphic signals. A comparative evaluation is made of these systems with regard to their interference rejection and effectiveness when fluctuating intereference is present.

Asymmetry in the Performance of High-Frequency Radiotelegraph Circuits, by A. M. Humby and C. M. Minnis. "Proc. BIEE." July 1956. 6 pp. Evidence is produced which tends to show that circuit asymmetry is sometimes due to the decrease in the signal/noise ratio in one direction which can occur when a distant thunderstorm area, lying in the direction of the main beam of the receiving aerial, reaches its diurnal activity maximum.

Experimental Investigation of the Distribution Law for the Duration of the Deflections of Fluctuations, by V. I. Tikhonov. "Radiotek." Aug. 1956. 5 pp. The paper describes a method of experimentally determining the density of the probability distribution for the duration of the deflections and the intervals between deflections of electrical fluctuations at various levels.

On the Reduction of Noise in Communication Lines Affected by Strong External Electromagnetic Fields, by E. Widl. "Arc. El. Uber." Sept. 1956. 15 pp. Not only the voltage but also the current distribution of the disturbing current is taken into consideration in the development of a balancing method to reduce interference from power lines. A two-step method involving first equalization of the capacitive unbalances and second a transposing equalization is introduced. The results of experimental evaluation of the two steps of this method and their combination are included.

Multichannel Transmission with Amplitude-Multiplex Systems, by K. Radius. "Nach. Z." Sept., 1956. 4 pp. This system is particularly indicated if the dynamic range of the transmission channel is considerably larger than range of the signal. A plurality of zero and unit pulse series can be simultaneously transmitted by a signal pulse series having a number of step amplitudes corresponding to the number of different possible additive pulses. A two-channel transmission system has been tested; results are reported.

Carrier Telephone Expands Rural Service, by J. E. Macdowell and H. J. B. Nevitt. "El." Oct. 1956. 3 pp. The complete carrier telephone equipment described makes possible up to 60 subscriber circuits on one pair of wires. Block diagrams and schematics of key portions are included.

Transistorized Receiver for Vehicular Radio, by S. Schwartz. "El." Oct. 1956. 3 pp. Twenty-one transistors and ten diodes are used to replace the twenty-five vacuum tubes originally used in this military receiver. All portions are transistorized with the exception of the r-f stage.

On the Space-Diversity-Receiving Method with Antenna Selection, by W. Kronjaeger, B. Lenhart, and K. Vogt. "Nach. Z." Sept. 1956. 7 pp. In high frequency transmission, the selection of either of two spaced antennas may considerably increase the level of the received signal. A switch for this selection, controlled by the received signal, is suggested. It is concluded that under specified conditions this system is equivalent to the two-receiver system which requires the provision of an additional receiver.

Subcarrier Switch for Microwave Party Line, by B. Harris. "El." Nov. 1956. 3 pp. An improvement on push-to-talk or voice controlled 'party line' systems is described. The controlled carrier system described cuts off the station carrier when the incoming audio level exceeds the audio of the station. Break-in is accomplished simply by raising your voice to exceed the incoming audio level.

COMPONENTS

Design Data on Fixed Glass Capacitors, by J. G. Lanning. "El. Eq." Nov. 1956. 2 pp. A general discussion of the design of capacitors made of ribbon glass.

Industrial Thermistor Applications, by Robert S. Goodyear. "El. Mfg." Oct. 1956. 7 pp. The author gives a summary of the present state of thermistor art. Typical characteristics are discussed, and common circuits explained.

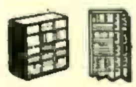
Tantalum Capacitors Use Solid Electrolyte, by D. A. McLean. "El." Oct. 1956. 2 pp. In place of an aqueous electrolyte, with its attendant sealing and congealing or freezing problems, the tantalum capacitor described uses a solid semi-conductor. Structure and characteristics are discussed.

Ceramic Condensers in Fluorescent Lamp Starters, by R. E. Perkins. "Syl. Tech." Oct. 1956. 2 pp. Failings of customarily used waxed paper condensers in fluorescent lamp starters are cited in presenting ceramic condensers for this use.

Damage to Lead Sheathing Caused by Beetle Larvae. by K. Lapkamp and D. Magnus. "Nach. Z." Sept. 1956. 6 pp. Beetle larvae have caused considerable damage to the lead sheathing of telecommunication cables at various places of the Federal German Republic. An extensive investigation of these pests is reported in detail, and protecting measures are suggested.

Silicon Rectifier Operates to 300°C, by R. W. Hull. "El. Eq." Oct. 1956. 2 pp. Reviews development and present potentialities of silicon rectifying devices.

Hot-Molding: Key to Resistor Reliability, by A. C. Pfister. "El. Eq." Oct. 1956. 2 pp. Construction and performance of two types of resistor are discussed—with particular emphasis on factors affecting reliability.



COMPUTERS

Reading and Writing Defined, by A. Blundi. "El. Ind." Dec. 1956. 1 p. A plain-language description of magnetic drum read-write techniques, components, and technical terms is presented.

Locating "Open Heaters" In Computer Circuitry, by Ronald L. Ives. "El. Ind." Dec. 1956. 2 pp. Circuitry is described for the high speed inspection of tube filaments in computers. The circuitry described can indicate continuity of large banks in a matter of seconds.

Number Systems for Computers, by I. J. Gabelman. "El. Ind." Dec. 1956. 2 pp. Among the number systems used in modern electronic digital computers are the decimal, binary, octal, bi-quinary, coded-decimal, and excess three. The author describes these number systems and their associated arithmetic operations.

The Design of Cold-Cathode Valve Circuits, Part 2, by J. E. Flood and J. B. Warman. "El. Eng." Nov. 1956. 5 pp. Computer circuit design is discussed and sample circuits shown.

Computers, Analog and Digital, by A. Boggs. "Tech. Rev." Oct. 1956. 6 pp. The author explores some of the implications of the descriptive terms "digital" and "analog."

Operation of Electronic Brain Computers With Telegraph Circuits, by J. H. Toop. "Tech. Rev." Oct. 1956. 11 p.p A description is given of the FERUT electronic computer at University of Toronto and the use of this computer to solve problems transmitted over 1700 miles of telegraph circuits.

Transistor-Magnetic Analog Multiplier, by G. L. Keister, "El." Oct. 1956. 4 pp. Simplified multiplication for airborne control computers is offered by the system described. The customary servo-driven potentiometer is replaced by a four-quadrant voltage multiplier using only magnetic cores and transistor switches, with attendant reduction of size, power consumption, and supply voltage requirements.

Bandwidth-Rise Time Chart, by M. D. Prince. "El." Nov. 1956. 1 pp. The chart solves graphically the approximate empirical formula: (Rise Time) × (Bandwidth) = 0.35, and the equation: Overall rise time = (Rise time per stage) × √Number of stages.

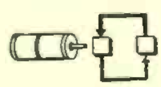
A New Technique for Classification and Selection of Documents, by J. Samain. "Onde." July 1956. 5 pp. The information to be stored is recorded on a micro-film and provided with a code. An electronic selector will at any desired time sort these microfilms according to any code.

Application Of Semiconductor Diodes In The Circuits Of Nonlinear Units In Electro-Simulating Devices, by G. M. Petrov. "Avto. i Tel." Aug. 1956. 10 pp. The paper discusses the use of germanium diodes in the basic nonlinear units which accomplish the operations of multiplying two quantities and reproducing functions of one variable by the linear-segment approximation method in electrical simulators. The application of such diodes in the supply circuits of these devices is also discussed.

A Junction-Transistor Scaling Circuit With 2 Microsec Resolution, by G. B. B. Chaplin and A. R. Owens. "Proc. BIEE." July 1956. 6 pp. The basic binary scaling circuit described in this article overcomes the limiting speed of transistor circuits by eliminating capacitors, a differentiating transformer being used instead for coupling. In this way the speed of the circuit depends only on transistor characteristics. With currently-available low-frequency junction transistors the circuit is capable of reliably resolving 2 μsec. The basic binary scaler is readily adapted to the formation of a scale-of-5 circuit using three binary stages. The circuits have wide tolerances and are insensitive to transistor variations. A complete scale-of-ten circuit would use eight transistors, ten diodes, and five transformers.

Photoelectric Analog Function Generator. by R. A. Sinker. "El." Oct. 1956. 4 pp. In this generator, a gray-scale standard deflection feedback loop and an intensity servo feedback loop are utilized to eliminate unsatisfactory variations in photographic, lighting, and optical conditions.

A Point-Contact Transistor Scaling Circuit with 0.4 Microsec. Resolution, by G. B. B. Chaplin. "Proc. BIEE." July 1956. 5 pp. This article describes some scaling circuits using transistors which will resolve 0.4 μsec and hence count at a maximum rate of 2.5 MC. The transistors are the normal point-contact type, and the circuits are simple, they have wide tolerances and are economical in power consumption. Features which contribute to the short resolving time are the prevention of bottoming of collector potential and the absence of capacitors. A typical scale-of-10 circuit uses seven transistors, seven pulse transformers, and 14 crystal diodes.



CONTROLS

Comparative Analysis of Several Improved Methods of Two-Position Control. by A. A. Kampe-Nemm. "Avto. i Tel." Aug. 1956. 19 pp. The paper examines improved methods of two-position control of temperature and of other parameters: these methods permit more accurate control. A graphical-analytical and an experimental investigation of these methods are given, and the methods are comparatively evaluated.

Four Steps to Machine Tool Control, by W. M. Brittain. "Auto. Con." Oct. 1956. 4 pp. The author reports the results of a study preceding the design of an automatic tool. The study involves an analysis of desired objectives, available input media, the tool itself, and possible components for the automatic system. A comparison is made of the cost of digital and analog control, and problems of backlash error are discussed.

Relationships between Automation and Electronics, by F. H. Raymond. "Onde." July 1956. 5 pp. The paper deals with the concept of information and with the engineering aspects of transmitting such information in general terms.

Economic Considerations on Automation, by D. P. Campbell. "Onde." July 1956. 4 pp. Industrial control and office work are considered as fields for automatization. It is concluded that for work that is difficult to perform without errors, automatization is indicated; this is particularly stressed in the case of office work.

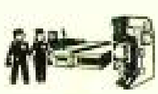
Track Circuits, Automatic Apparatus on the Railway, by J. Walter. "Onde." July 1956. 11 pp. Circuits indicating the presence or absence of trains are connected to the rail section concerned in the automatic block system. Installation and maintainance cost has been reduced by the S.N.C.F. by electronic apparatus for this purpose. It is pointed out that remote control of trains according to a program is feasible.

Lamouilly Railway Station: A Prototype "Press-Button" Center Featuring Complete Electronic Track Control Circuitry, by M. Duboudin and M. Trogneux. "Onde." July 1956. 12 pp. The system operates on 25 kv at 50 cps. The equipment used in the small electric station has been designed for general economy and reliability of the signalling system.

An Application of Automation in the Cable and Wire Control of Rubber-Insulated Cable Diameter, by M. Gleitz. "Onde." July 1956. 5 pp. The deviation from the specified wire diameter is converted into a voltage which controls the rubber-feed mechanism by means of a speed-variation gear control. The results are satisfactory but improvements are indicated.

Electronic Control and Servomechanisms, by R. Larguier. "Onde." July 1956. 11 pp. The cooperation of mechanical and electronic methods is stressed, electronics supplying high flexibility of operation and a large field of applications, while mechanics is held responsible for high accuracy and excellent automation.

Feedback Control Systems Containing Digital Computers, by Ia. Z. Tsypkin. "Avto. i Tel." Aug. 1956. 15 pp. The paper examines the special features of a digital computer unit functioning as an element of a feedback control system. Feedback control systems containing digital computer units are classified. On the basis of pulse control theory, certain dynamic properties of such systems are clarified. Examples of the improvement in the quality of processes when digital computer units are introduced are cited.



INDUSTRIAL ELECTRONICS

Test Control Circuitry Automatically, by A. Borck. "Auto. Con." Oct. 1956. 4 pp. An automatic testing device is described for complex control gear. Automatic programming and digital print-out are featured.

Two-Reactor Circuit For Reversible Control By Means Of A Two-Phase Induction Motor, by O. I. Aven, S. M. Domanitsky, A. Ia. Lerner. "Avto. i Tel." Aug. 1956. 5 pp. The paper examines a circuit which uses two saturable reactors (single-contact magnetic amplifiers) in order to achieve reversible control by means of a two-phase induction motor. It is shown that this circuit may be utilized for the contactless control of the drive of actuating mechanisms in feedback control systems. The proposed circuit is compared to a circuit which utilizes push-pull magnetic amplifiers. Results are cited from the experimental investigation of a mockup of the drive.

Square-Wave Electromagnetic Flowmeter Design, by A. B. Denison and M. P. Spencer. "Rev. Sci. Inst." Sept. 1956. 5 pp. This article considers the objectives that should be considered in the design and construction of practical equipment using the square-wave principle for electromagnetic flow recording. Block diagrams and circuitry are included.

Narrowing Of The Signal Spectrum When Telemetering Radioactive Radiation, by V. M. Mikhailovsky, A. N. Svenson. "Avto. i Tel." Aug. 1956. 6 pp. The paper proposes and analyzes a method for narrowing the spectrum in units which are used for telemetering radioactive radiation. An example is given in which the circuit elements required for the distribution converter are derived.

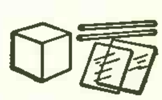
The Contribution of Electronics to Instrumentation, by J. Avril. "Onde." July 1956. 3 pp. In instrumentation, a mechanical or other quantity is converted by means of a transducer or other device into an electrical quantity representative thereof and then electronically measured. The technological and mechanical difficulties encountered are set forth, and the unwarranted use of electronic in some instances is pointed out. Quantity production of simple standard instruments is recommended.

Beta Gage Controls Cigarette Machine, by E. Harrison, Jr. "El." Nov. 1956. 4 pp. The author presents a discussion of the servo system that is used to monitor and control variables in the production of uniform weight cigarettes.

Transistors and Diodes Stabilize A-C Servos, by R. Gittleman. "El." Oct. 1956. 2 pp. A transistorized automatic gain control circuit can be used to stabilize the gain of a servo amplifier over a wide range of control voltage and ambient temperature. Technique described uses a shunt-feedback amplifier with a nonlinear element placed in the feedback loop, the small signal resistance of which is made to vary inversely with control voltage.

Electronic Ignition for Internal Combustion Engines, "Toute R." Oct. 1956. 1 p. It is reported that Mr. Guiot suggested a fixed frequency transistor oscillator (of the order of between 20 and 50 KC) to replace the conventional coil and feed the spark plugs through a distributor as usual. A distributor-driven alternator may, for instance, supply a control signal which is squared and used to intermittently block the oscillator.

Scanning Electrometer for Electron Microscopy, by G. F. Bahr, L. Carlsson, and G. Lomakka. "Rev. Sci. Inst." Sept. 1956. 2 pp. A scanning electrometer device designed for direct measurements of electron intensities in the image plane of the RCA electron microscope is described. Linear resolution of 0.06 to 0.92 μ is achieved.



MATERIALS

Nickel-Chromium-Aluminium-Copper Resistance Wire, by A. H. M. Arnold. "Proc. BIEE." July 1956. 9 pp. A review is given of the principal materials used for the construction of resistance standards. The difficulty of producing manganin and constantan commercially with the requisite small value of temperature coefficient at room temperature is compared with production of a nickel, chromium, aluminum, and copper alloy known commercially as Evanohm. High resistivity and favorable resistance/temperature characteristic are cited.

Unique Phosphors That Amplify Light, by D. A. Cusano and F. E. Williams. "GE Rev." Sept. 1956. 5 pp. Luminescence of Crystalline Solids and solid-state light amplification are discussed, with the mechanism of light amplification. Various suitable phosphors and methods of deposition are described.

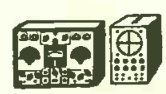
The Flowsolder Method of Soldering Printed Circuits, by R. Strauss and A. F. C. Barnes. "El. Eng." Nov. 1956. 3 pp. Substantial advantages are claimed for a soldering method which passes the surface to be soldered through the crest of a mechanically induced stationary wave in the tank of molten solder. Freedom from faulty joints or bridging is stressed.

Frequency-Temperature-Angle Characteristics of AT-Type Resonators Made of Natural and Synthetic Quartz, by R. Bechmann. "Proc. IRE." Nov. 1956. 8 pp. A shift of the optimum angle of orientation by a few minutes of arc, observed in several laboratories, and a slight change of the frequency-temperature function are reported; and natural and synthetic quartz characteristics discussed.

How to Evaluate Screen Phosphors, by J. Bramley. "El. Des." Oct. 15, 1956. 3 pp. Several phosphors are described and compared, with notes on selection criteria.

Mechanical Properties of Silicone Resins, by J. R. McLoughlin. "Insul." Nov. 1956. 4 pp. Developments to date in silicone resins are outlined.

Magnetic Head has Megacycle Range, by O. Kornei. "El." Nov. 1956. 3 pp. Ferrites are used for core materials in high frequency recording heads. Other materials used to produce high frequency heads are discussed, with results of performance tests and head life considerations.



MEASURING & TESTING

Errors in Bridge Measurements, by C. G. Mayo, and J. W. Head. "Wirel. Eng." Nov. 1956. 4 pp. Three errors are discussed: a ratio error, an error impedance in series with the standard, and an error admittance in parallel with the unknown.

Microwave Determinations of the Velocity of "Light," by K. D. Froome. "J BIRE." Sept. 1956. 16 pp. A description is given of methods utilizing microwaves for the purpose of measuring the free-space vacuum velocity of electromagnetic waves. The cavity resonator and the microwave interferometer methods are discussed in detail; brief mention is made of the molecular band spectrum method. The values obtained from these methods are compared with optical values.

Argonne 256-Channel Pulse-Height Analyzer, by Robert W. Schumann and James P. McMahon. "Rev. Sci. Inst." Sept. 1956. 11 pp. The 256-channel pulse-height analyzer using a magnetic core memory now in use at the Argonne National Laboratory uses a form of the Wilkinson method of generating numbers in response to input pulses. These numbers are proportional to the amplitudes of the input pulses, and correspond to the channel numbers into which the individual counts are to be recorded. The advantages of this system and significant circuitry are discussed.

Magnetic-Switch B-H Loop Tracer, by W. Geyger. "El." Oct. 1956. 3 pp. A device is described for tracing dynamic hysteresis loops of magnetic materials up to 20,000 cps. Silicon junction diode chopper circuits are used—no electron tubes are used.

The Calibration of Inductance Standards at Radio Frequencies, by L. Hartshorn, and J. J. Denton. "Proc. BIEE." July 1956. 10 pp. The precise relation between the familiar equivalent network for a coil and the basic definitions is indicated, and practical details are given for the resonance method of measurement that has been adopted as standard practice for all work of this kind at the National Physical Laboratory. It is successfully operated at all frequencies from the audio range, where it overlaps the bridge methods to values little short of those of self-resonance of the coils.

Dielectric Testing in the Service of the Development of Circuit Components, by P. Henninger, G. Kremmling, and H. Eisenlohr. "Freq." Sept. 1956. 6 pp. This continuation of a previous article considers the organic dielectric with dipole polarization and discusses some pertinent problems of the properties of solids.

The Power Developed by a Series of Rectangular Pulses in a Lossy Capacitor, by H. Eisenlohr. "Freq." Sept. 1956. 2 pp. The power dissipated or converted into heat of a lossless capacitor in series with a pure resistance is computed for the case of a series of rectangular pulses. This model is equivalent to a capacitor having losses due to dipole relaxation with only one relaxation constant.

Measurements of Wave Resistance of Homogeneous Lines by Means of the Electrolytic Trough, by H. O. Koch. "Freq." Sept. 1956. 7 pp. A section of the two-wire line is immersed in an electrolyte. The resistance measured between the two wires is proportional to the wave resistance. The method is described in detail and the possible errors investigated.

Theory and Engineering Information on a Setup for Frequency Measurements of Great Accuracy, by G. Becker. "Arc. El. Uber." August 1956. 11 pp. A general study on accuracy attainable in frequency comparison measurements is followed by a description of the experimental circuitry. A circuit diagram including component values is included. A maximum error of 10^{-9} for a measuring time of 100 sec was obtained between 15 KC and 15 MC, while it did not exceed an average of 1.4×10^{-11} at 100 KC.

The Use of Electronic Apparatus for the Study of Rapidly Varying Pressures, by L. Soukiassian. "Onde." July 1956. 10 pp. To trace the indicator diagram of internal combustion reciprocating engines, the horizontal sweep is synchronized with the engine, and the vertical deflection is proportional to the balancing pressure, produced by an electropneumatic circuit. A pick-up with a balanced diagram is incorporated and the making and breaking of the diagram and the associated electrode is indicated by a spot on the screen.

Electronic Program Control Arrangement for Test Benches, by F. D. Dayonnet and J. Illien. "Onde." July 1956. 16 pp. A particular program to test car engines on test benches has been developed. Care has been taken to subject the engines to conditions simulating actual operating conditions. The predetermined but variable program is automatically followed; it is inserted by a special curve for each parameter. Methods for recording the various parameters in cars during operation are also included.

Electronic Apparatus for Tests and Research on Carbo-Hydrates, by F. Kermarrec, L. Soukiassian, and J. Weissmann. "Onde." July 1956. 11 pp. Electronic apparatus for the investigation of fuel carbo-hydrates on test benches as well as in cars are described. The relative intensity of pre-ignition on single-cylinder engines is measured on the test bench. Engine speed and advance of ignition giving a constant degree of pre-ignition during acceleration of a vehicle is measured on the road.

Phase Generator for Tropospheric Research, by R. W. Hubbard and M. C. Thompson, Jr. "El." Oct. 1956. 4 pp. As an aid to research in tropospheric radio propagation, a laboratory standard for phase-displaced signals is indicated. Such an instrument is described by the authors.

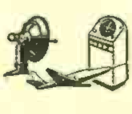
Stark Modulation Atomic Clock, by I. Takahaski, T. Ogawa, M. Yamano, A. Hirai, and M. Takeyama. "Rev. Sci. Inst." Sept. 1956. 7 pp. An atomic clock utilizing the Stark effect has been designed and constructed. Explanation is given of the methods used to reduce the error caused by the reflections in the microwave circuits to within the error by random noises. Various components of the clock are described in detail, and theoretical limits of accuracy discussed.

Surge Voltage Breakdown of Air in a Nonuniform Field. "NBS Bull." Sept. 1956. 3 pp. Difference between the mechanism of breakdown in uniform and non-uniform fields is verified by experimental results presented in this report. It is demonstrated that nonuniform field discharge streamers (corona) are initiated by a sudden current rise, quickly decreasing and remaining near zero unless complete breakdown is to occur.

Fluctuations in Continuous-Wave Radio Bearings at High Frequencies, by W. C. Bain. "Proc. BIEE." July 1956. 1 p.

Calibration of Vibration Pickups by the Reciprocity Method, by S. Levy and R. R. Bouche. "NBS J." Oct. 1956. 17 pp. The reciprocity theory for the relationship between mechanical force and velocity and electric current and voltage is presented for a linear electrodynamic vibration-pickup calibrator having a driving coil, a velocity-sensing coil, and a mounting table. A description is given of the mechanical arrangement and electric circuitry used at NBS in calibrating calibrators by the reciprocity method. Practical limitations of the method are discussed.

Magnetic Flux Meter for Measuring in Three Dimensions, by M. Muller. "J IT&T." Sept. 1956. 4 pp. Theoretical considerations and practical design problems of a magnetic flux meter capable of measuring the three components of narrow cylindrical magnetic fields are discussed. Pictures of an operating model are included.



RADAR, NAVIGATION

Scattering of Microwaves by Long Dielectric Cylinders, by A. W. Adey. "Wirel. Eng." Nov. 1956. 6 pp. The author presents near-field results for the scattering of 3 cm waves by dielectric rods of circular, square, and rectangular cross-section.

Design and Application of Miniature Microwave Noise Sources, by R. E. White and R. H. Geiger. "El. Eq." Nov. 1956. 2 pp. Noise sources developed for built-in system-performance monitors for Armed Services microwave equipment are described.

Frequency-Modulation Radar for Use in the Mercantile Marine, by D. N. Keep. "Proc. BIEE." July 1956. 8 pp. The principles of FM radar are outlined and a comparison is made between pulse and FM techniques. It is concluded that multi-gate FM radars are too complex for merchant service and methods are outlined for overcoming the inherently low scanning rate of single sweeping-gate systems. Equipment is described which has an aerial beamwidth of 1.7° and a rotation rate of 10 rpm with a fractional range resolution of 1/30.

Radar Simulator Trains Missile-Master Crews, by G. W. Oberle. "El." Nov. 1956. 3 pp. A general description is given of a simulator-computer used to train ground-based radar system crews without need for expensive aircraft flights.

Radar Simulator for Laboratory Use, by H. J. Bickel and R. I. Bernstein. "El." Oct. 1956. 4 pp. The simulator is designed to provide simulated target scintillation amplitude probability distribution; target-scintillation spectrum; antenna beam axis rms signal-to-noise ratio; receiver noise figure; receiver bandwidth; antenna pattern shape and beamwidth; pulse shape and pulse width; pulse repetition frequency; antenna scan rate.

The Problem of Establishing Steady-State Oscillations in Self-Excited Oscillators Which Operate in the Decimeter Wave Range, by N. F. Alekseev. "Radiotek." Aug. 1956. 12 pp. The paper proposes a new method for reducing the average retardation of the wavefront of the high-frequency pulse, and for decreasing the "spread" of the retardation values. Experimental methods are used to determine the initial amplitudes of the self-oscillations and free oscillations, as well as to determine the values of pre-oscillation noise. The paper shows that it is possible to generate high-frequency pulses with a duration of 0.1 μsec while a flat wave-front is maintained for the supply pulse.

A Ferrite Microwave Modulator Employing Feedback, by W. W. H. Clarke, W. M. Searle, and F. T. Vail. "Proc. BIEE." July 1956. 6 pp. The author describes a feedback method of applying the modulation signal, providing a linearity substantially that of the feedback crystal used to detect the modulated microwave signal, and reducing the effect of hysteresis by an amount approximating the feedback loop gain. Pure sine-wave modulation is achieved at low frequencies, in which the second-harmonic sidebands are more than 45 db below the fundamental. Linear modulation, by sawtooth and square waveform, is also achieved, in which the modulation envelope faithfully reproduces the applied signal.

Wide-Band Noise Sources Using Cylindrical Gas-Discharge Tubes in Two-Conductor Lines, by R. I. Skinner. "Proc. BIEE." July 1956. 6 pp. The provision of wide-band noise sources for the decimeter wavelength region can be achieved by matching the plasma region of a gaseous discharge to a transmission line. Examination of the properties of a discharge plasma shows that a noise source with an output which is constant over several octaves can be obtained by matching a cylindrical discharge tube directly to a two-conductor line. The factors which affect the operation of the matching element are considered, and a practical design procedure is outlined.

Theory of a Spiral Transmission Line which is Surrounded by a Cylindrical Semiconductor Shell, by E. G. Solovyev, and L. V. Belous. "Radiotek." April 1956. 5 pp. The article investigates the propagation of electromagnetic waves along a spiral transmission line which is surrounded by a cylindrical semiconductor shell. Boundary conditions in the form of the impedance are used, taking into account the thickness of the shell. The analysis of the dispersion which is obtained indicates the presence of a maximum in the expression for the damping when the thickness of the semiconductor layer and the magnitude of the conductivity, lag, and frequency are varied. The results of the calculations are verified by experiment.

On the Analysis of Direction Finders at the Occurrence of Rotating Fields, by H. Gabler, G. Gresky and M. Waechtler. "Arc. El. Uber." Sept. 1956. 9 pp. The Effect of reflections from objects producing rotating electromagnetic fields on the indications of a visual direction finder on board ship is studied.

Hazards Due to Total Body Irradiation by Radar, by H. P. Schwan and K. Li. "Proc IRE." Nov. 1956. 10 pp. The frequency dependence of the coefficient of absorbed energy for different body tissues is discussed. Tolerance value for total body irradiation near .01 watts/cm² are suggested.

SEMICONDUCTORS

Transistorized Low-Level Chopper Circuits, by R. B. Hurley. "El. Ind." Dec. 1956. Asymmetrical alloyed germanium transistors are commonly used in the inverted, or low gain, configuration for chopper service. Theoretical and practical considerations are included in this discussion.

Computer Switching With Microalloy Transistors, by J. B. Angell and M. M. Fortini. "El. Ind." Dec. 1956. 4 pp. Basic switching circuits employing new transistors with low emitter-to-collector saturation voltages and large current amplification are described.

Thermistor Monitors Tube Exhaust Process, by R. Korner and G. Rieger. "El. Ind." Dec. 1956. 2 pp. A thermistor vacuum gauge for determination of pressures within a tube during exhausting procedures is described. Basic principle is variation of the thermistor dissipation constant with pressure.

Designing Transistor Circuits—Class B Amplifiers, Part 1, by R. B. Hurley. "El. Eq." Nov. 1956. 3 pp.

Fluctuation Noise, by F. J. Hyde. "Wirel. Eng." Nov. 1956. 6 pp. A method of measuring the current noise generated in temperature-sensitive solid-state devices, in narrow bandwidths about frequencies chosen between 5 x 10^{-3} and 10^{-1} cps is described. Main feature of the equipment described is a resistance-capacitance coupled amplifier of the type originally described by Schneider.

IRE Standards on Solid-State Devices: Methods of Testing Transistors. "Proc. IRE." Nov. 1956. 20 pp. Standards are presented for methods of measurement of important characteristics of transistors; it is emphasized that the standards will necessarily change as this young art progresses.

Common-Emitter Transistor Video Amplifiers, by G. Bruun. "Proc. IRE." Nov. 1956. 12 pp. Design theory for common-emitter video amplifiers using alloy junction type transistors is presented.

The Application of Transistors to the Trigger, Ratemeter and Power-Supply Circuits of Radiation Monitors, by E. Franklin and J. B. James. "Proc. BIEE." July 1956. 8 pp. The author outlines the general requirements and the conditions of use of radiation monitors employed in geological prospecting. Arguments leading to the transistor as the preferable component in all cases are given, and typical transistor circuits are discussed. Both point-contact and junction transistors are discussed, and the superiority of the junction-type circuits for this type of application is demonstrated.

On Stabilizing the D.C. Operating Point of Junction Transistors, by W. Guggenbuehl and B. Schneider. "Arc. El. Uber." Sept. 1956. 15 pp. A short outline of dc transistor characteristics and their variations is followed by formulae for the calculation of the circuit components of stabilizing circuits based on a permissible variation of the dc operating point. Several circuits are presented and their performance discussed; the use of temperature sensitive elements is dealt with.

Tolerance Compensation of Thermistors, by C. J. Kaiser. "El. Des." Oct. 15, 1956. 2 pp. The author presents a method using zero-temperature-coefficient resistors for compensation, at a cost less than having the nonlinear components held close to the desired tolerances.

Nomogram For Some Transistor Parameters, by H. Lefkowitz. "El. Des." Oct. 15, 1956. 2 pp. This nomogram simplifies calculation of alpha from either one-minus-alpha or beta.

Field-Effect Measurements and Application to Semiconductor Surface Studies, by Shyh Wang. "Syl. Tech." Oct. 1956. 4 pp. The author discusses semiconductor surface states, then proceeds to a discussion of field-effect experiments giving a measurement of field-induced surface conductance.

Applications of Semi-Conductors, by J. J. Dezoteux. "Bul. Fr. El." Sept. 1956. 7 pp. A short survey of transistor properties, different makes, and low-frequency, high-frequency and power transistor characteristics is followed by a description of transistor amplifiers and rectifiers. Future developments are anticipated.

Linear Sweep-Voltage Generators and Precision Amplitude Comparator Using Transistors, by L. C. Merrill and T. L. Slater. "J IT&T." Sept. 1956. 6 pp. Reduction of size, weight, and power consumption; without loss of stability and accuracy have been achieved through the use of silicon junction transistors in a bootstrap sweep generator, a Miller integrator sweep generator, and a precision amplitude comparator. Design and construction are discussed.

Transistor Design, by C. H. Zierdt. "El. Des." Oct. 15, 1956. 3 pp. The author explores questions of cost, size, applicability to printed circuitry, and interchangeability in transistor design. Standardization of transistor case design is discussed.

Circuit Design For Transistor Interchangeability, by W. J. Maloney. "El. Des." Oct. 15, 1956. 2 pp. Practical design suggestions are offered for development of circuits allowing germanium triode interchangeability in i-f power amplifier circuits. The method of approach is applicable to similar problems in other transistor circuit design.

Some Aspects of Transistor Progress, by H. W. Loeb. "J BIRE." Sept. 1956. 14 pp. Some of the more significant developments during the last seven years are surveyed with emphasis on interrelations between research progress and practical achievements. Transistor technology is outlined briefly and the development of the equivalent circuit used to illustrate advances in theory.

Transistor Guide 1956. "Toute R." Oct. 1956. 3 pp. A survey of transistor types manufactured or imported into France is presented. Characteristic data are tabulated.

TELEVISION

Spectrum of Television Signals, by D. A. Bell and G. E. D. Swann. "Wirel. Eng." Nov. 1956. 4 pp. A report is made on systematic measurements of the signals broadcast from the Sutton Coldfield TV station, with reference to the spectrum and energy distribution.

Three-Phase Detector for Color-TV Receivers, by A. A. Goldberg. "El." Oct. 1956. 3 pp. This article features a three-diode detector, in place of two double-diode detectors, which provides noise-immune afc, acc, and color killer functions.

On the Use of a Series Connection of a Germanium Diode and a Vacuum Diode to Maintain the Black Level in T.V., by W. Dillenburger and E. Sennhenn. "Freq." Sept. 1956. 4 pp. This series connection results in a reduction in the capacitance. However, small changes in the transmitted picture will be introduced. Experimental results are reported and measured voltage curves reproduced.

Video Amplifiers Use Shunt Regulation, by W. E. Jeynes. "El." Nov. 1956. 2 pp. Two applications of the shunt-regulated amplifier to video terminal equipment are described.

Switching at TV Operating Centers, by A. L. Stillwell and A. D. Fowler. "Bell. Rec." Oct. 1956. 4 pp. New video switches are described which offer greatly improved operating features for TV operating centers. The switches require a minimum of equalization and can be remotely controlled.

Slow-Sweep TV for Closed-Circuit Use, by H. E. Ennes. "El." Nov. 1956. 4 pp. The system described is designed for use at 60 cps horizontal and up to 7 cps vertical sweep rates. Reduction of scan rates produces an effective increased sensitivity of the pickup tube.

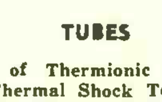
Proof of Performance for TV Broadcasting, by J. R. Sexton. "El." Nov. 1956. 5 pp. Test techniques are outlined.

TRANSMISSION LINES

Capacitance of Shielded Balanced-Pair Transmission Line, by A. W. Gent. "J IT&T." Sept. 1956. 7 pp. A formula is derived for the capacitance of a shielded balanced-pair transmission line by application of the method of images. Range of validity of the derived formula is compared with those of the formulas derived by Green, Curtis, and Mead; Craggs and Tranter; and Meinke.

Waveguide Surface Finish and Attenuation, by J. Allison and F. A. Benson. "El. Eng." Nov. 1956. 6 pp. Discrepancies between theoretical and experimental performance of waveguide surfaces are largely due to the effect of surface roughness. The authors present information on surface finishes of drawn, mechanically-lined, sprayed, cast, electroplated, electropolished, chemically-polished, and electroformed waveguides.

Waveguide Hybrid Circuits and Their Use in Radar Systems, by J. W. Sutherland. "El. Eng." Nov. 1956. 6 pp. The principal types of waveguide hybrids are described and their properties are compared. Balanced duplexers, balanced mixers and wave-guide switching, adding, and subtracting circuits are discussed.



TUBES

The Control of Thermionic Valve Envelope Quality by Thermal Shock Testing, by G. D. Redston. "El. Eng." Nov. 1956. 6 pp. The factors controlling the failures of all-glass tubes in thermal shock tests are discussed. Different thermal shock tests are described for different defects. Distinctions are shown between downward and upward shock test, and the failure of tube base tempering to produce a significant change in the number of failures on life test is pointed out.

Correlation Conditions of Noise Fluctuations at the Potential Minimum of a Diode (Triode), by H. Kosmahl. "Arc. El. Uber." August 1956. 5 pp. The correlation coefficient of the fluctuations of the spacecharge attenuated shot current and the fluctuations of electron velocity at the potential minimum for low frequencies is calculated. For ideal diodes and triodes this correlation coefficient is between 0.65 and 0.75 and for actual tubes it is considerably smaller. This coefficient is used in computing the induced grid noise.

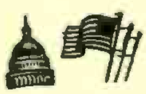
The Behavior of Space-Charge Diodes at High-Frequencies, Taking the Maxwell's Velocity Distribution into Consideration, by H. Pankseh. "Nach. Z." Sept. 1956. 5 pp. Proceeding from an integral expression for the ratio of the displacement current to the total current expressions for admittance and slope of the tube characteristic are derived. A numerical evaluation of these expressions and a short derivation of the basic formulae are presented.

Taking the Heat Off Miniature Equipment, by J. P. Welsh. "El." Oct. 1956. 5 pp. A survey of common heat dissipation problems and techniques in miniature equipment is presented.

How to Measure UHF Noise Figure, by J. W Rush. "El. Eq." Nov. 1956. 3 pp. Noise measurements in UHF triodes are discussed.

Ferrite Attenuators for Traveling-Wave Amplifiers. by R. Kompfner and J. S. Cook. "Bell Rec." Oct. 1956. 5 pp. The development of a helical ferrite attenuator for a traveling wave tube is outlined. The developed attenuator requires no dc coils to establish the circumferential field.

Pentode Does Two Jobs, by L. M. Balter. "El Des." Oct. 1, 1956. 2 pp. A description is given of the manner in which an RCA portable TV set utilizes a single pentode as both sound i-f amp. and also first audio voltage amplifier, through the use of high and low pass filters.



U. S. GOVERNMENT

Research reports designated (LC) after the price are available from the Library of Congress. They are photostat (pho) or microfilm (mic), 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.

When an agency other than LC or OTS is the source, use the full address included in the abstract of the report. Make check or money order payable to that agency.

Electronic Scheduling Machine Requirements (PB 121117), by R. G. Canning. March 1955. 43 pp. $1.25. (OTS) The application of electronic digital computers to job shop scheduling in production plants is discussed from a research perspective. The cause of the problem is presented, followed by a discussion of a method of performing shop scheduling on electronic computers. Illustrative times and costs based on one plant studied are presented. Desirable computer characteristics are considered.

Frequency Modulated Magnetic Tape Recording and Playback Instrumentation System (PB 120931), by J. Petes. U. S. Naval Ordnance Laboratory, White Oak, Md. Feb. 1953. 66 pp. Pho $10.80, mic $3.90. (LC) The development of a frequency modulated system for the recording of pressures and accelerations resulting from high explosive detonations is described. The intelligence from a pressure gage or accelerometer gage frequency modulates a carrier frequency, and after being multiplexed this FM signal is transmitted by cable and remotely recorded on a magnetic tape recorder. In playback the output of a magnetic tape reproducer is fed through band pass filters which separate the various carrier frequencies of the multiplexed signal; from here each filtered signal is fed to a discriminator unit which converts the frequency modulated signal to an amplitude signal. Finally this amplitude signal is presented to a string oscillograph which produces a photographic record of the signal.

Analysis of Eddy Current Loss in Laminated Core Material (PB 120909) by O. J. Van Sant, Jr. U. S. Nav. Ord. Lab. June 1953. 22 pp. Mic $2.70, pho $4.80. (LC) The eddy current loss in a laminated, constant permeability (non-ferromagnetic) core material is derived rigorously starting with Maxwell's equations. It is pointed out that neither the popular nor the rigorous results can be applied properly to the ferromagnetic case, although such an application is commonly referred to in the literature.

Capacitance Effects in Thin Conductive Films (PB 120974), by J. N. Humphrey, F. L. Lummis, and W. W. Scanlon, U. S. Nav. Ord Lab., White Oak, Md. July 1952. 17 pp. Mic $2.40, pho $3.30. (LC) The frequency dependence of the resistance of thin films of lead sulfide and tellurium are analyzed on the basis of the effects of distributed capacitance and intercrystalline capacitance. It is shown that while for some films the observed behavior can be accounted for by distributed capacitance effects alone, others require both effects. A correlation between photoconductivity and the presence of intercrystalline capacitance was not found in these experiments.

Extraction of Weak Signals from Noise by Integration (PB 122625), by F. R. Dickey, Jr., A. G. Emslie, and Harry Stockman, U. S. Air Materiel Command, Cambridge, Mass. Sept. 1948. 44 pp. Mic $3.30, enl pr $9.30. (LC) The detection of weak signals imbedded in noise was achieved by marking a sequence of transmitted pulses in order to permit the use of an efficient storage system, and by using a synchronization scheme that automatically provided signal excitation in the right phase.

Ferrite Applications: Electronic Properties of Ferrites and their Application to Microwave Devices (PB 122890), by D. W. Healy, Jr., and R. A. Johnson, Revised, Syracuse University Research Institute, Syracuse, N. Y. May 1956. 63 pp. Mic $3.90, pho $10.00. (LC) The unusual coupling of magnetic and electric properties possessed by ferrites has made them of great interest in the microwave electronics field. The bulk of this report describes observations made of the Faraday rotation observed when a cylindrical wave guide is loaded with hollow cylindrical ferrite samples. Experimental measurements are made of the variation with magnetic field of the wave lengths of the modes propagating in the ferrite. All the data collected was taken at the X-band frequencies and the ferrites discussed in this report are sintered ferrites obtained commercially.

High Impedance Fixed and Continuously Variable Delay Lines with Ferrite Cores (PB 120952), by W. S. Carley and J. F. Peoples, U. S. Naval Ordnance Laboratory, White Oak, Md. Jan. 1952. 27 pp. Mic $2.70, pho $4.80. (LC) This report concerns a preliminary feasibility study of artificial delay lines using ferrite cores. The results of tests on these lines using both sine wave and rectangular input signals are given. Lines with characteristic impedances as high as 22,000 ohms are obtained. Two methods of obtaining continuously variable time delays are described. Time delay variations from 0 to 1 μsec in a 1 μsec line were achieved. The variation in time delay with frequency for sine wave input signals is shown for both fixed and variable types of delay lines. The response of the delay lines to rectangular pulses of several pulse widths is shown.

PATENTS

Complete copies of the selected patents described below may be obtained for 25¢ each from the Commissioner of Patents, Washington 25, D. C.

Semiconductor Signal Translating Devices, #2,763,731. Inv. W. G. Pfann. Assigned Bell Telephone Labs. Issued Sept. 18, 1956. Two rectifying point electrodes are so closely arranged at opposite sides of a P-N junction that the carriers injected by the first electrode will control the carrier flow to the second electrode. A third electrode makes ohmic connection to the zone to which the first electrode is connected. An input circuit is connected between the first and third electrodes and an output circuit between the second and third electrodes; suitable biasing is provided.

Arc Suppressor for Dielectric Heating Equipment, #2,763,758. Inv. F. Kohler. Issued Sept. 18, 1956. The two plates of a capacitor, the dielectric of which is to be heated, are connected to an oscillator. The oscillation will be interrupted in response to the closure of a switch which is controlled by a dc resistance indicator. As soon as the dc resistance of the capacitor dielectric reaches a value approaching the arcing value, the dc resistance responsive circuit will operate the switch.

Short Circuiting Plug for Coaxial Line, #2,763,845. Inv. O. T. Laube. Assigned American Telephone and Telegraph Co. Issued Sept. 18, 1956. To present an uninterrupted short circuiting surface to a coaxial line, a conductive cylinder is fitted within the outer conductor and a conductive tube embraces the inner conductor. A washer engages both these elements at flexible sections thereof. Washer, cylinder and conductor are shaped and fitted to present a continuous surface.

Television Systems, #2,764,627. Inv. M. B. Johnson. Issued Sept. 25, 1956. The screen of a cathode-ray tube which is normally opaque is rendered translucent by a scanning electron beam, the electron beam is modulated by successive color frames, and the degree to which the screen becomes translucent depends on the energy of the impinging electrons. Simultaneously, the screen is successively illuminated with colored light of the color of the beam-controlling frame signals.

Television, #2,764,629. Inv. P. C. Goldmark. Assigned Columbia Broadcasting Co. Issued Sept. 25, 1956. The frames of several films are alternately and successively scanned. The frames are mounted in alignment and their frames alternately scanned in a predetermined sequence. Each film is pulled down for scanning the next frame during scanning of a frame of another film.

Compensated Amplifying System, #2,764,641. Inv. R. A. Muschamp. Assigned General Electric Co. Issued Sept. 25, 1956. A two-stage direct coupled amplifier has a coupling resistance between the plate and screen grid of the first tube, which resistor supplies the input for the second stage. The resistance of this resistor is substantially equal to the inverse of the screen grid-to-plate mutual conductance of the first tube.

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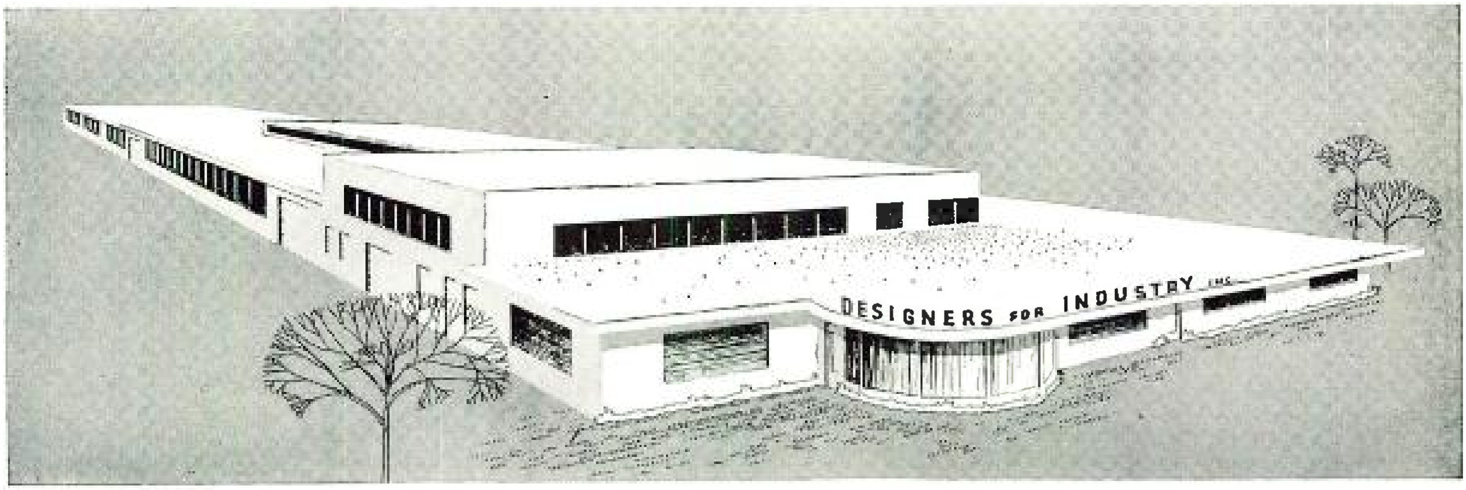

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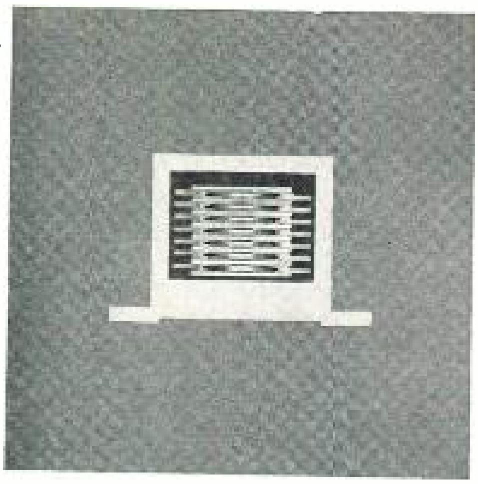

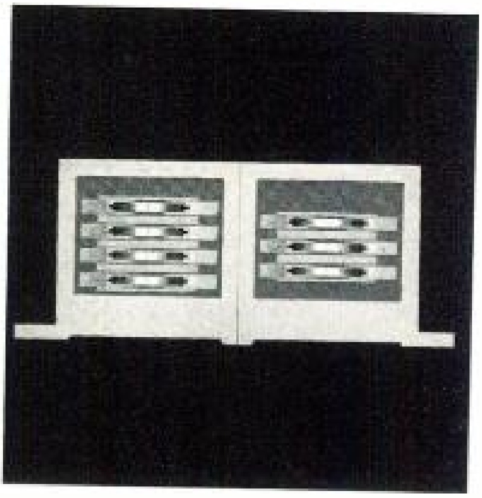

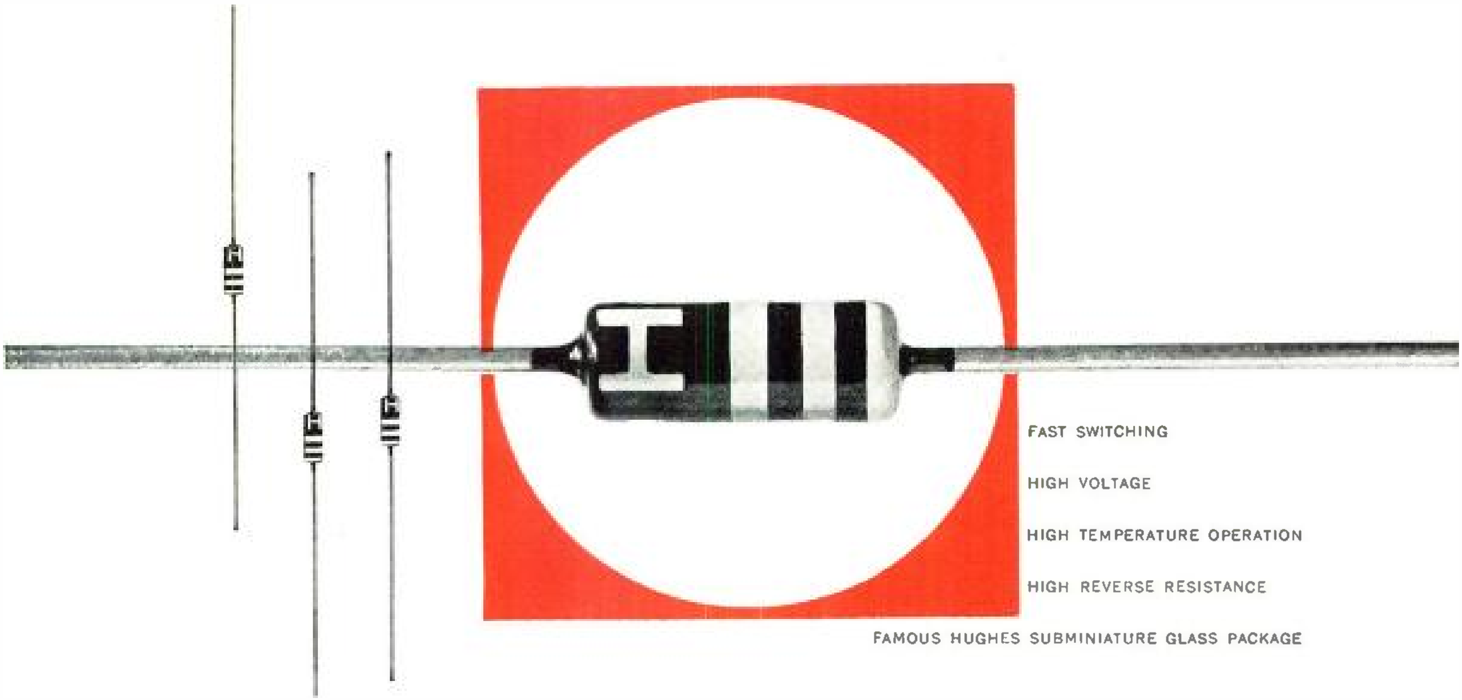

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Excellent high-frequency characteristics of the new diodes enable you to use them instead of vacuum or germanium diodes in such applications as: FLIP-FLOP CIRCUITS . . . MODULATORS AND DEMODULATORS . . . DISCRIMINATOR CIRCUITS . . . CLAMPING AND GATING CIRCUITS . . . DETECTORS. *So, whenever you need a diode for pulse or computer circuitry to perform under conditions that are marginal for vacuum or germanium diodes, use the new* QUICK RECOVERY *Silicon Junction Diodes—by* HUGHES!

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Electronic Industries' 1957 Directory of Computer Equipment Manufacturers

A comprehensive listing of the manufacturers of computers, computer components, and accessory equipment. Names and addresses of the firms are listed alphabetically in 6 major categories: computers, components and accessories, converters, data recorders, memory and storage.

COMPUTERS

Analog 1
Digital 2

Air Associates Inc 1
511 Joyce St Orange NJ
Airborne Instrument Lab Inc 1-2
160 Old Country Rd Mineola NY
Analogue Controls Inc 1
39 Roselle St Mineola NY
Arma Div American Bosch Arma Corp 1-2
Roosevelt Field Garden City NY
Austin Co Special Devices Div 1-2
76 9th Ave New York 11
Avion Div ACF Ind 1-2
99 Park Pl Paramus NJ
Beckman Instrument Inc 1-2
Berkeley Div 2200 Wright Ave Richmond 3 Calif
Bendix Aviation Corp Computer Div 1-2
5630 Arbor Vitae St Los Angeles 45
Bergen Labs 1
247 Crooks Ave Clifton NJ
Burroughs Corp 2
6071 2nd Ave Detroit 32 Mich
Computer Control Co Inc 2
92 Broad St Babson Park 57 Mass
Computer Eng'g Assoc Inc 1
350 N Halstead St Pasadena Calif
Computing Devices of Canada Ltd 1-2
P O Box 508 Ottawa 4 Ontario Canada
Control Instrument Co Inc 1-2
67 35th St Brooklyn 32 NY
Control Specialists Inc 1
115 E Arbor Vitae St Inglewood 1 Calif
Corbin Corp 1
5419 56th Place Riverdale Md
Dalmo Victor Co 1-2
1515 Industrial Way Belmont Calif
Datamatic Corp 2
151 Needham St Newton Highlands Mass
Daystrom Instrument 1-2
Div of Daystrom Inc Archbald Pa
The de Florez Co 1
116 E 30th St New York 16
Donner Scientific Co 1
888 Galindo St Concord Calif
ElectroData 2
Div of Burroughs Corp 460 Sierra Madre Villa Pasadena Calif
Electro-Measurements Inc
7524 SW Macadem Ave Portland 1 Ore
Electronics Associates Inc 1
Long Branch & Naberal Ave Long Branch NJ
Electronic Control Systems Inc 2
2136 Westwood Blvd Los Angeles 25
Electronics Corp of America 1-2
1 Memorial Dr Cambridge 42 Mass
Electronic Tube Corp 2-3
1200 E Mermaid Lane Phila 17
Federal Telecommunications Labs 1-2
Div IT & T 500 Washington Ave Nutley NJ
Feedback Controls Inc 1
899 Main St Waltham 54 Mass
Ferranti Electric Inc 2
30 Rockefeller Plaza New York 20
Fischer and Porter Co 1-2
19 Warminster Rd Hatboro Pa
Garrett Corp 1
9851 S Sepulvecla Blvd Los Angeles 45
General Electric Co 1-2
Computer Dept 1103 N Central Ave Phoenix Ariz
General Electric Co 1-2
Syracuse NY
General Precision Lab Inc 1-2
63 Bedford Rd Pleasantville NY
Genisco Inc 1-2
2233 Federal Ave Los Angeles 64
Geotechnical Corp
3712 Haggar Dr Dallas 9 Tex
Gerber Scientific Ins Co 1
162 State St Hartford 3 Conn
Goodyear Aircraft Corp 1
Akron Ohio
Haller Raymond Brown Inc 1-2
124 N Atherton St State College Pa
Hall-Scott Inc 1
Electronics Div 2950 N Ontario St Burbank Calif
Hathaway Instrument 5
Div Hamilton Watch Co 1315 S Clarkson St Denver 10 Colo
Heath Co. 1
305 Territorial Benton Harbor Mich
Hoover Electronics Co 2
3640 Woodland Ave Baltimore 15 Md
Hughes Aircraft Co 1-2
Culver City Calif
Industrial Control Co 1
Straight Path & Arlington Ave Wyandanch NY
Industrial Electronic Eng 2
3973 Lankershim Blvd N Hollywood Calif
Industrial Test Equip Co 1
55 E 11th St New York 3
International Business Mach Corp 2
590 Madison Ave New York 22
Jacobs Instrument Co 2
4718 Bethesda Ave Bethesda 14 Md
Kearfott Co Inc 1-2
1378 Main Ave Clifton NJ
Laboratory for Electronics Inc 2
75 Pitts St Boston 14 Mass
Leeds & Northrup Co 1
4901 Stenton Ave Phila 44
Librascope Inc 1-2
133 E Santa Anita Ave Burbank Calif
Librascope Inc 1-2
808 Western Ave Glendale Calif
Link Aviation Inc 1
Hillcrest Binghamton NY
Litton Industries 2
336 N Foothill Rd Beverly Hills Calif
Logistics Research Inc 2
141 S Pacific Ave Redondo Beach Calif
Magnasync Mfg Co Ltd 2
5546 Satsuma Ave N Hollywood Calif
Marchant Calculators Inc 2
1475 Powell St Oakland 8 Calif
Melpar Div Westinghouse 1-2
Air Brake Co 3199 Arlington Blvd Falls Church Va
Mid-Century Instrumatic Corp 1
611 Broadway New York 12
Monroe Calculating Machine Co 2
Hanover Ave Morris Plains NJ
Motorola Inc 1-2
4501 W Augusta Blvd Chicago 51
Motorola Inc 1-2
Riverside Calif
Mountain Systems Inc 2
864 Franklin Ave Thornwood NY
M Ten Bosch Inc 1
80 Wheeler Ave Pleasantville NY
National Cash Register Co 2
Main & K Sts Dayton 9 O
The Newton Co 1-2
55 Elm St Manchester Conn
Norden-Ketay Corp 1
Commerce Rd Stamford Conn
Northrop Aircraft Inc 1-2
Hathorne Calif
Otis Elevator Co Electronic Div 1-2
35 Ryerson St Brooklyn NY
Philbrick Researches Inc G A 1
230 Congress St Boston 10 Mass
Philco Corp 2
Govt & Industrial Div 4700 Wissahickon Ave Phila 44
Potter Instrument Co Inc 2
115 Cutter Mill Rd Great Neck NY
Radiation Counter Labs Inc 1
5121 W Grove St Skokie Ill
Radio Corp of America 2
Front & Cooper Sts Camden NJ
Raytheon Mfg Co 2
Waltham Mass
Rea Co J B 1-2
1723 Cloverfield Blvd Santa Monica Calif
Reeves Instrument Corp 1
215 E 91 St New York 28
Remington-Rand Inc 1-2
315 4th Ave New York
Remington Rand Univac 1
Div Sperry Rand Corp Univac Pk St Paul 16 Minn
Royal Precision Corp 2
Westchester Ave Port Chester NY
Servo Corp of America 1
20-20 Jericho Tpk New Hyde Pk NY
Skiatron Electronics & TV Corp 1-2
180 Varick St New York 14
Southwestern Industrial Electronics Co 1
2831 Post Oak Rd Houston 19 Tex
Standard Electric Time Co 1
89 Logan St Springfield 2 Mass
Stavid Eng'g Inc 1
U S Hwy No. 22 Plainfield NJ
Sterling Precision Corp 1
34-17 Lawrence St Flushing 1 NY
Sylvania Electric Prods Inc 2
100 1st Ave Waltham 54 Mass
Taller & Cooper Eng'g 1-2
75 Front St Brooklyn 1 NY
Technitrol Eng'g Co 2
1952 E Allegheny Ave Phila 34
Telemeter Magnetics Inc 2
2245 Pontius Ave W Los Angeles 64
Ultrasonic Corp 1-2
640 Memorial Dr Cambridge 39 Mass
Underwood Corp 2
35-10 36th Ave Long Island City 6 NY
Vectron Inc 1
1611 Trapelo Rd Waltham 54 Mass
Westinghouse Electric Corp 1-2
Friendship International Airport Baltimore 3 Md

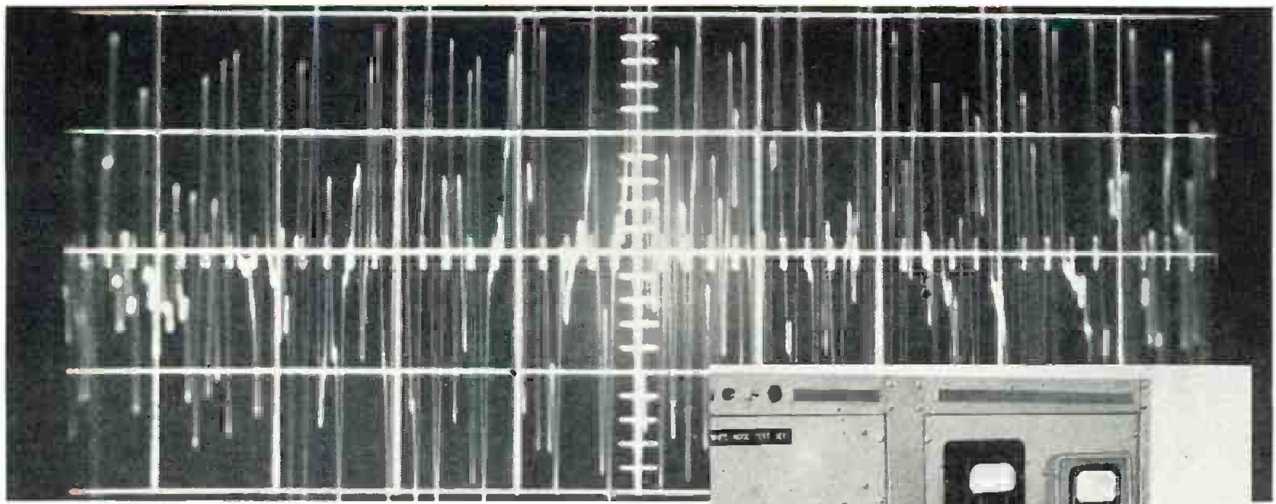
COMPUTER COMPONENTS & ACCESSORIES

Computer Heads 1
Decoders 2
Differential Analyzers 3
Encoders 4
Input Equipment 5
Output Equipment 6
Plotters 7
Resolvers 8
Samplers 9
Delay Lines 10
Function Generators 11

Air Associates Inc 2-4-9
511 Joyce St Orange NJ
American Electronics Inc 8
655 W Washington Blvd Los Angeles 15
AMP Inc 5
Eisenhower Blvd Harrisburg Pa
Ampex Corp 5-6
934 Charter St Redwood City Calif
Analogue Controls Inc 3-5-6-7
39 Roselle St Mineola NY
Arma Div American Bosch 5-6-7-8
Arma Corp Roosevelt Field Garden City NY
Automation Corp of America 1
5546 Satsuma Ave N Hollywood Calif
Avion Div of ACF Ind 2-4
99 Park Pl Paramus NJ
Baldwin Piano Co 4
1801 Gilbert Ave Cincinnati 2 O

(*Continued on page 81*)

Manufacturers of tubes, semiconductors, resistors, tapes, capacitors, transformers and other components having equal application outside the computer field have been, of necessity, omitted from this listing.



Unretouched oscillogram demonstrates the wide spectrum and random nature of vibrations inherent in Sylvania's new "white noise" vibration test. Its approximation of flight conditions to which guided missiles are subjected is an important contribution to tube reliability.

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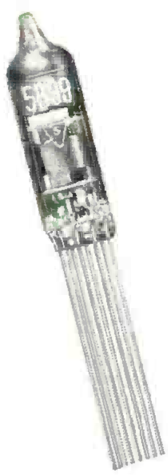
"White Noise"

puts wings on a test rack, advances tube reliability



By providing a more realistic tube vibration test which can be adapted to large-scale production techniques, the "white noise" vibration test is contributing to greater tube reliability.

Developed by Sylvania engineers in conjunction with Naval contracts, the "white noise" vibration test meets important requirements for testing tubes used in guided missiles and other vehicular applications.

First, it simulates environmental conditions by presenting a wide range of vibrational frequencies. Secondly, it presents these frequencies at random g-levels. Thirdly, it provides specification limits through direct meter readings.

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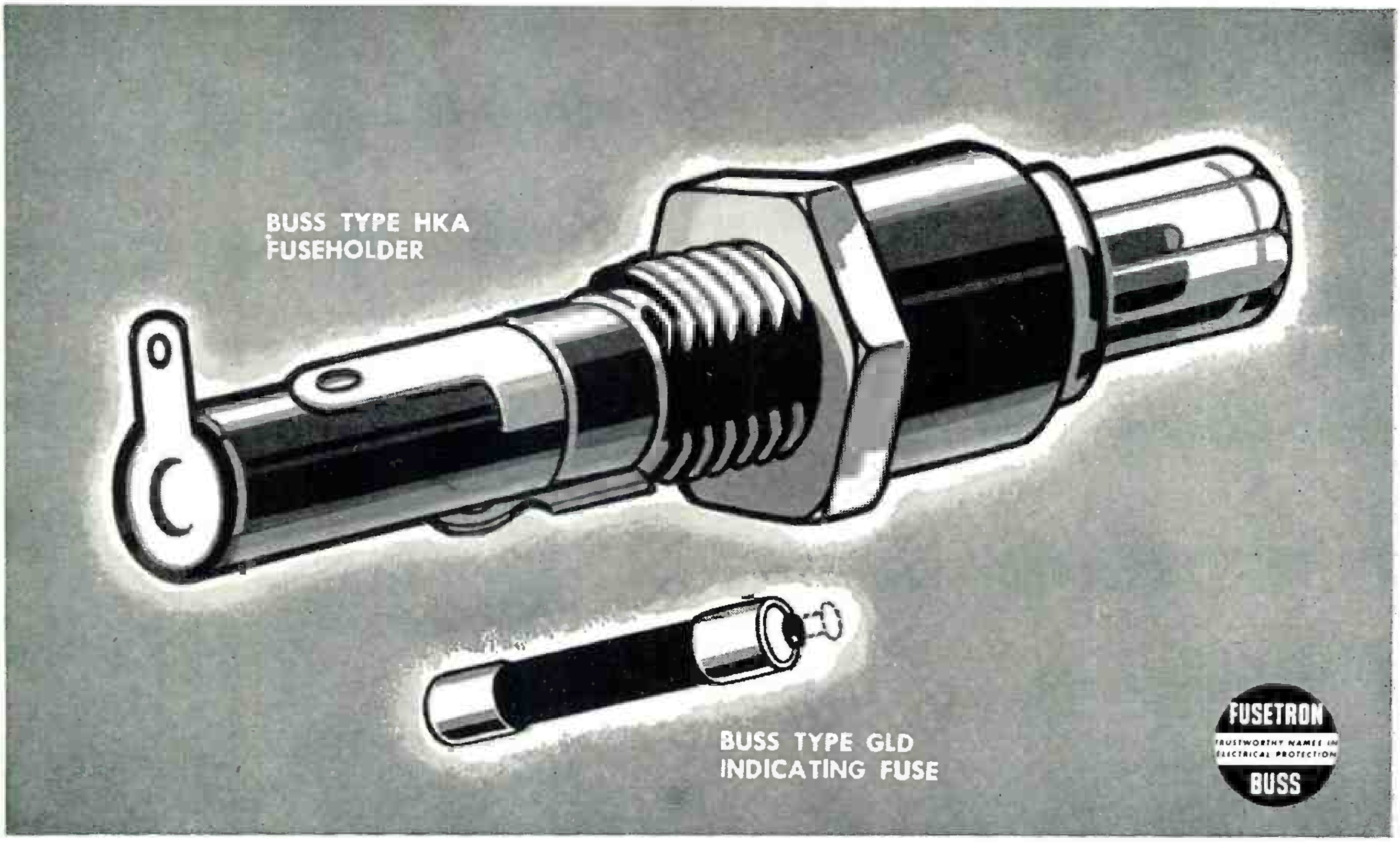

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FLASHES A LIGHT • RINGS A BELL • TRIPS A RELAY OR GIVES OTHER SIGNALS • *TO TELL YOU WHEN AND WHERE A FUSE BLOWS!*

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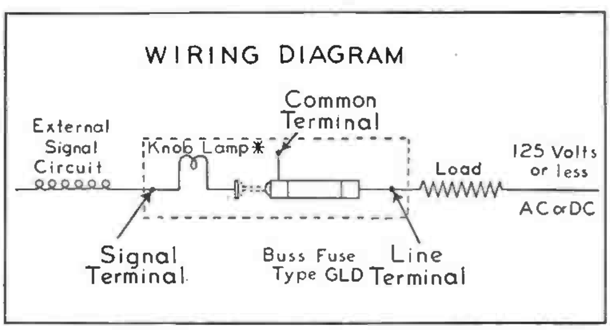


1256

DIRECTORY OF COMPUTER MANUFACTURERS (cont.)

Beckman Instrument Inc 3-5-6
Berkeley Div 2200 Wright Ave Richmond 3 Calif
Bendix Aviation Corp 1-3-5-6
Computer Div 5630 Arbor Vitae St Los Angeles 45
Bendix Aviation Corp. 2-4-5-6
Pacific Div 11600 Sherman Way N Hollywood Calif
Benson-Lehner Corp 5-6-7
11930 W Olympic Blvd Los Angeles 64
BJ Electronics 5
Div Borg-Warner Corp P O Box 1679
3300 Newport Blvd Santa Ana Calif
Bowmar Instrument Corp 6
2415 Pennsylvania St Ft Wayne Ind
Brew & Co Inc Richard D 10
90 Airport Road Concord NH
Bristol Co 5
P O Box 1790 EITT Waterbury 20 Conn
Brush Electronics Co 1-5-6
3405 Perkins Ave Cleveland 14 O
Burroughs Corp 2-4-5-6-7
6071 2nd Ave Detroit 32 Mich
Commercial Controls Corp 5-6
1 Leighton Ave Rochester 2 NY
Computer Control Co Inc 2-4-10
92 Broad St Babson Park 57 Mass
Computer Instrument Corp 8
92 Madison Ave Hempstead LI NY
Computing Devices of Canada Ltd 2-3-9
P O Box 508 Ottawa 4 Ontario Canada
Control Instrument Co Inc 5-6
67 35th St Brooklyn 32 NY
Cubic Corp 2-4-5-6
5575 Kearny Villa Rd San Diego 11 Calif
Dalmo Victor Co 1-5-6-7-8
1515 Industrial Way Belmont Calif
Daven Co The 10
Rt 10 Livingston N J
Davies Labs 1-5
10721 Hanna St Beltsville Md
Daystrom Instrument 2-7
Div of Daystrom Inc Archbald Pa
Dennison Mfg Co 5
300 Howard St Framingham Mass
Developmental Electronics Corp 10
4213 S Broadway Los Angeles 37
Devol Research Co 2-4-5-6
Brookside Dr Greenwich Conn
Eclipse-Pioneer Div 2-4-5-6-8-9
Bendix Aviation Corp Teterboro NJ
Edison Inc Thomas A 1-8
549 Eagle Rock Ave Roseland NJ
ElectroData 1-2-4-5-6
Div of Burroughs Corp 460 Sierra Madre Villa Pasadena Calif
Electro Instruments Inc 7
3794 Rosecrans San Diego 10 Calif
Electro-Miniatures Corp 4-9
1060 Elm Ave Ridgefield NJ
Electronic Eng'g Co of Calif 5
180 South Alvarado Los Angeles 57
Electronics Associates Inc 5-6-7-8-9
Long Branch & Naberal Ave Long Branch NJ
Electronics Corp of America 4-5
1 Memorial Dr Cambridge 42 Mass
Engineered Electronics Co 5-6
506 E 1st St Santa Ana Calif
Epsco Inc 2-4-5-6-9
588 Commonwealth Ave Boston 15 Mass
E S C Corp 10
534 Bergen Blvd Palisades Pk NJ
Essex Electronics 10
550 Springfield Ave Berkeley Heights NJ
Feedback Controls Inc 5-6-7
899 Main St Waltham 54 Mass
Ferranti Electric Inc 5
30 Rockefeller Plaza New York 20
Fischer and Porter Co 1-2-4-5-6-9
19 Warminster Rd Hatboro Pa
Friden Calculating Mach Co Inc 5-6
San Leandro Calif
General Electric Co 3-4-5-6-7
Computer Dept. 1103 N Central Ave Phoenix Ariz
Genisco Inc 3-7
2233 Federal Ave Los Angeles 64
Giannini & Co Inc G M 4
1307 S Myrtle Ave Monrovia Calif
Haller Raymond Brown Inc 2-4-9
124 N Atherton St State College Pa
Hall-Scott Inc 11
Electronics Div 2950 N Ontario St Burbank Calif
Hamner Electronics Co Inc 10
P O Box 531 Princeton NJ
Helipot Corp 8
Newport Calif
Hoover Electronics Co 5-6-9
3640 Woodland Ave Baltimore 15 Md
Industrial Control Co. 4-5-6
Straight Path & Arlington Ave Wyandanch NY
Industrial Electronic Eng 2-4-5-6
3973 Lankershim Blvd N Hollywood Calif
Intelligent Mach Research Corp 5-6
1101 Lee Hwy Arlington Va
IBM 5-6
590 Madison Ave New York 22 NY
International Standard Trading Corp 5-6
22 Thames St New York 6
Jacobs Instrument Co 5-6
4718 Bethesda Ave Bethesda 14 Md
Kay Electric Co 5
Maple Ave Pine Brook NJ
Kearfott Co Inc 4-5-6-8
1378 Main Ave Clifton NJ
Leeds & Northrup Co 5-6-7
4901 Stenton Ave Phila 44
Librascope Inc 1-2-4-7
133 E Santa Anita Ave Burbank Calif
Librascope Inc 1 thru 7
808 Western Ave Glendale Calif
Litton Industries 1 thru 9
336 N Foothill Rd Beverly Hills Calif
Logistics Research Inc 5-6-7
141 S Pacific Ave Redondo Beach Calif
Magnasync Mfg Co Ltd 1
5546 Satsuma Ave N Hollywood Calif
Marchant Calculators Inc 5-6
1475 Powell St Oakland 8 Calif
Mid-Century Instrumatic Corp 5-6-8
611 Broadway New York 12
Monroe Calculating Machine Co 1
Hanover Ave Morris Plains NJ
Moseley Co F L 7
409 N Fair Oaks Ave Pasadena Calif
Norden-Ketay Corp 8
Commerce Rd Stamford Conn
Newton Co 4
55 Elm St Manchester Conn
Norton Associates Inc 1
P O Box 96 Garden City NY
Northrop Aircraft Inc 7
Hawthorne Calif
Oster Mfg Co John 8
1 Main St Racine Wis
Philbrick Researches Inc G A 11
230 Congress St Boston 10 Mass
Photographic Products Inc 2-4-6-9
1000 N Olive St Anaheim Calif
Pic Design Corp 1
Div of Benrus Watch Co 477 Atlantic Ave E Rockaway NY
Polyphase Instrument Co 5-6
701 Haverford Rd Bryn Mawr Pa
Potter Instrument Co Inc 1-2-4-5-6-9
115 Cutter Mill Rd Great Neck NY
Precision Photomechanical Corp 2-4
170 S Van Brunt St Englewood NJ
Radiation Counter Labs Inc 3
5121 W Grove St Skokie Ill
Radiation Inc 4-5-7
P O Box 37 Melbourne Fla
Radio Corp of America 5-6
Front & Cooper Sts Camden NJ
Rea Co J B 1-5-6-7-8
1723 Cloverfield Blvd Santa Monica Calif
Redman Electronics Corp 10
92 Prospect St Thompsonville Conn
Reeves Instrument Corp 5-6-7-8
215 E 91st St New York 28
Remington Rand Univac 5-6-7
Div Sperry Rand Corp Univac Pk St Paul 16 Minn
Sanborn Co Industrial Div 6
Cambridge 39 Mass
Skiatron Electronics & TV Corp 2-4-6-7
180 Varick St New York 14
Soroban Eng'g Inc 2-4-5-6
Box 338 Melbourne Fla
Southwestern Indust'l Electronics 2-4-5-6
2831 Post Oak Rd Houston 19 Tex
Stavid Eng'g Inc 2-5-6-7
U S Hwy No 22 Plainfield NJ
Stromberg-Carlson 2-6-7
Box 2449 San Diego 12 Calif
Sylvania Electric Prods Inc 2-4-5-6
100 1st Ave Waltham 54 Mass
Taller & Cooper Eng'g 2-3-4-5-6-8-9
75 Front St Brooklyn 1 NY
Telecomputing Corp 5-7-8
12838 Saticoy St N Hollywood Calif
Telemeter Magnetics Inc 2-4-5-6
2245 Pontius Ave Los Angeles 64
Transicoil Corp 8
Worcester Montgomery County Pa
Ultrasonic Corp 1 thru 7
640 Memorial Dr Cambridge 39 Mass
Underwood Corp 1-5-6-10
Computer Div 35-10 36th Ave Long Island City 6 NY
United Electrodynamics 2-4-5-6
Div of United Geophysical Corp Pasadena Calif
Vectron Inc 7-8
1611 Trapelo Rd Waltham 54 Mass
Wang Laboratories Inc 2 thru 6
37 Hurley St Cambridge 41 Mass
Western Gear Corp 8
132 W Colorado Pasadena Calif
Westinghouse Electric Corp 2 thru 6
Friendship International Airport Baltimore 3 Md

CONVERTERS

Analog-to-Digital 1
Digital-to-Analog 2

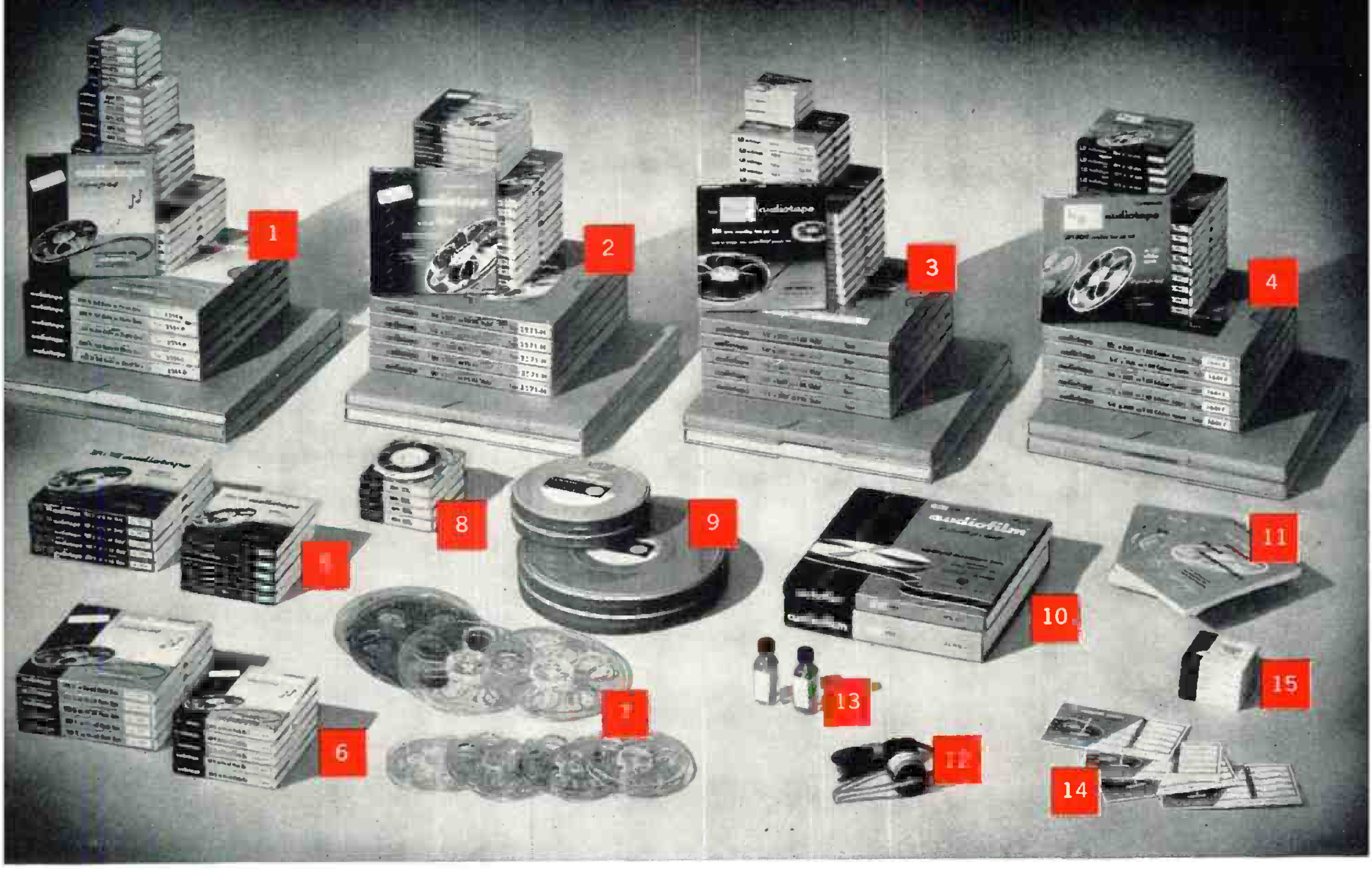
Air Associates Inc 2
511 Joyce St Orange NJ
Applied Science Corp of Princeton 1
P O Box 44 Princeton NJ
Arma Div American Bosch Arma Corp 1-2
Roosevelt Field Garden City NY
Assembly Products Inc 1
Wilson Mill Rd Chesterland O
Atomic Instrument Co. 1-2
Div Baird Assoc 33 University Rd Cambridge Mass
Austin Co Special Devices Div 1
76 9th Ave New York 11
Avion Div of ACF Ind 1-2
99 Park Pl Paramus NJ
Baldwin Piano Co 1
1801 Gilbert Ave Cincinnati 2 O
Beckman Instruments Inc 1
2500 Fullerton Rd Fullerton Calif
Beckman Instrument Inc 1-2
Berkeley Div 2200 Wright Ave Richmond 3 Calif
Bendix Aviation Corp 1-2
Pacific Div 11600 Sherman Way N Hollywood Calif
Benson-Lehner Corp 1-2
11930 W Olympic Blvd Los Angeles 64
Bergen Labs 1
247 Crooks Ave Clifton NJ
BJ Electronics 2
Div Borg-Warner Corp P O Box 1679
3300 Newport Blvd Santa Ana Calif
Bristol Co 1
P O Box 1790 EITT Waterbury 20 Conn
Burroughs Corp 1-2
6071 2nd Ave Detroit 32 Mich
Coleman Engineering Co 1-2
6040 W Jefferson Blvd Los Angeles 16
Computer Instrument Corp 1
92 Madison Ave Hempstead LI NY
Computing Devices of Canada Ltd 1-2
P O Box 508 Ottawa 4 Ontario Canada
Consolidated Electrodynamics Corp 1
300 N Sierra Madre Villa Pasadena Calif
Cubic Corp 1-2
5575 Kearny Villa Rd San Diego 11 Calif
Dalmo Victor Co 1-2
1515 Industrial Way Belmont Calif
Daystrom Instrument 1
Div of Daystrom Inc Archbald Pa
Devol Research Co 1-2
Brookside Dr Greenwich Conn
Eclipse-Pioneer Div 1-2
Bendix Aviation Corp Teterboro NJ
Electro Instruments Inc 1
3794 Rosecrans San Diego 10 Calif
Electronic Computer Co 1
6191 Ridge Ave Phila 28
Electronics Corp of America 1
1 Memorial Dr Cambridge 42 Mass
Epsco Inc 1-2
588 Commonwealth Ave Boston 15 Mass
Ferranti Electric Inc 1-2
30 Rockefeller Plaza New York 20
Fischer and Porter Co 1-2
19 Warminster Rd Hatboro Pa
Franklin Electronics Inc 1
E 4th St Bridgeport Pa
General Electric Co 2
Computer Dept 1103 N Central Ave Phoenix Ariz
General Electric Co 1-2
Electronic Pk Syracuse NY
Genisco Inc 1
2233 Federal Ave Los Angeles 64
Gilmore Industries Inc 1-2
5713 Euclid Ave Cleveland 5
Giannini & Co Inc G M 1-2
1307 S Myrtle Ave Monrovia Calif
Gurley W & L E 1
514 Fulton St Troy NY
Haller Raymond Brown Inc 1
124 N Atherton St State College Pa
Hoover Electronics Co 1-2
3640 Woodland Ave Baltimore 15 Md
Hughes Aircraft Co 1-2
Culver City Calif
Industrial Electronic Eng 1-2
3973 Lankershim Blvd N Hollywood Calif
Jacobs Instrument Co 1-2
4718 Bethesda Ave Bethesda 14 Md
Kearfott Co Inc 1-2
1378 Main Ave Clifton NJ
Kybeonetes Corp 1
9 E 40 St New York 16
Laboratory for Electronics Inc 1
75 Pitts St Boston 14 Mass

(Continued on page 85)

now you can meet every tape recording need

with this COMPLETE audiotape LINE

TRADE MARK



1. PLASTIC-BASE AUDIOTAPE on 1½-mil cellulose acetate meets the most exacting requirements of the professional, educational and home recordist at minimum cost. Known the world over for matchless performance and consistent uniform quality. Series 51, in the red box.

2. AUDIOTAPE ON 1½-MIL MYLAR* — a premium-quality professional tape with maximum mechanical strength and immunity to heat and humidity. Will not dry out or embrittle with age. Series 71, in the green box.

3. "LR" AUDIOTAPE ON 1-MIL "MYLAR" — 50% more recording time per reel. Strong, super-durable polyester film base assures trouble-free operation even under extreme heat and humidity. Series 61, in the black and red box.

4. PLASTIC-BASE "LR" AUDIOTAPE provides 50% more recording time on low-cost 1-mil cellulose acetate base, affording maximum economy where high strength is not required. Series 41, in the blue box.

5. SUPER-THIN AUDIOTAPE on ½-mil "Mylar" gives twice as much recording time per reel as standard plastic-base tape. For long-play applications where tape tension is not excessive. Series 31, in the yellow box.

6. COLORED AUDIOTAPE on green or blue 1½-mil plastic base provides fast, easy color cueing and color coding, at no extra cost.

7. COLORED AUDIOTAPE REELS — 7″ and 5″ reels in jewel-tone colors — red, yellow, green and blue — for color coding, at no extra cost.

8. HEAD ALIGNING TAPE pre-recorded with precise head alignment, giving a highly accurate reference for aligning recording heads.

9. TYPE "EP" AUDIOTAPE provides extra precision and guaranteed freedom from defects, for computers, telemetering and high-speed magnetic data recording.

10. AUDIOFILM extends Audiotape's unsurpassed sound quality to motion picture and TV film recording. Available in 35mm, 17½mm and 16mm sizes.

11. "HOW TO MAKE GOOD TAPE RECORDINGS" The complete handbook of tape recording, containing 150 pages of up-to-the-minute information of practical value to every tape recordist. $1.50 paper bound, $2.50 cloth bound.

12. AUDIO HEAD DEMAGNETIZER removes all permanent magnetism from recording and reproducing heads in a matter of seconds.

13. AUDIO HEAD CLEANER, especially formulated for use on magnetic recording heads — superior to carbon tetrachloride.

14. ADHESIVE REEL LABELS provide positive identification of your tapes right on the reel. Press to apply, pull off to remove.

15. AUDIO SELF-TIMING LEADER TAPE A strong, durable leader tape of white "Mylar" with spaced markings for precise timing of leader intervals.

New 5-Reel Cellophane Package

gives *extra protection* against dust and dirt — keeps tape and boxes factory fresh.

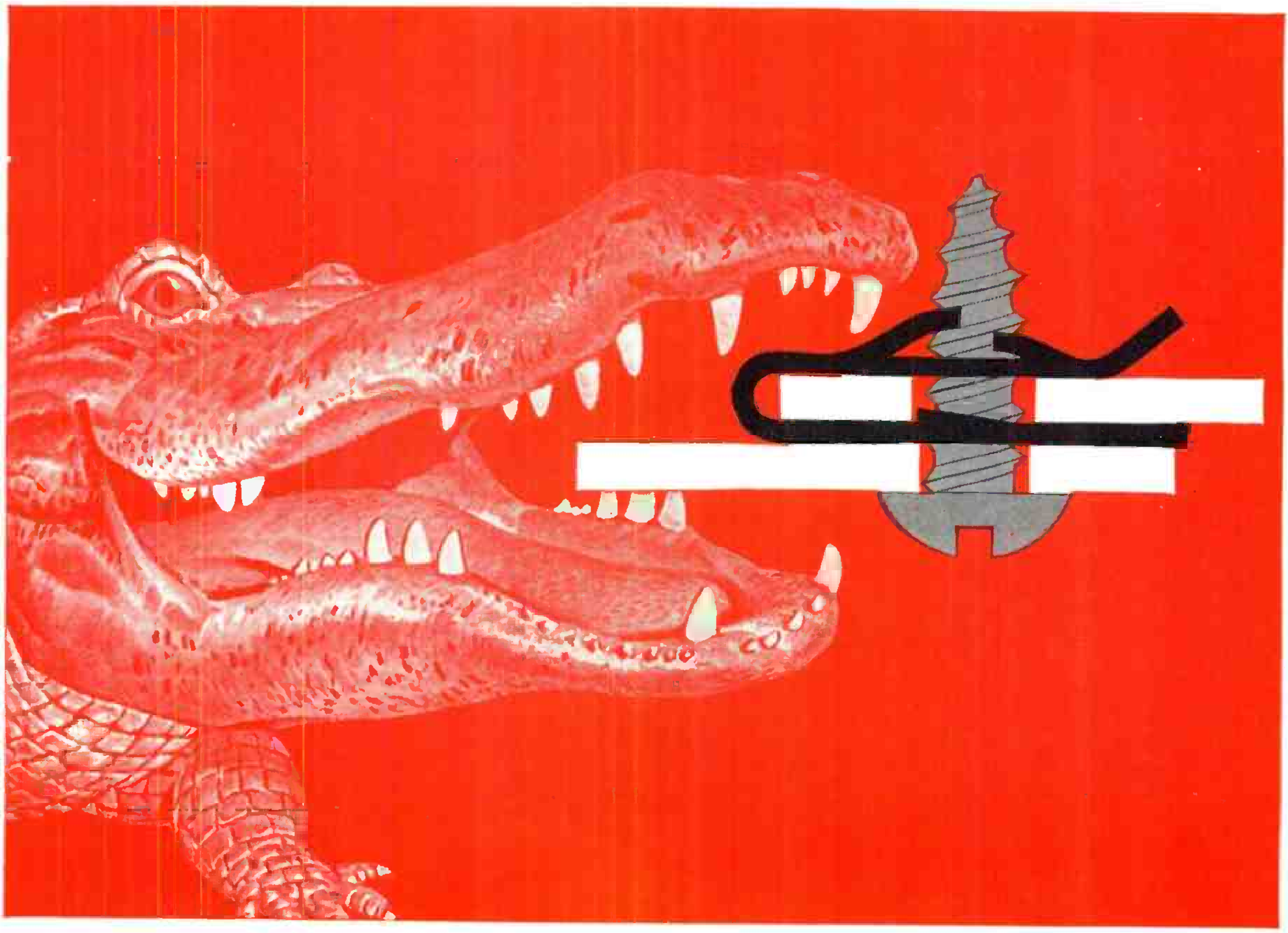
Ask your dealer for genuine, professional-quality Audiotape ... it now costs no more than ordinary tape!

AUDIO DEVICES, Inc.

444 Madison Avenue, New York 22, N.Y.

Offices in Hollywood — Chicago   Export Dept., 13 E. 40th St., New York, N.Y.

*DuPont Trade Mark



STEEL JAWS THAT NEVER RELAX

fasten a fastener in place

Alligator jaws have nothing on Tinnerman "U" and "J" type fasteners in gripping power. These fasteners press easily into locked-on position over panel edge or center panel locations. Yet they provide positive self-retention, ending the need for welding, staking or other secondary fastening devices. They are ideally suited for blind assembly or hard-to-reach locations.

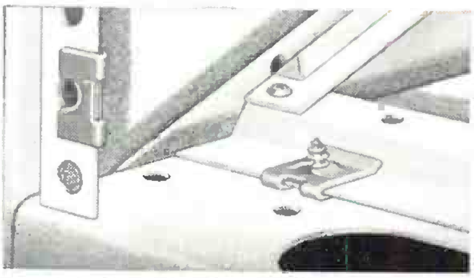
When combined with the familiar Tinnerman SPEED NUT, this unique fastening principle provides a one-piece, self-locking, self-retaining fastener that is fast and easy to apply. The "U" or "J" feature can be combined with wire and tube retainers, latches, catches and a host of other fastening requirements to save time, material and production costs.

Find out about these and more than 8,000 other types of SPEED NUT brand fasteners now serving industry all around the world. They can make important savings for you, can also simplify your assemblies. See your Tinnerman representative soon or write to us. **Tinnerman Products, Inc., Box 6688, Dept. 12, Cleveland 1, Ohio.**

TINNERMAN

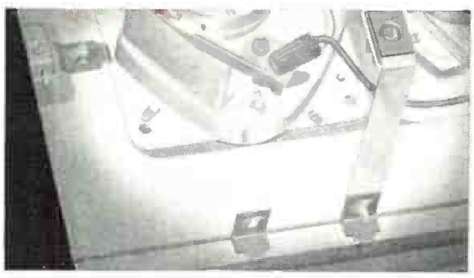
Speed Nuts®

FASTEST THING IN FASTENINGS®



Greater flexibility for control equipment enclosures is provided by self-retaining "J" type SPEED NUTS at 30% less production cost.

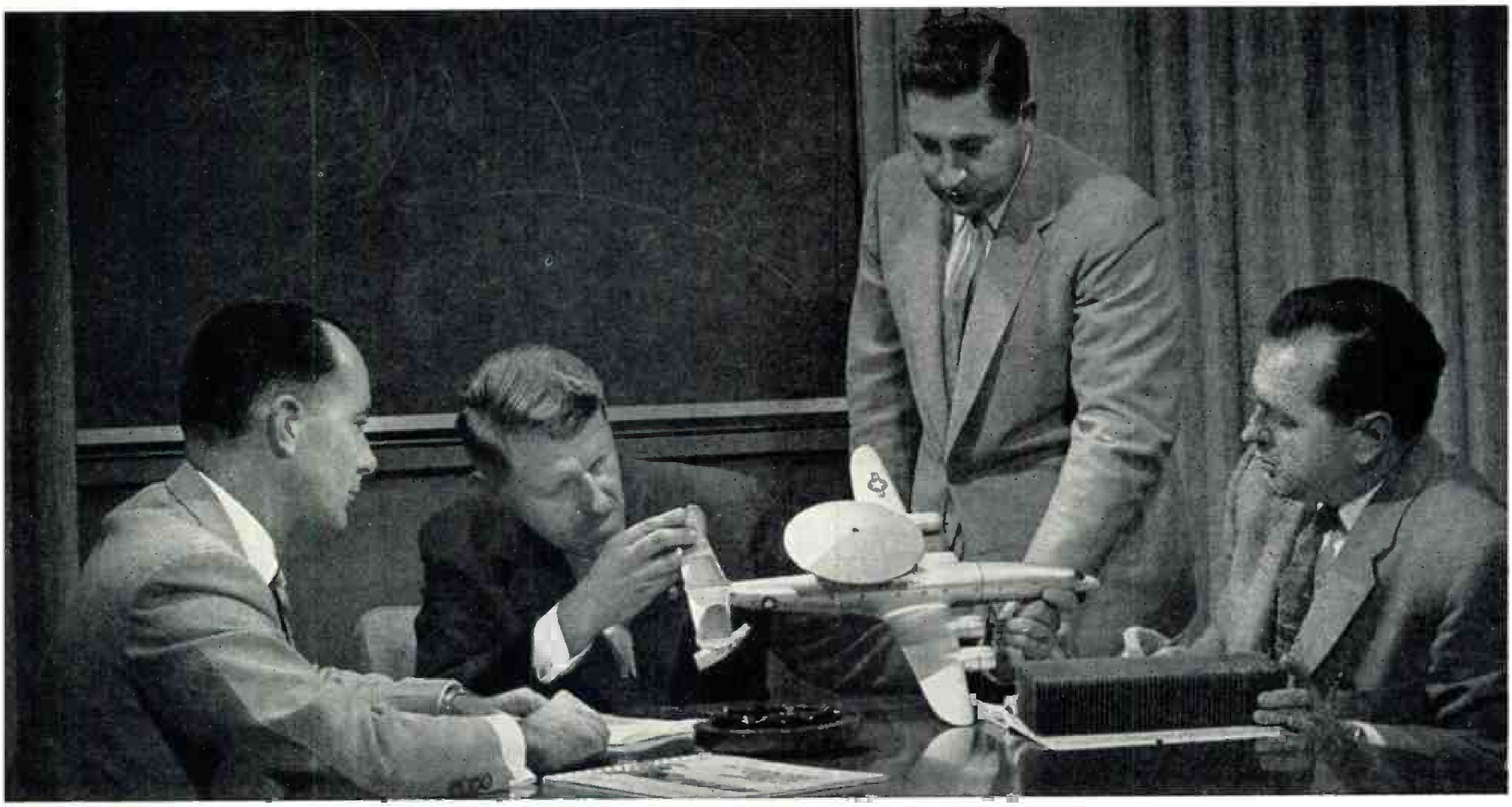
Assembly costs on this sheet-metal skylight frame are reduced 66% by Tinnerman "U" type SPEED NUTS.



Gas range assembly costs are reduced 25% to 50% by using Tinnerman "U" and "J" type SPEED NUTS.

For product information, use inquiry card on page 105.

Henry Rempt (second from left), head of the Electronics and Armament Systems Division, discusses problems inherent in the application of large electronic sensing devices to aircraft with David Morrissey, A.E.W. Systems Specialist, Harold Held, Data Links Specialist in the Advanced Techniques Group, and Nelson Harnois, head of the Electronics and Armament Systems Engineering Department.



Lockheed expands electronics division

■ To keep pace with its ever-increasing emphasis on electronics, Lockheed has expanded and centralized research and development activities under the Electronics and Armament Systems Division. The Division is under the direction of Henry Rempt.

Responsibilities of the Division include originating and developing complex electronics and armament systems for all new Lockheed aircraft.

A number of technical management positions for Electronics Systems Engineers has been created. The positions will appeal particularly to those who seek an extremely wide range of assignments.

Technical management positions are open in fields of:

Fire control, countermeasures, inertial systems, weapons, communications, infra-red, optics, sonics, magnetics, antennas and micro-waves.

Under Lockheed's philosophy of operation, Electronics Systems Engineers supervise and participate in conceiving advanced systems and then performing research, development and evaluation up to production stages on all Lockheed aircraft – radar search planes, high-speed fighters, cargo and passenger transports, bombers, jet trainers.

Electronics Engineers possessing experience or keen interest in systems activities are invited to write E. W. Des Lauriers. Dept. ED-29-12.

California Division

LOCKHEED

AIRCRAFT CORPORATION • BURBANK

CALIFORNIA

Computer Directory

(*Continued from page 81*)

Leeds & Northrup Co 1
4901 Stenton Ave Phila 44

Librascope Inc 1-2
133 E Santa Anita Ave Burbank Calif

Librascope Inc 1-2
808 Western Ave Glendale Calif

Litton Industries 1-2
336 N Foothill Rd Beverly Hills Calif

Macleod & Hanopol Inc 1
10 Roland St Charlestown 29 Mass

Metrotype Corp 1-2
104 E St Michigan City Ind

Moseley Co F L 1
409 N Fair Oaks Ave Pasadena Calif

Newton Co 1-2
55 Elm St Manchester Conn

Norden-Ketay Corp 1
Commerce Rd Stamford Conn

Northrop Aircraft Inc 1-2
Hathorne Calif

Photographic Products Inc 1-2
1000 N Olive St Anaheim Calif

Potter Instrument Co Inc 1
115 Cutter Mill Rd Great Neck NY

Radiation Counter Labs Inc 1
5121 W Grove St Skokie Ill

Radiation Inc 1-2
P O Box 37 Melbourne Fla

Rea Co J B 1-2
1723 Cloverfield Blvd Santa Monica Calif

Skiatron Electronics & TV Corp 2
180 Varick St New York 14

Southwestern Indust'l Electronics Co 1-2
2831 Post Oak Rd Houston 19 Tex

Stavid Eng'g Inc 1
U S Hwy No 22 Plainfield NJ

Sterling Precision Corp 1
34-17 Lawrence St Flushing 1 NY

Stromberg-Carlson 1-2
Box 2449 San Diego 12 Calif

Sylvania Electric Prods Inc 1-2
100 1st Ave Waltham 54 Mass

Taller & Cooper Eng'g 1-2
75 Front St Brooklyn 1 NY

Telecomputing Corp 1
12838 Saticoy St N Hollywood Calif

Telemeter Magnetics Inc 1-2
2245 Pontius Ave W Los Angeles 64

Ultrasonic Corp 2
640 Memorial Dr Cambridge 39 Mass

United Electrodynamics 2
Div of United Geophysical Corp
Pasadena Calif

Wang Laboratories Inc 1-2
37 Hurley St Cambridge 41 Mass

Westinghouse Electric Corp 1-2
Friendship International Airport Baltimore 3 Md

DATA RECORDERS

Analog 1
Digital 2

Air Associates Inc 2
511 Joyce St Orange NJ

American Electronics Inc 1-2
655 W Washington Blvd Los Angeles 15

Ampex Corp 1-2
934 Charter St Redwood City Calif

Analogue Controls Inc 1
39 Roselle St Mineola NY

Applied Science Corp of Princeton 1
P O Box 44 Princeton NJ

Atomic Instrument Co 2
Div Baird Assoc 33 University Rd
Cambridge Mass

Austin Co Special Devices Div 1-2
76 9th Ave New York 11

Automation Corp of America 2
5546 Satsuma Ave N Hollywood Calif

Avion Div of ACF Ind 1
99 Park Pl Paramus NJ

Beckman Instrument Inc 1-2
Berkeley Div 2200 Wright Ave Richmond 3 Calif

Beckman Instruments Inc 2
2500 Fullerton Rd Fullerton Calif

BJ Electronics 2
Div Borg-Warner Corp P O Box 1679
3300 Newport Blvd Santa Ana Calif

Bristol Co 1
P O Box 1790 EITT Waterbury 20 Conn

Burroughs Corp 1-2
6071 2nd Ave Detroit 32 Mich

Coleman Eng Co Inc 2
6040 W Jefferson Blvd Los Angeles 16

Consolidated Electrodynamics Corp 1-2
300 N Sierra Madre Villa Pasadena Calif

Dalmo Victor Co 1-2
1515 Industrial Way Belmont Calif

Davies Labs 1-2
10721 Hanna St Beltsville Md

The deFlorez Co 1
116 E 30th St New York 16

Devol Research Co 2
Brookside Dr Greenwich Conn

Electro Instruments Inc 1-2
3794 Rosecrans San Diego 10 Calif

Electronics Associates Inc 1
Long Branch & Naberal Ave Long Branch NJ

Electronic Tube Corp 2
1200 E Mermaid Lane Phila 17

Epsco Inc 2
588 Commonwealth Ave Boston 15 Mass

Fischer and Porter Co 1-2
19 Warminster Rd Hatboro Pa

Geotechnical Corp 1
3712 Haggar Dr Dallas 9 Tex

Giannini & Co Inc G M 2
1307 S MyrtleAve Monrovia Calif

Heiland Div of Minneapolis Honeywell 1
5200 E Evans Ave Denver 22 Colo

Industrial Electronics Eng 2
3973 Lankershim Blvd N Hollywood Calif

International Business Mach Corp 2
590 Madison Ave New York 22

Laboratory for Electronics Inc 2
75 Pitts St Boston 14 Mass

Leeds & Northrup Co 1
4901 Stenton Ave Phila 44

Librascope Inc 1-2
808 Western Ave Glendale Calif

Litton Industries 1-2
336 N Foothill Rd Beverly Hills Calif

Logistics Research Inc 2
141 S Pacific Ave Redondo Beach Calif

Magnasync Mfg Co Ltd 1-2
5546 Satsuma Ave N Hollywood Calif

Marchant Calculators Inc 2
1475 Powell St Oakland 8 Calif

Metrotype Corp 1-2
104 E St Michigan City Ind

Mid-Century Instrumatic Corp 1-2
611 Broadway New York 12

Midwestern Instruments 1
41 & Sheridan Rd P O Box 7186 Tulsa Okla

Mountain Systems Inc 1-2
864 Franklin Ave Thornwood NY

Northrop Aircraft Inc 1-2
Hathorne Calif

Potter Instrument Co Inc 2
115 Cutter Mill Rd Great Neck NY

Radiation Inc 1-2
P O Box 37 Melbourne Fla

Rea Co Inc J B 2
1723 Cloverfield Blvd Santa Monica Calif

Reeves Instrument Corp 1
215 E 91st St New York 28

Remington Rand Univac 2
Div Sperry Rand Corp Univac Pk St Paul 16 Minn

Skiatron Electronics & TV Corp 1-2
180 Varick St New York 14

Stavid Eng'g Inc 2
U S Hwy No 22 Plainfield NJ

Stromberg-Carlson 1-2
Box 2449 San Diego 12 Calif

Taller & Cooper Eng'g 2
75 Front St Brooklyn 1 NY

Telecomputing Corp 2
12838 Saticoy St N Hollywood Calif

Telemeter Magnetics Inc 2
2245 Pontius Ave W Los Angeles 64

Ultrasonic Corp 1-2
640 Memorial Dr Cambridge 39 Mass

United Electrodynamics 1-2
Div of United Geophysical Corp
Pasadena Calif

Victor Adding Machine Co 2
3900 N Rockwell St Chicago 18

Wang Laboratories Inc 2
37 Hurley St Cambridge 41 Mass

MEMORY

Crystal 1
Drums 2
Multi-Core Magnetic 3
Tape Loop 4
Tubes 5
Matrix Assemblies 6

Affton Industries 4
8300 Flex-o-lit Dr St Louis 23 Mo

Airborne Instrument Lab Inc 5
160 Old Country Rd Mineola NY

Air Associates Inc 5
511 Joyce St Orange NJ

Alden Products Co 3
12123 N Main St Brockton 64 Mass

Ampex Corp 4
934 Charter St Redwood City Calif

Arma Div American Bosch Arma Corp 1-10
Roosevelt Field Garden City NY

Arnold Eng'g Co 3
P O Box G Marengo Ill

Automation Corp of America 2-4
5546 Satsuma Ave N Hollywood Calif

Avion Div ACF Ind 3
99 Park Pl Paramus NJ

(*Continued on page 118*)

News of Reps

Reps Wanted: Established national mfr. seeks technical sales representation in midwest, northeast and New England areas for **high quality custom designed transformers, voltage regulators, power supplies, high voltage test sets and reactors. R-12-1.**

M. Clifford Agress appointed to represent General Transformer Co., Homewood, Ill., for military and commercial transformers in New England.

Three reps named for Astron Corp., Newark, N. J., and its subsidiary, Skottie Electronics, Inc., and Astron Sales Corp.: **Bill Kolans & Co.,** 3589 20th St., San Francisco 10, for No. Calif.; **Robert G. Moye Co.** for So. Calif.; and **George E. Anderson Co.,** 1901 Griffin St., Dallas, for La. and Texas.

Technical Instruments, Inc., 971 Main St., Waltham, Mass., appointed sales reps for Polytechnic Research & Development Co., Inc., 202 Tillary St., Brooklyn 1; **Gawler-Knoop Co.,** Roseland, N. J., named reps for Greater N. Y. and Middle Atlantic States by PRD.

Dave Kubrick Co. and Sam Yurman functioning as **Kubrick-Yurman Co.,** Suite 1606, 200 W. 34th St., New York 1.

Basic Service Corp., 16544 Plymouth Rd., Detroit 27, named sales rep for Michigan by General Control Co., Boston.

Koehler-Pasmor Co., 11833 Hamilton, Detroit 3, announced: Richard **Streng** joined staff for electronic distributor sales; and, rep has been named by Dialight Corp., Brooklyn, to cover Michigan.

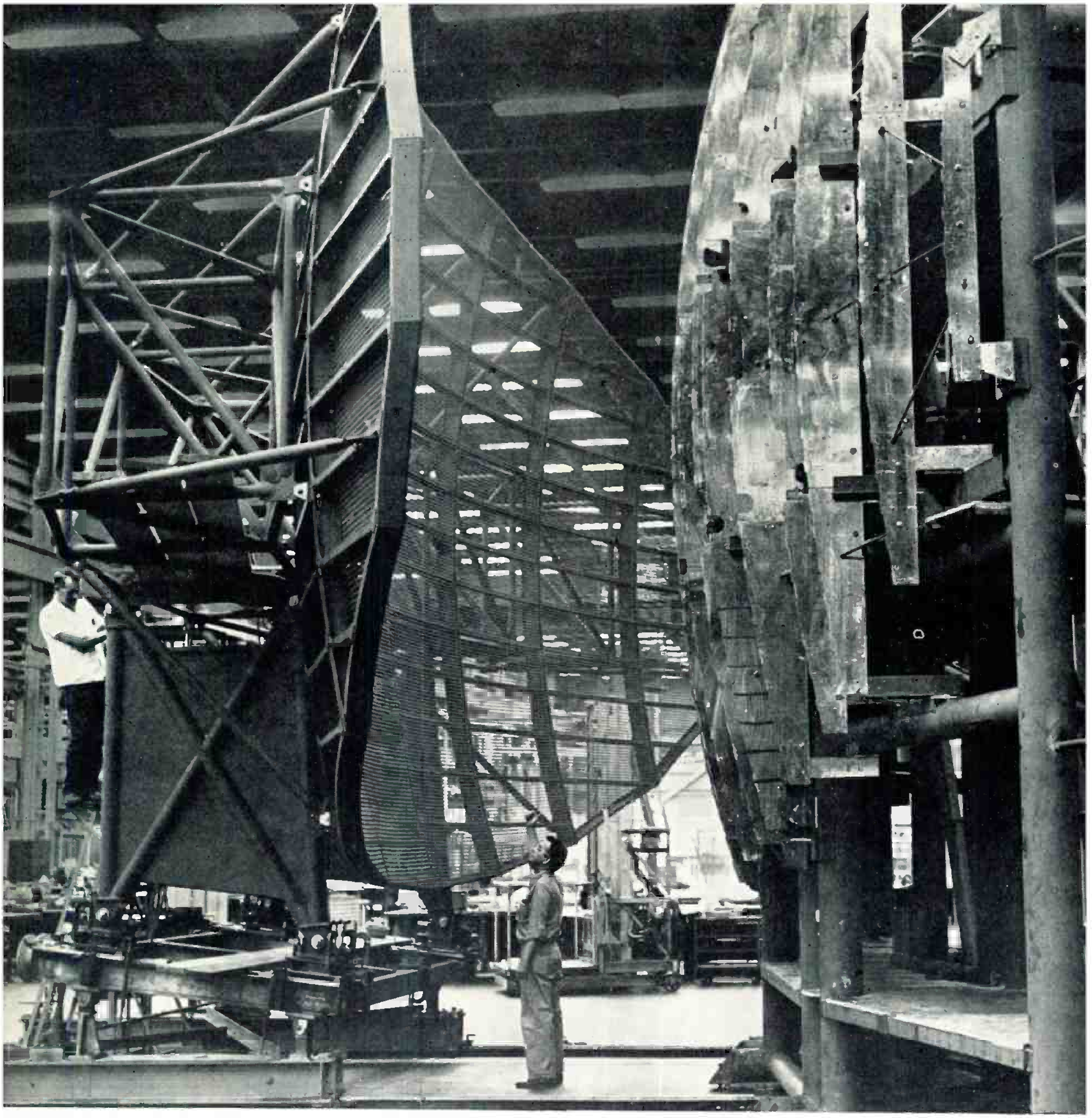
R. C. Whitmore & Associates, 605 N. Michigan, Chicago, appointed reps by United Transformer Co., New York, for Chicago and Northern Illinois.

Sales Engineering Co., Chelmsford, Mass., and Bridgeport, Conn., named reps for New England by Sealectro Corp., Mamaroneck, N. Y., which also appointed **Anderson & Associates,** 3825 York Ave., No. Minneapolis, as reps for Minnesota.

Carmine-Paden Associates, Box 569, Jefferson City, Mo., is successor to Ward Paden Co., as Carmine A. Vignola becomes firm member. Rep operates in Missouri, Kansas, Iowa, Nebraska and So. Illinois.

Koessler Sales Co., Los Angeles and San Francisco, moves to new quarters: 818 No. Fairfax Ave., Los Angeles 46—phone OLive 3-1605.

For product information, use inquiry card on page 105.



PRECISION JIG (RIGHT) GAGES ACCURACY OF HUGE ANTENNA SURFACE TO 1/100 OF AN INCH—PROOF THAT LARGE OR SMALL . . .

General Electric Antennas Are Engineered to Give Your Radar System Top Reliability and Accuracy

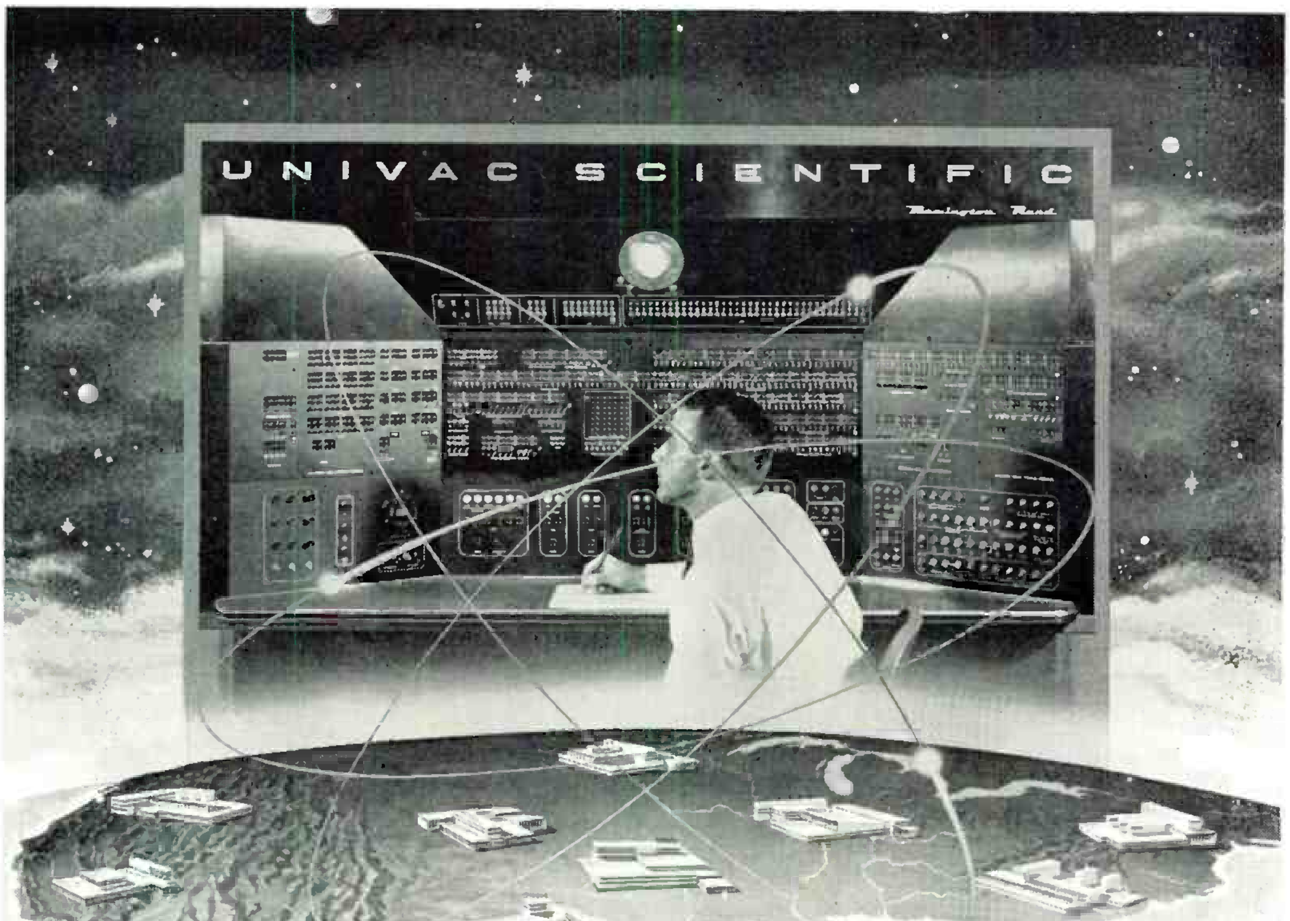
Backed by more than two decades of experience and proven reliability, General Electric antennas are thoroughly engineered to your specific needs.

Whether your radar system calls for extensive research and development—for component manufacturing—or simply for production of your antenna design, G.E.'s advanced facilities and intensive engineering programs are your assurance of the finest antenna work available!

Examine *your* antenna needs, now. Large or small, simple or complex—General Electric engineering can answer them. Simply contact your local G-E Apparatus Sales Office. An antenna specialist will be glad to give you specific information. General Electric Co., Section 223-6, Schenectady, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Challenge: Help develop the first electronic control center for a nationwide network of automated factories

Think of it . . . Completely automatic factories, hundreds of miles apart, all operated by a single Remington Rand Univac® computing system. Flow of materials, processing, quality control, packaging, even market analysis, controlled from the electronic "brain center" . . . control so complete that when a shift in the wind changes the draft of a chimney at a distant plant, the computer corrects the firing of a boiler.

Far fetched? Not at Univac. The Univac team of scientists, engineers and technicians has already designed the completely automatic factory. They have built a computer (Univac Scientific) capable of remote control of ten to a hundred factories. The next step—central control of chains of automated plants—will completely revolutionize American industry.

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 For product information, use inquiry card on page 105.

New Tech Data

Core Tester

Illustrated bulletin describes the BCT 301 Core Tester and key components. Five sections of tester are discussed by manufacturer, Burroughs Corp. Electronics Instruments Div., Philadelphia. (Ask for B-12-1)

DC Power Supplies

Pre-punched to fit standard 3-ring binders, this four-page bulletin from Sola Electric Co., Chicago, describes the DC Solavolt adjustable-output, constant voltage DC power supply. Material is illustrated and gives specs and features. (Ask for B-12-2)

Radiation Shielding Windows

Twelve-page general information bulletin on radiation shielding windows offered by Corning Glass Works, Corning, N. Y. Bulletin No. PE-51, includes charts, graphs and sketches to explain various characteristics. (Ask for B-12-3)

Balanced Mixers

Catalog C-756, issued by Microwave Development Labs, Inc., Wellesley, Mass., is a 12-page illustrated publication covering balanced mixers and mixer elements in detail. (Ask for B-12-4)

Quartz Crystals

General background of Midland Mfg. Co., Kansas City, Kan., is included in illustrated brochure which lists conventional crystals, "Midland Miniature" crystals, color TV crystals and other types. Material includes spec chart and necessary details. (Ask for B-12-5)

Tubes for Computers

Specs and applications of tubes and semiconductors designed for computers are in a 64-page publication of Sylvania Electric Products, Inc., New York. Volume defines firm's philosophy on tube manufacture and its theories on transistor parameters as required for computer applications. (Ask for B-12-6)

Vacuum Tubes

All Eimac production vacuum tubes and accessories are listed in 12-page Quick Reference Catalog provided by Eitel-McCullough, Inc., San Bruno, Calif. Tentative data sheet and two brochures describing 4CX300A ceramic power tetrode also available. (Ask for B-12-7)

Data Processing System

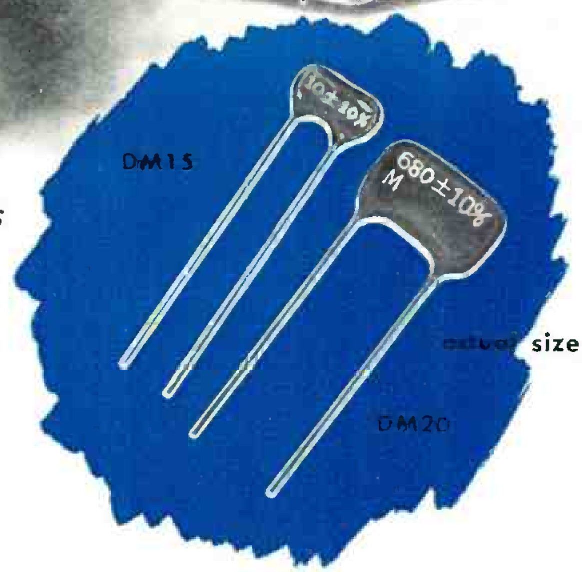
New Developments: ELECOM 125 System is title of new data sheet issued by Underwood Corp. Electronic Computer Div., Long Island City, N. Y. Material describes operations and characteristics and is illustrated. (Ask for B-12-8)

Radiography Data

Norelco X-Ray for Industry is title of 12-page booklet with illustrations and charts, plus operating and application data, on six different types of radiography units. Information also included on industrial image intensifier and closed-circuit TV installations. From North American Philips Co., Inc., Mount Vernon, N. Y. (Ask for B-12-11)

ELECTRONIC INDUSTRIES' readers can obtain copies of desired literature by filling in key numbers of indivdiual items on Inquiry Card Page 105.

These EL-MENCO Dur-Mica Capacitors will still be on the job!



In rigid life tests in which the applied voltage was 1½ times rated voltage and the ambient temperature was 125° centigrade, El-Menco DM-15, DM-20 and DM-30 capacitors out-distanced all normal ratings with each lasting over 10,000 hours. Because of the acceleration of these tests, the life of these capacitors may be equivalent to 15 years or more under normal operating conditions.

New, toughened phenolic casing prolongs life, increases stability over wide temperature range. Made to meet environmental and electrical requirements of RETMA and MIL-C-5 specs. Parallel leads simplify use in television, computors, miniature printed circuits, guided missiles, and countless civilian and military applications.

El-Menco Dur-Mica DM15, DM20, and DM30 Capacitors Assure:

1. Longer Life
2. Potent Power
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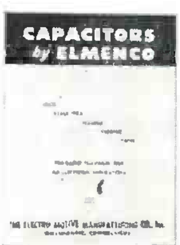
We'll be glad to advise you on your specific needs. Put El-Menco Dur-Mica Capacitors to your own tests. See for yourself.



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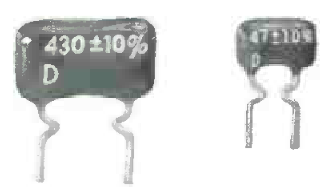

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For product information, use inquiry card on page 105.

Reading and Writing

(Continued from page 40)

ing this amount, but the two most common are:

1—The number of Bits—A bit is a binary digit and in this case refers to the number of spots that can be magnetized on a given drum in a given system.

2—The Number of Words—Information is usually handled in groups.

Channel Size

The narrow section of the drum controlled by one read-write head is called a Track or Channel. The number of spots that can be magnetized on one track in a given system is called the Track Size.

The capacities of our imaginary drum are:

Drum Size	8½ in.
Number System	Binary
Number of Words	512
Number of Bits	
Number of Data Channels	8
Channel Size	2048 Bits / 64 Words

Data Band

The left tracks in the diagram refer to the Data Band. In this section of the drum, the information can be changed, and the heads perform both the functions of reading and writing.

Address Band

The right tracks indicate the Address Band in which the information is fixed and the heads only perform the function of reading.

T Track

The track on the chart marked T contains 2048 evenly spaced, permanently recorded, magnetized spots each representing a "1." The purposes of the T Track are:

1—It furnishes the basic timing pulses for the entire system.

2—It is a reference point for reading and writing information. In other words, the signal to read or write a particular bit is always given in conjunction with a pulse on the T Track so that the read-write head will be activated at the proper time and assure proper spacing.

B Track

The B or Bracket Track usually

(Continued on page 96)

DESTINATION:

PEACE!

Heart of a new weapon system in America's inventory of counter-measures that guard the peace is an IBM airborne computer — specially designed to guide America's most powerful bombers with unbelievable precision.

To build *complete systems reliability* into this airborne computer, IBM submits the finest available components to tests of torturing extremes. Only those that survive are used. But, from this test data, IBM electronic computers figure ways to improve the failures and make those selected even better. In this way, IBM helps strengthen the general reliability of all electronic systems, and give to America's airborne defenders a mighty—and dependable —weapon for guarding the peace.

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WRITE, giving details of background and interests, to: R. A. Whitehorne, Room 4612, International Business Machines Corporation, 590 Madison Avenue, New York 22, N. Y.

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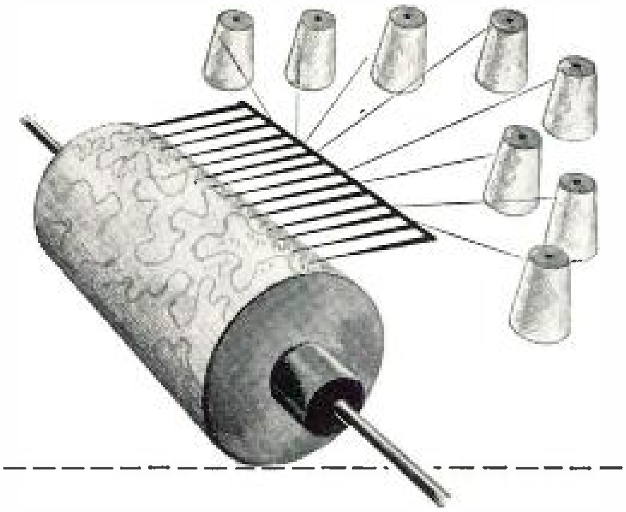
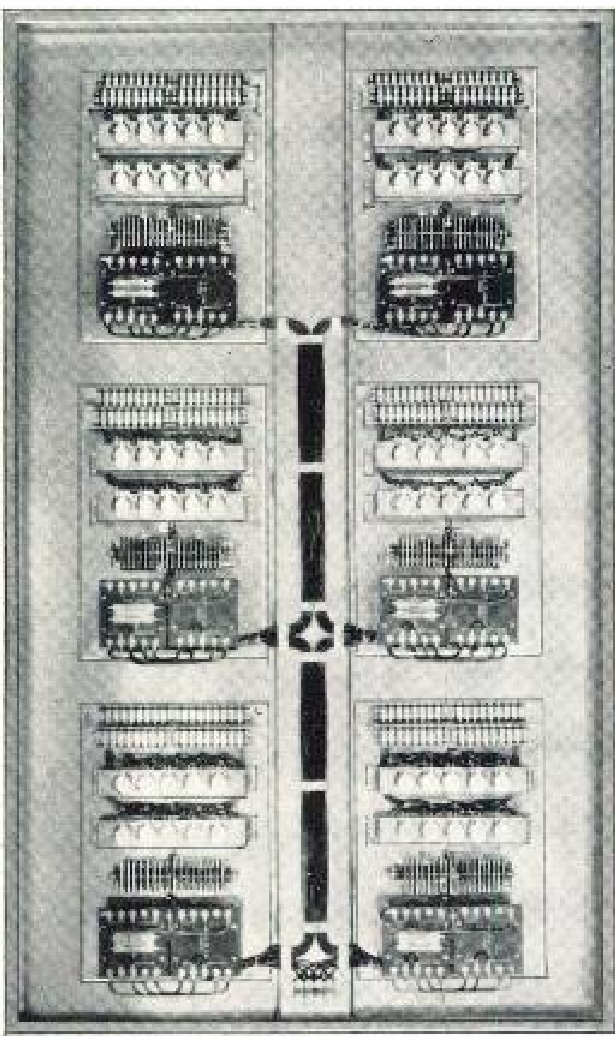
WARNER ELECTRIC BRAKE & CLUTCH CO.

"puts the finger" on automatic rug machinery with the aid of



RADIO RECEPTOR SELENIUM RECTIFIERS



Guiding the 120 electric clutches that act as automated fingers in a new rug tufting machine is a Warner control panel whose key components are six Radio Receptor rectifiers. These fingers "feel" the rug pattern on a revolving roll, send information to the control station from which actuating impulses are relayed to clutches controlling yarn feed.

A Radio Receptor customer for many years, Warner Electric Brake & Clutch Co. utilizes RRco. selenium rectifiers in this application and many others because long experience has proved they can depend upon them for continuous and heavy duty, without fear of costly breakdowns.

If you have a problem in rectification, do as many fine companies do in the United States and throughout the world — Specify RRco. selenium rectifiers. Millions are in service in almost every possible type of circuit. Would you like our most recent literature? Please write section T-11.

Semiconductor Division

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Midland answered by making frequency control crystals both smaller **and better.** Today there's a Midland miniature for every crystal need . . . doing the same kind of dependable job that made Midland's conventional-size units first choice in two-way communications throughout the world.

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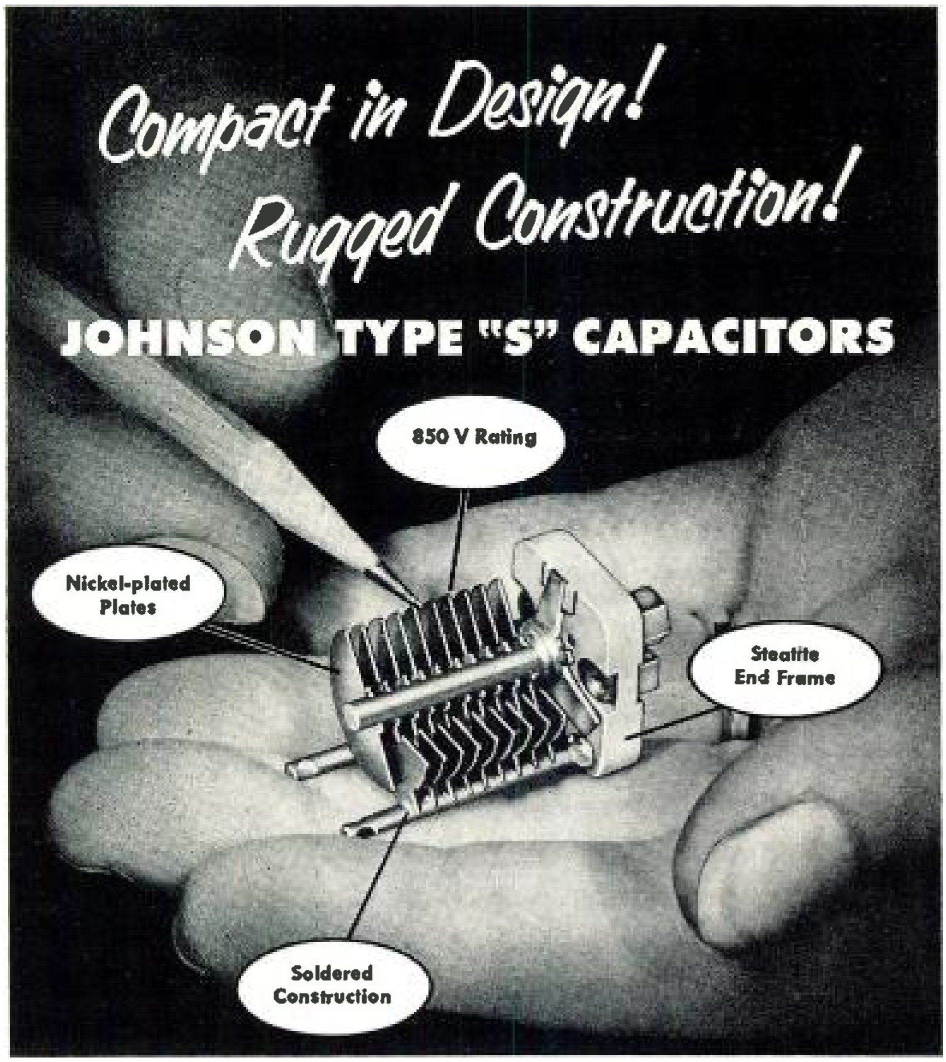
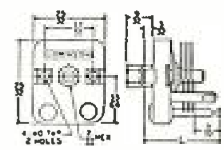




(*Continued from page* 92)

contains two pulses although sometimes one is sufficient. These pulses are called the B_1 pulse and the B_2 pulse. Their uses are as follows:

1—In order to eliminate the difficulties involved in dividing the circumference of the drum exactly into the number of pulses on the T Track (in this case 2048) it is sometimes convenient to space these pulses so that they do not completely fill a track. A B_1 pulse is written on the B Track so that it occurs just a little before the first T pulse and a B_2 pulse is written so that it occurs shortly after the last T pulse.

2—The B_2 pulse acts as a bench mark. It indicates the end of the track.

W Track

We have seen how it is possible by means of the T Track to control the writing of pulses so that we know where the pulses occur. The next thing to control, since we are writing Words, is the general location of a word, that is, how do we know where a word begins? This is accomplished by means of the W track. The W track has 64 evenly spaced pulses permanently written on it. These W pulses spaced 32 bits apart are used:

1—To mark the beginning of words.

2—To act as address markers in certain systems (one such system will be described below).

Selecting the Head

In our system the 3 most significant digits of the address refer to the channel. Three flip-flops, corresponding to these 3 bits, control 8 gates to allow the pulses from the proper amplifier through.

Word Selection

The common methods are:

1—Counting W Pulses. Since there is a W Pulse to indicate the beginning position of each of the 64 words it is necessary only to count the W Pulses to locate the word we want.

2—Address Comparison. This method gives a unique identification to each of the 64 positions

(*Continued on page* 98)

New Phelps Dodge Development

Foamflex coaxial cable—a companion of Styroflex and Spirafil coaxial cables—is the latest addition by Phelps Dodge to its unique line of semi-flexible, aluminum sheathed, communication cables.

This new low-loss, radiation-free cable is particularly adapted to use in community antenna systems, signal circuits and aviation communications, including both airborne and ground installations.

Foamflex coaxial cable has a number of outstanding advantages. These include *lighter weight*, longer cable life and improved operating characteristics over solid dielectric (RG) types of cables, with good frequency response over wide temperature variations.

★ ★ ★

Foamflex is available in 50 ohm and 70 ohm impedances. When intended for underground duct or direct burial installations and submarine applications, a Habirlene (polyethylene) jacket is supplied for corrosion protection.

A special bulletin describing Foamflex coaxial cable will be supplied upon request. Write Dept. HF3.

PHELPS DODGE COPPER PRODUCTS
CORPORATION

300 PARK AVENUE, NEW YORK 22, N. Y.

(Continued from page 96)
around the perimeter of the drum.

The address track consists of 64 groups of pulses permanently written on the drum. Each of these groups contains a different arrangement of 6 bits representing the numbers from 0 through 63. A group is written on the address track so that the first bit of the group occurs slightly after a W Pulse.

When the W Pulse is read, it sets a flip-flop (call it FF A) which allows the bits in the address group to be compared, bit by bit, to the address desired. Whenever there is a difference, a flip-flop (call it FF B) is set, indicating Wrong Address. If flip-flop B is set when the next W Pulse appears, the W Pulse resets flip-flop B and sets FF A, thus starting the comparison process all over again with the next address group.

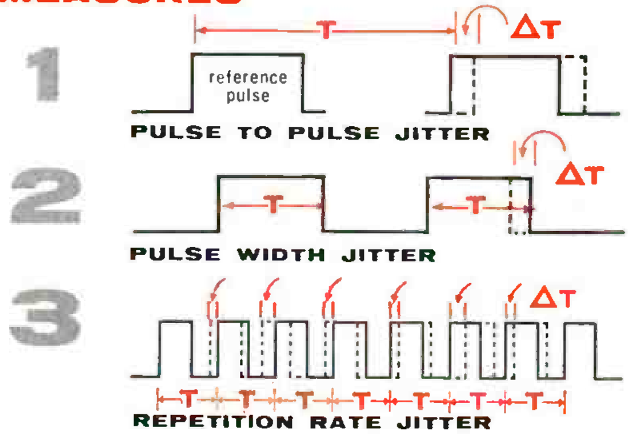
If FF B is not set indicating the right location has been found when the W Pulse appears, then the W Pulse sets a third flip-flop, FF C, and allows reading or writing into that location.

PULSE JITTER TESTER

FEATURES

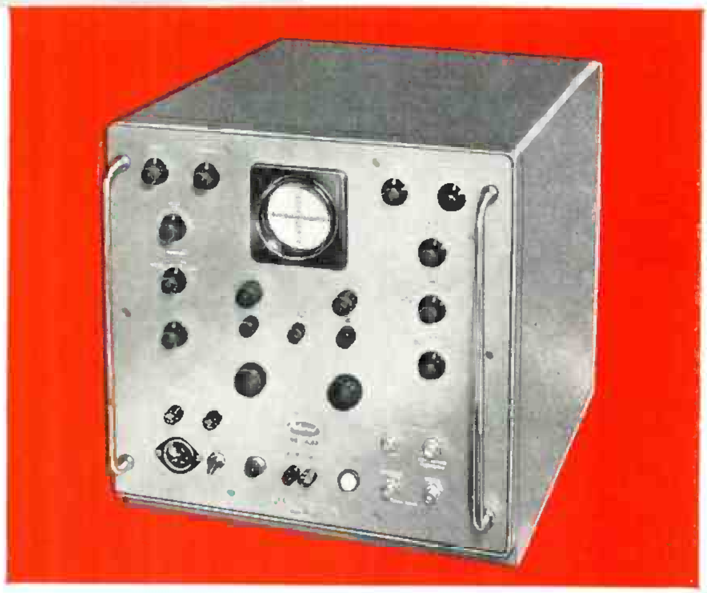
- Self-contained cathode ray tube with continuously adjustable horizontal sweep from 40 to 2,000 cps. Can be synchronized with signal.
- Printed circuit construction
- Self-contained calibration in three ranges: 100 milli u sec., 10 milli u sec., 5 milli u sec.
- Power frequency range from 50 to 420 cps.
- Provision for measurement of jitter frequency by Lissajous figures.

MEASURES



DISPLAYS

- JITTER MAGNITUDE
- JITTER WAVEFORM



MODEL PJ-1

A new Polarad instrument to show the magnitude and waveform of jitter modulation in rate generators, pulse width modulators encoding devices, precision time generators.

Here is how it measures:

1. **pulse to pulse jitter.** Two 5 mc oscillators are pulsed—one with the leading edge of each pulse. The outputs of the oscillators are compared in the phase detector and displayed on the CRT.

2. **pulse width jitter.** The leading and trailing edges of a pulse gate the 5 mc oscillators and are compared.

3. **repetition rate jitter.** The leading edge of the pulse gates a 5 mc oscillator which is compared with a stable 5 mc crystal controlled oscillator in a phase detector. The output of the phase detector is divided by a calibrated attenuator in factors of ten and two and displayed on a CRT.

4. **waveform of jitter.** Obtained by rectifying the output of the phase detector.

SPECIFICATIONS

Input Requirements:	
Pulse Width	0.2 to 10.0 microseconds.
Repetition Rate	50 to 6,000 pps.
Amplitude	5 to 50 volts, peak-to-peak.
Polarity	Positive or negative.
Input Impedance	82,000 ohms shunted by 25 micromicrofarads.
Measuring Level	50% point of input pulse, nominal.
Jitter Measurements:	
Repetition Rate Jitter	5, 10, 100 millimicroseconds and 1, 10, 100 microseconds full scale.
Width or Relative Jitter	5, 10, 100 millimicroseconds full scale.
Residual Jitter	Less than 0.5 millimicroseconds on 5, 10, and 100 millimicrosecond ranges.
Useable Horizontal Frequency Range	15 cycles to 25 kc.
Power Input	115 v ± 10%, 50 to 420 cps, 400 watts.
Dimensions	19 wide by 17½ high by 12 inches deep.
Weight	60 lbs.
Outputs Provided For	(1) External oscilloscope; (2) Recorder (± 5 ma. into 1,000 ohms) for disturbance frequency.

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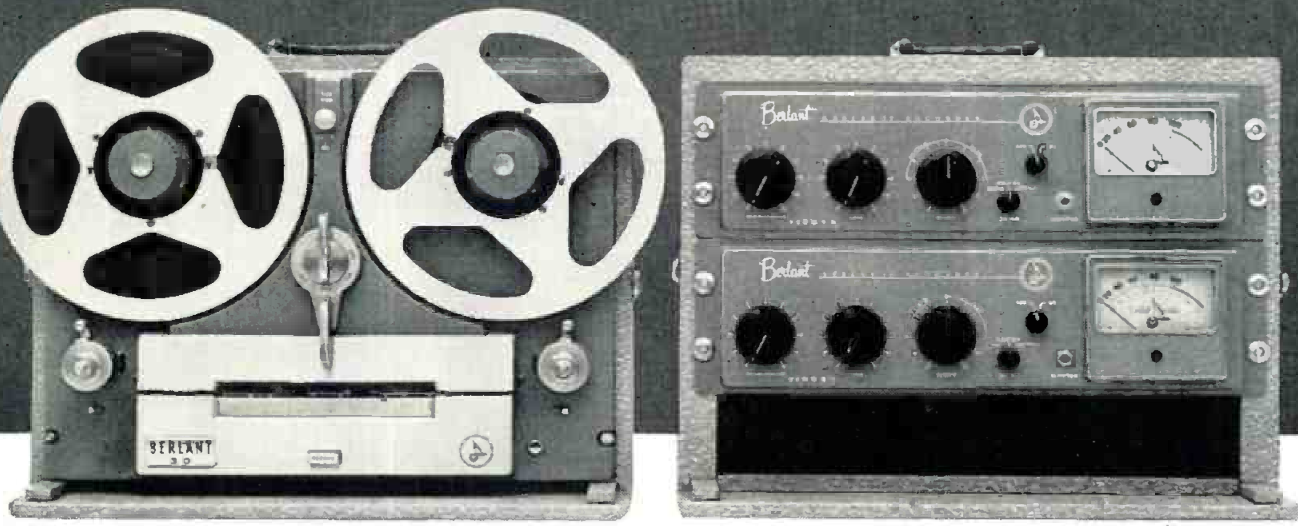
For product information, use inquiry card on page 105.

Now! ONE *Berlant-Concertone Recorder does the work of* THREE



The 36ST Berlant Deluxe Recorder is ideal for radio station use. Delivers performance characteristics for the most exacting quality use. Hysteresis synchronous drive model — (99.8% timing accuracy). Frequency response 40 to 15,000 cps at 15 ips ± 2db. Save the cost of a second recorder plus savings in space, operator time and tape. Perfect for the station planning stereo tape broadcasts on AM and FM simultaneously.

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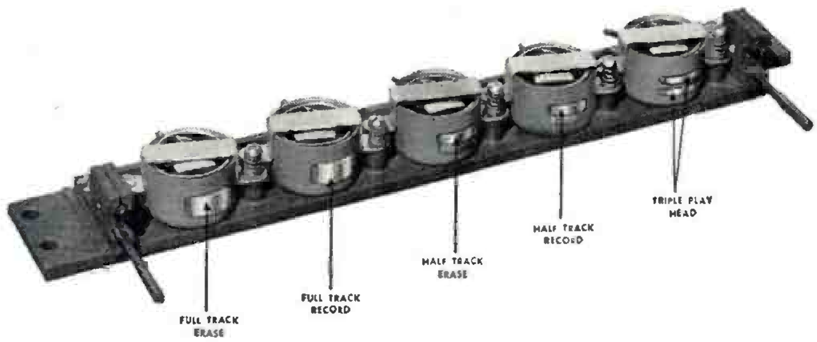
the Concertone Custom Recorders answer recording and playing needs for years to come. Full professional features include use of 10½ reels, editing and cueing, 4½ signal level meter, 3 motors, monitoring from tape while recording, 2 channel input mixer.

Take Time to Pay...

Terms to meet your budget on all models. (Model 22) As low as $49.50 down, $7.50 per week, 24 months to pay.

THIS NEW STEREO TRIPLE PLAY HEAD DOES IT—
Plays Full Track, Half Track, Stereo



Head Compliment Model 26ST and Model 36ST. Another exclusive development of the superb engineering laboratories of American Electronics — America's foremost manufacturer of electronics for military, home and industrial use.

TWO SPECIAL OFFERS FEATURED NOW BY YOUR BERLANT-CONCERTONE DISTRIBUTOR

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2. ***SAVE***— $73.50 on a new $93.50 Concertone Custom Microphone.

Offers limited and may be withdrawn without notice. See your Berlant-Concertone distributor today for your FREE tape library or for the microphone savings . . . featured at the dealer stores listed on opposite page. Write for new 6-page brochure No. 13-D.

Audio Division,
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The following Berlant-Concertone distributors invite you to visit their store to see the new TRIPLE PLAY RECORDERS and/or get your free $50.00 tape library or Concertone Custom Microphone for $20.00 with purchase of any Berlant-Concertone recorder.

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Recording Center
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5140 El Cajon Blvd.

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San Francisco Radio & Supply Co.
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520—10th Street N. W.

 For product information, use inquiry card on page 105.

Open Heaters

(Continued from page 47)

the previously described bridge is a "free rider." It also requires a minimum of components—a lamp and socket!

Biblical System

All filaments on a chassis or installation can be checked by a single test, if a gang push button and lamp display board is used, as in Figs. 3a and b.

With this system, an open filament, which results in a dead lamp, can be located in about 10 sec. by reference to the display board. This type of monitoring is ideally suited to computers, where a multiplicity of similar tubes is used on a single chassis or element. Standard pilot lamps, in this type of service, have a working life greatly exceeding 5000 cycles, if they are operated at or below their rated current.

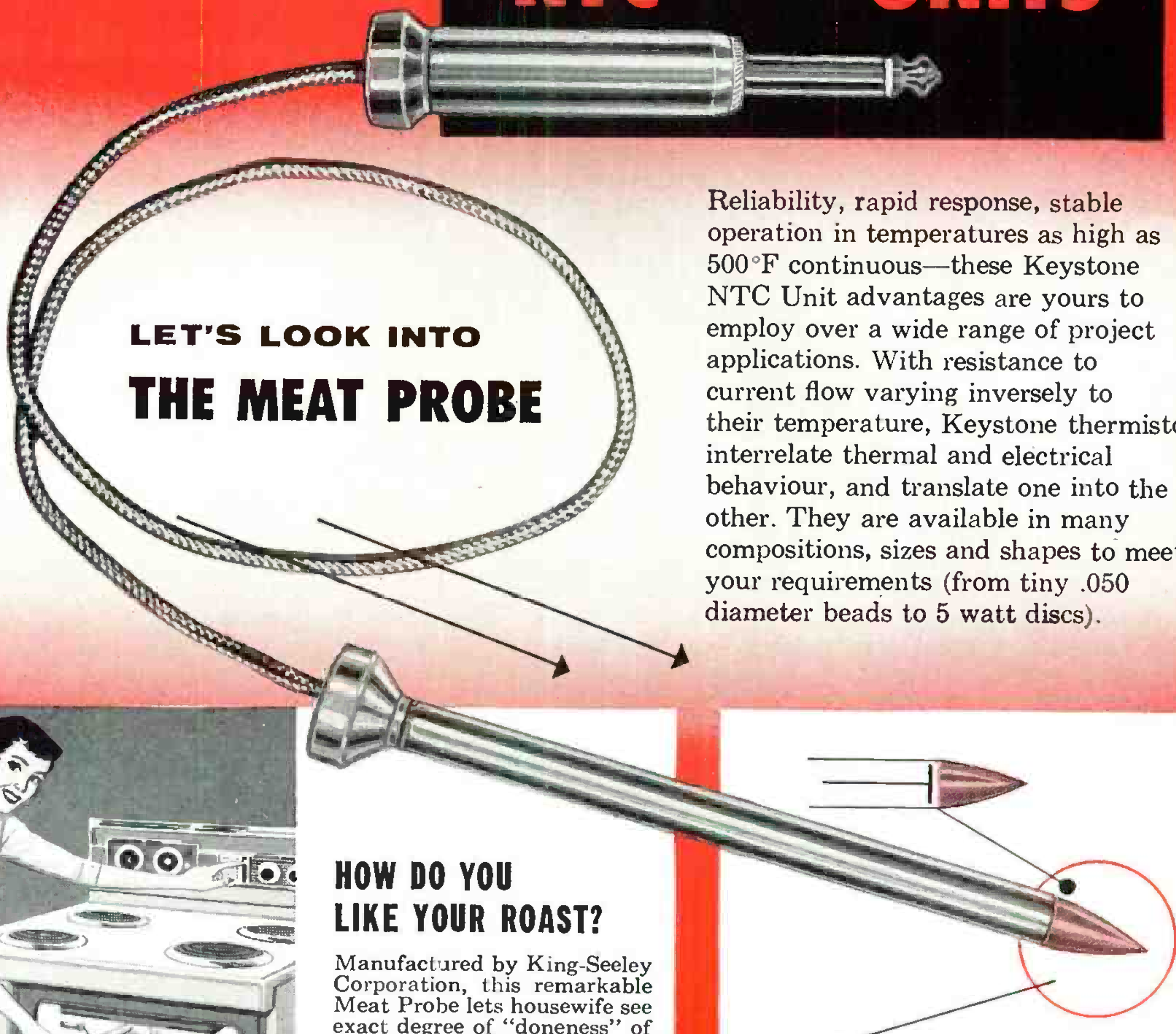
Series Filaments

In any series filament circuit, the voltage across an open filament is substantially the supply voltage. When the supply voltage is above about 85v., a neon lamp with suitable series resistor can be shunted across each filament, and will light only when the pertinent filament is open. Neon bulbs in this service are substantially immortal, so that indicator failure is unlikely to occur. Connections are shown in Fig. 2a. Cost of parts for such an indicating system is considerably less than $1.00 per tube.

In many aeronautical installations, where supply voltage is nominally 28v., four 6.3v. tubes are commonly wired in series, and the series string connected across the supply. If each tube in the string is shunted by a low-current 28v. lamp, Fig. 2b, all of the lamps will glow dull red when all of the filaments are whole; and one will light brilliantly when the filament across which it is shunted is open. To obtain maximum difference in lamp brilliance between "filament whole" and "filament open" indications, lamp current must be very small relative to filament current. In some instances, it is desirable to use lower voltage lamps with series resistors.

WHERE YOUR PROJECT CALLS FOR **TEMPERATURE MEASUREMENT and CONTROL....**

Design with DEPENDABLE KEYSTONE NTC THERMISTOR UNITS



Reliability, rapid response, stable operation in temperatures as high as 500°F continuous—these Keystone NTC Unit advantages are yours to employ over a wide range of project applications. With resistance to current flow varying inversely to their temperature, Keystone thermistors interrelate thermal and electrical behaviour, and translate one into the other. They are available in many compositions, sizes and shapes to meet your requirements (from tiny .050 diameter beads to 5 watt discs).

LET'S LOOK INTO

THE MEAT PROBE

HOW DO YOU LIKE YOUR ROAST?

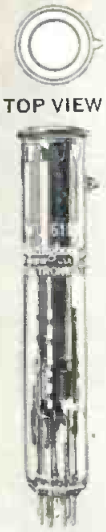
Manufactured by King-Seeley Corporation, this remarkable Meat Probe lets housewife see exact degree of "doneness" of the meat as cooking progresses—without opening oven door! Probe is inserted in roast, monitors internal rising temperature continuously, indicates Rare, Medium, Well Done conditions accurately on external gauge, thanks to Keystone NTC sensing element.

KEYSTONE NTC Thermistor in nose of stai less steel probe decreases in electrical resistan as temperature rises, permitting greater circu current flow, thus actuating external temper ture gauge. Circuit consists of regulated volta supply with thermistor and gauge connect in series.

Keystone CARBON COMPANY

ST. MARYS, PA. Telephone 41-591

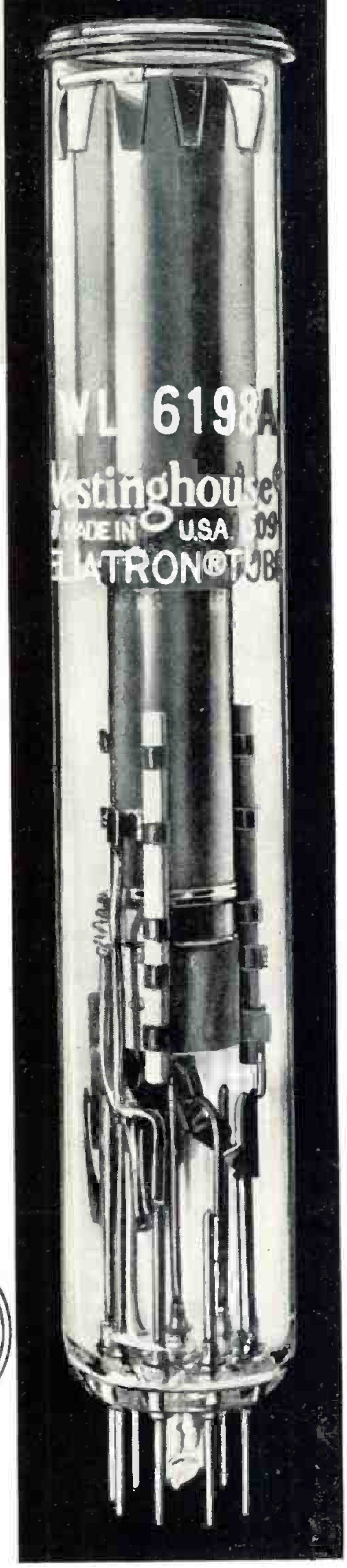
CURRENT WL-6198

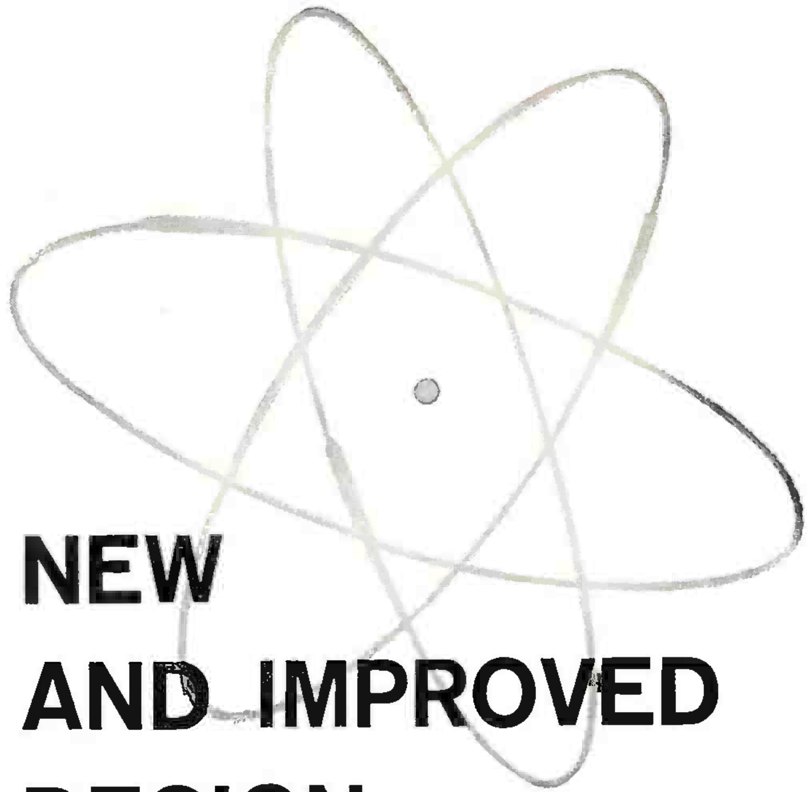


TOP VIEW

The side appendage will no longer be necessary thanks to advanced Westinghouse design.

NOW! NEW WL-6198A





NEW AND IMPROVED DESIGN FROM WESTINGHOUSE

Westinghouse first with redesigned Type 6198 Vidicon Camera Pick-Up Tube . . . first to bring you these important improvements!

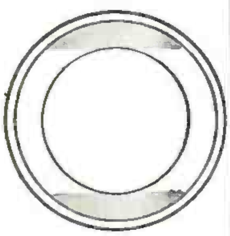
IMPROVED MECHANICAL DESIGN. Since the side appendage has been deleted, yoke construction can be greatly simplified because a slot does not have to be provided.

IMPROVED ELECTRICAL DESIGN. This advanced new design permits use of full-length deflection coils in the yoke, and provides focus uniformity to materially improve picture shading. Further, the new WL-6198A permits the introduction of a more uniform photo-sensitive surface to reduce the mottling effects in the picture.

IMPROVED PERFORMANCE FEATURES. Now that mottling is reduced and picture shading improved, the resultant picture is of more uniform clarity . . . with a truer image . . . closer by far to the actual subject being observed and transmitted by the camera.

ENGINEERS! For challenge, security, growth potential, investigate career opportunities now being offered by Westinghouse Electronic Tube Division. Write Technical Placement Director, Westinghouse Electric Corp., Electronic Tube Division, Elmira, N. Y.

You will want full details on this new Westinghouse Vidicon Camera Pick-Up Tube. Get detailed technical data by writing to Commercial Engineering Dept., Westinghouse Electric Corp., Elmira, N. Y.



TOP VIEW
New orientation markings on the 6198A permit use of the full photo surface area.

WATCH WESTINGHOUSE
WHERE BIG THINGS ARE HAPPENING FOR YOU!

6ET-4118

 For product information, use inquiry card on page 105.

Transistor Chopper

(*Continued from page* 43)

emitter leg, R_E. For the small variable signal current, I_C, traversing the collector-emitter path, the ohmic drops in the collector and emitter legs, R_C and R_E, can be shown simply as resistances in series. Thus a practical "on" circuit is established (Fig. 4a). For the "off" setting, the surface leakages around the two reverse biased junctions can be represented by a shunt conductance, G_S (Fig. 4b). While the surfaces may have breakdown characteristics and act more like reverse biased diodes,[6] at the low-levels considered herein, they can probably be treated as simple conductances.

To obtain an appreciation for the equivalent circuits, a very modest example will be considered. Assume

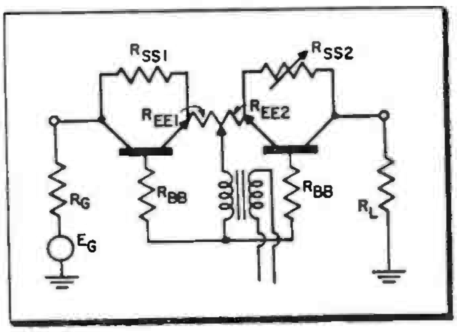


Fig. 6: Improved series-pair circuit.

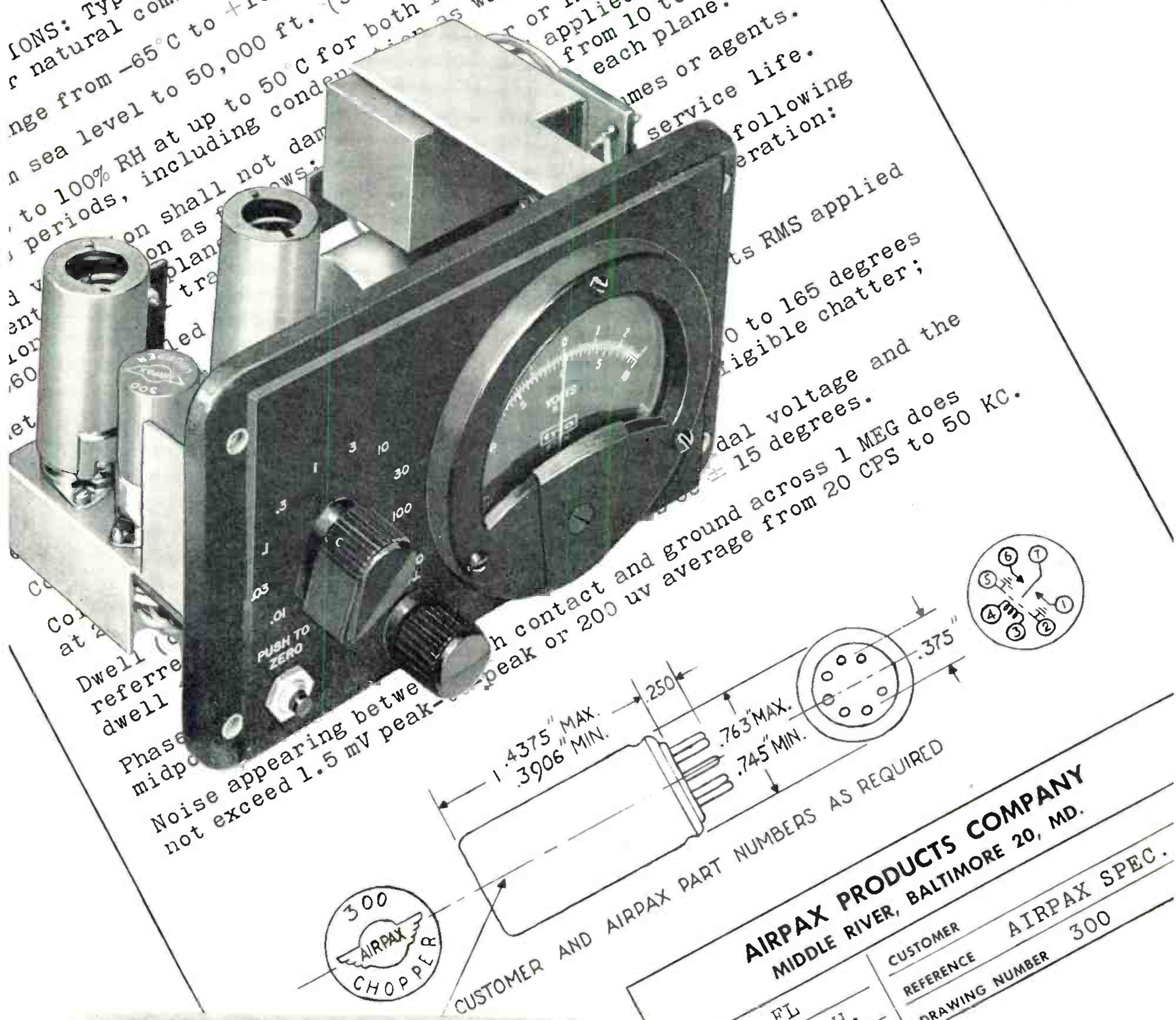
a symmetrical alloyed germanium transistor in which $I_{CO} = I_{EO} = 10\ \mu a$ and $\alpha_n = \alpha_i = 0.95$. Further assume an "on" drive current of $I_B = 0.25$ ma. and an "off" drive voltage of $V_B = -0.25$ v. (approx. $10kT/q$ at room temperature). In addition consider $R_E = R_C = 10$ ohms and $1/G_S = 10$ megs (reasonable values). These assumptions lead to the following values for the equivalent circuits of Fig. 4:

"ON"	"OFF"
$R_C = 10\ \Omega$	$I = 5\ \mu a.$
$R_E = 10\ \Omega$	$1/G = 5.6$ meg
$R = 10\ \Omega$	$1/G_S = 10$ meg
$V = 1.3$ mv.	
$I_B R_E = 2.5$ mv.	

By the use of an asymmetrical unit (one alpha near unity and the other very low) in its low-gain orientation, V and I can be appreciably reduced. Units with smaller saturation currents, surface leakages, and ohmic resistances will, of

(*Continued on page* 110)

Miniature DC VTVM uses AIRPAX chopper



RATING ON TYPE 300 CHOPPER

Drive: 6.3 volts at 400 CPS
Contacts: up to 100 volts at 2 ma
Dwell Time: 147 electrical degrees
Phase Angle: 65 electrical degrees lagging
Noise: 200 microvolts average across a 1 megohm resistance into a band from 20 CPS to 50 KC from each contact to ground

Hermetically sealed for maximum life under all ambient conditions. Available to plug into a 7-pin miniature tube socket, or with solder lugs and flange mount.

AIRPAX
DESIGNERS ENGINEERS
MIDDLE RIVER BALTIMORE 20, MD.

Zero Drift Is 0.5% Maximum

An Airpax Type 300 chopper gives this panel-mounting instrument several unusual characteristics. It has a 5-megohm input impedance, yet only 0.5% maximum drift. With it you can read as low as 500 DC microvolts and as high as 300 DC volts, both to an accuracy of 2%.

You may have another equipment that can benefit from a chopper to convert DC to AC. Why not discuss your problem with us today? Airpax makes the chopper (Trio Laboratories, Seaford, New York makes the VTVM).

(*Continued from page* 108)

course, yield yet better performance.

Series-Pair Circuit

In the "series-pair" circuit of Fig. 5,[2,4] both transistors turn on and off together. Therefore their null voltages (V_{N1} and V_{N2}) buck each other simultaneously, delivering only a small difference to the signal-load circuit during the "on" half of the driving cycle. There is also a tendency for the null currents (I_{N1} and I_{N2}) to buck.

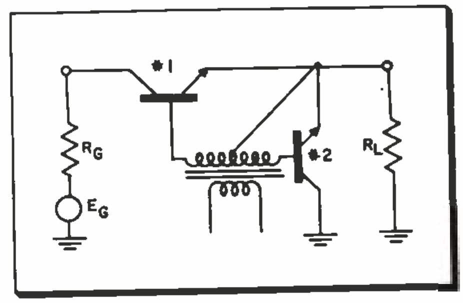


Fig. 7: Series-shunt chopper circuit.

For critical applications, better nulls may be required than can be obtained ecomonically through "perfect" matching. In these cases crude matching plus external "alignment" may be employed to achieve the desired signal sensitivity and impedance levels. Fig. 6 illustrates an improved series-pair that is readily adjusted for minimum nulls. The series drive resistances, R_{BB}, are used to insure a known drive current level for the "on" half cycle. The externally added series emitter resistances (R_{EE1} and R_{EE2}) are used to add a small but controllable amount to the two null voltages, allowing the two "on" null voltages to be almost perfectly matched. The shunts R_{SS1} and R_{SS2}, are incorporated to serve as paths for the "off" null currents. If the internal shunt resistances are high enough to allow external shunts of a lower order of magnitude without "spoiling" the "open" state of the switch, then they will yield minimum "off" effects in the load circuit when

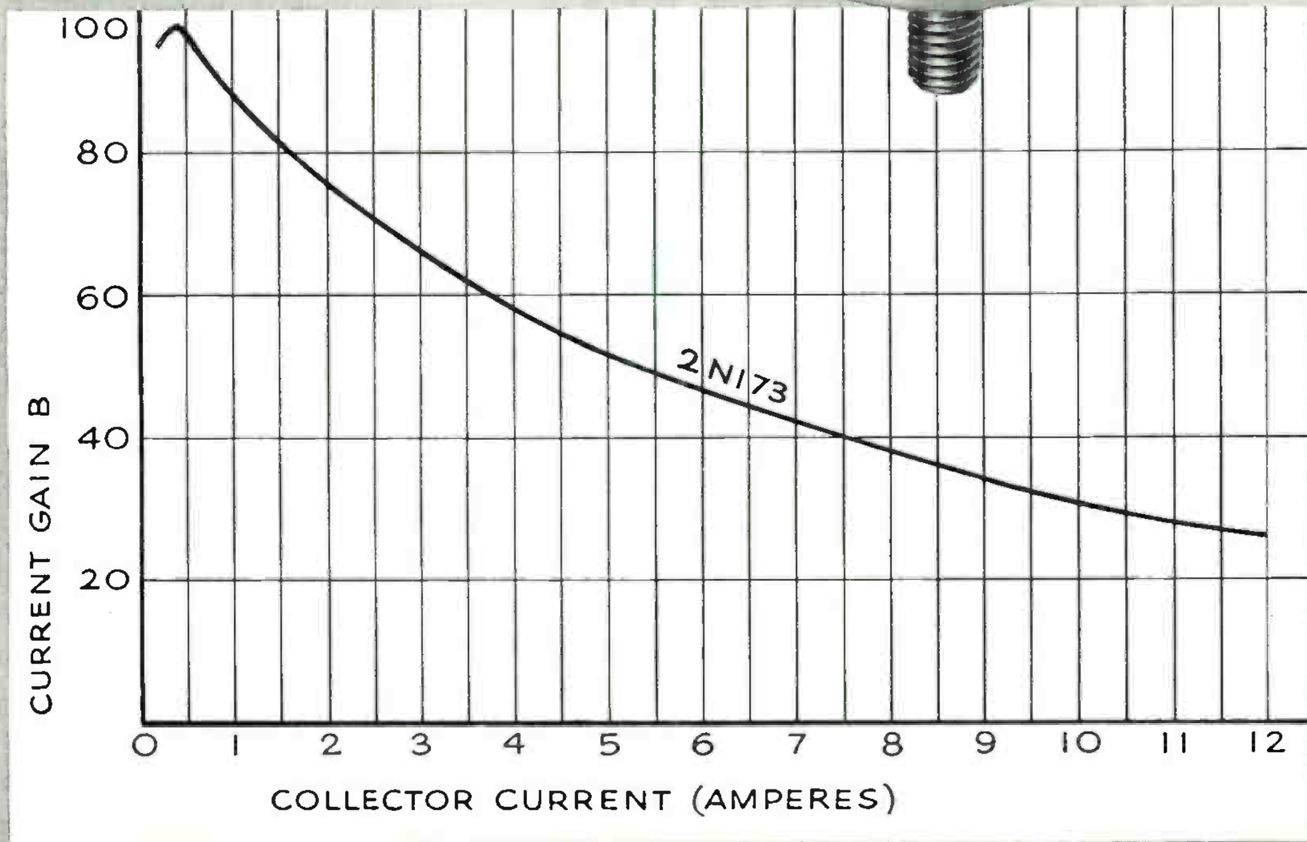
$$\frac{R_{SS1}}{R_{SS2}} = \frac{I_2}{I_1}. \qquad (11)$$

Series-Shunt Circuit

Another useful chopper circuit is the series-shunt pair (Fig. 7).[2,3,4] In this circuit, the "on" null volt-

(*Continued on page* 112)

Industry's Highest Power Transistors



Delco Radio "High-Power" Transistors set a new industry standard of performance—

Produced by the thousands each day!

Delco Radio alloy junction germanium PNP power transistors 2N173 and 2N174, now in volume production, are characterized by high output power, high gain and low distortion. Stabilizing processes eliminate the effect of time on performance characteristics.

The high power handling ability does not exclude applications for low and medium power levels. Performance at low levels exceeds that of many low power transistors and will provide a higher degree of safety and stability to equipment design.

TYPICAL CHARACTERISTICS

	2N173	2N174	
Properties (25°C)	12 Volts	28 Volts	
Maximum current	12	12	amps
Maximum collector voltage	60	80	volts
Saturation voltage (12 amp.)	0.7	0.7	volts
Power gain (Class A, 10 watts)	38	38	db
Alpha cutoff frequency	0.4	0.4	Mc
Power dissipation	55	55	watts
Thermal gradient from junction to mounting base	1.2°	1.2°	°C/watt
Distortion (Class A, 10 watts)	5%	5%	

DELCO RADIO DIVISION OF GENERAL MOTORS
KOKOMO, INDIANA

For product information, use inquiry card on page 105.

(*Continued from page* 110)

ages again buck one another. This bucking, however, is over a complete cycle rather than simultaneously as in the series-pair.

When the shunt unit (#2) is "off," its null current creates a positive drop in the load. When the series unit (#1) is "off," however, the shunt unit is "on" and thus prevents the series unit null current from reaching the load. Hence, a large unbalance in "off" nulls exists and an undersirable ac signal is created in the load. The addition of an external collector resistance, R_{CC2}, in the collector leg of the shunt unit will allow the series "off" current to also produce a positive voltage at the load.[4] If this voltage is adjusted to be equal to that caused by the shunt transistor's "off" current, the fundamental component of "off" nulls will be minimized. The relationship to be satisfied is

$$\frac{I_1 R_{CC2}}{R_{CC2} + R_L} = \frac{I_2 R_G}{R_G + R_L} \qquad (12)$$

References

[1] W. Shockley, "Transistor Electronics: Imperfections, Unipolar and Analog Transistors," *Proc. IRE*, pp. 1289-1313, Nov. 1952.

[2] R. L. Bright, "Junction Transistors Used as Switches," *AIEE Trans.*, Part 1, Communications and Electronics, pp. 111-21, Mar. 1955.

[3] A. P. Kruper, "Switching Transistors Used as a Substitute for Mechanical Low-Level Choppers," *AIEE Trans.*, Part 1, Communications and Electronics, pp. 141-4, Mar. 1955.

[4] R. L. Bright & A. P. Kruper, "Transistor Choppers for Stable D-C Amplifiers," *Electronics*, pp. 135-7, Apr. 1955.

[5] J. J. Ebers & J. L. Moll, "Large-Signal Behavior of Junction Transistors," *Proc. IRE*, pp. 1761-72, Dec. 1954.

[6] S. L. Miller & J. J. Ebers, "Alloyed Junction Avalanche Transistors," *BSTJ*, pp. 883-902, Sept. 1955.

* * *

Number Systems

(*Continued from page* 33)

$$\bar{m} + \bar{s} = (10^n - m) + (10^n - s)$$
$$= 2 \times 10^n - (m + s). \qquad (10)$$

If the operands are restricted so that $(m+s) < 10^n$, a carry is propagated into the 10^n digit column. Assuming modulo 10^n addition, this carry is discarded, the equivalent of subtracting 10^n from Eq. 10,

$$\bar{m} + \bar{s} = 10^n - (m + s)$$
$$\text{or, } \bar{m} + \bar{s} = \overline{(m + s)} \qquad (11)$$

Adding the negative numbers (—40) and (—27) as an example,

$$\bar{m} = 60$$
$$\bar{s} = 73$$
$$\bar{m} + \bar{s} = 133$$

Discarding the underlined 1, the 10^2 carry, the final answer is 33 or (m+s).

Multiplication

Multiplication may be accomplished by a series of additions and right shifts. The multiplicand is added a number of times determined by the least significant digit of the multiplier to form a first partial product, P_1. Then P_1 is shifted right one digit place. The multiplicand is added a number of times determined by the second least significant digit. This second sum is added to P_1 to form the second partial product, P_2. P_2 is shifted right one digit place. The process is continued until all digits of the multiplier have been used. The following decimal example illustrates the process.

213	Multiplicand
103	Multiplier
213	
213	
213	
639	First Partial Product
63 9	Shift Right
000	
063 9	Second Partial Product
006 39	Second Shift Right
213	
219 39	Third Partial Product
21939	Final Product

In binary multiplication, this process is very simple since the multiplicand is added or not added dependent upon whether the digit of the multiplier being considered is a 1 or a 0.

1011	Multiplicand
1011	Multiplier
1011	First Partial Product
101 1	
1011	
10000 1	Second Partial Product
1000 01	
0000	
1000 01	Third Partial Product
0100 001	
1011	
1111 001	Fourth Partial Product
1111001	Final Product

(*Continued on page* 114)

(*Continued from page 113*)

Division

Division is accomplished by subtracting the divisor from the dividend repeatedly, comparing after each subtraction the divisor and the remainder. The first digit of the quotient is the number of subtractions performed before the divisor exceeds the remainder, R_1. The remainder is shifted left and the cycle starts again, continuing until the entire quotient and final remainder have been determined. A

AUGEND \ ADDEND	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	10	11
1	1	2	3	4	5	6	7	10	11	12
2	2	3	4	5	6	7	10	11	12	13
3	3	4	5	6	7	10	11	12	13	14
4	4	5	6	7	10	11	12	13	14	15
5	5	6	7	10	11	12	13	14	15	16
6	6	7	10	11	12	13	14	15	16	17
7	7	10	11	12	13	14	15	16	17	20
8	10	11	12	13	14	15	16	17	20	21
9	11	12	13	14	15	16	17	20	21	22
10	12	13	14	15	16	17	20	21	22	23
11	13	14	15	16	17	20	21	22	23	24
12	14	15	16	17	20	21	22	23	24	25
13	15	16	17	20	21	22	23	24	25	26
14	16	17	20	21	22	23	24	25	26	27
15	17	20	21	22	23	24	25	26	27	30
16	20	21	22	23	24	25	26	27	30	31
17	21	22	23	24	25	26	27	30	31	32
18	22	23	24	25	26	27	30	31	32	33
19	23	24	25	26	27	30	31	32	33	34
20	24	25	26	27	30	31	32	33	34	35
21	25	26	27	30	31	32	33	34	35	36
22	26	27	30	31	32	33	34	35	36	37
23	27	30	31	32	33	34	35	36	37	40
24	30	31	32	33	34	35	36	37	40	41
25	31	32	33	34	35	36	37	40	41	42
26	32	33	34	35	36	37	40	41	42	43
27	33	34	35	36	37	40	41	42	43	44
28	34	35	36	37	40	41	42	43	44	45
29	35	36	37	40	41	42	43	44	45	46
30	36	37	40	41	42	43	44	45	46	47

Fig. 3: Completed octal addition.

decimal example illustrates the process

Dividend $= D_1 = 243$;
divisor $= D_2 = 781$

2430		Dividend shifted left
9219		Complement of divisor
1649	1	
9219		
0868	2	
9219		
0087	3	$R_1 < D_2$
0870		Shift left
9219		
0089	31	$R_2 < D_2$
0890		Shift left
9219		
0109	311	$R_3 < D_2$, Final Remainder

311 $\frac{109}{781}$ Quotient

Excess 3 Code

Groups of bi-stable elements such as relays, flip-flops constructed from transistors, magnetic cores, tubes, switches, etc., are used by digital computer designers to represent numbers. The natural analogy of the two states of such elements to the 0 and 1 of the binary system accounts for the widespread use of the binary system or variations of it in almost all digital computers.

Attempts to represent decimal numbers as a series of binary marks have resulted in the coded-decimal systems. In the basic binary coded-decimal system, each decimal digit of a number is coded into 4 binary digits. The number 729 would be in this code.

729 =	0111	0010	1001
	(7)	(2)	(9)

A basic disadvantage of this coding scheme becomes apparent when addition is performed.

729	0111	0010	1001
+ 43	0000	0100	0011
772	0111	0110	1100
	(7)	(6)	(12)

There is no carry from the ones to the tens column. If a carry were to be performed, it would not represent a 10 carry, but rather a 16 carry.

A variation of the basic binary coded-decimal is the excess 3 code in which each decimal digit n is represented by the binary number n + 3.

The advantage of the code is that the normal binary carry-out of the most significant binary digit also serves as the carry between decimal digits, i.e., the interdigit carry.

Arithmetic operations in the excess 3 code follow conventional binary arithmetic except that (1) if an interdigit carry is generated in the addition of any two decimal digits, represented in excess 3 code, add three (0011) to the sum of the digits to obtain the correct excess 3 sum, or (2) if a carry is not generated, subtract three.

The excess 3 code is only one of a

(*Continued on page* 116)

(*Continued from page* 115)

large number of coded decimal representations.

Bi-Quinary System

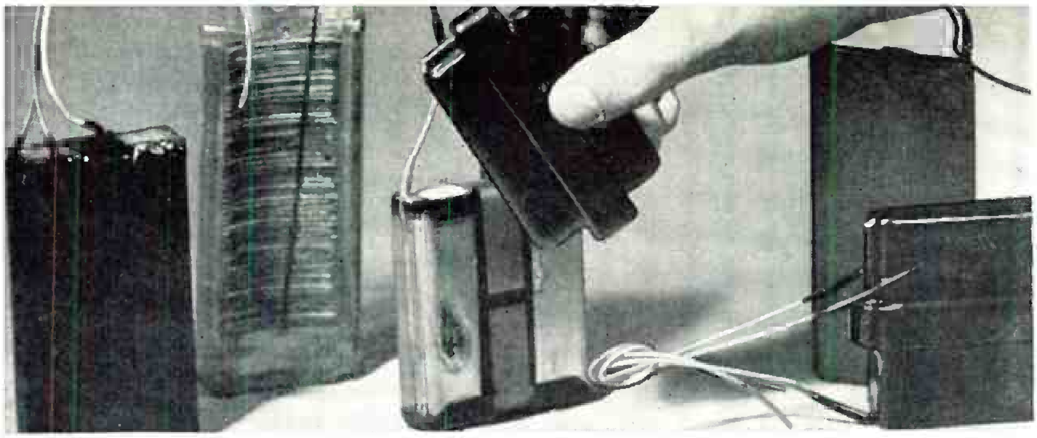
The bi-quinary system represents a decimal digit by 2 digits, a binary digit and a quinary digit. The binary digit has 1 of 2 values, 0 or 1, while the quinary digit has one of 5 values, 0, 1, 2, 3, or 4. The system is used in the Bell Telephone relay digital computers where 7 relays are needed to represent a single decimal digit, 2 for the binary digit and 5 for the quinary digit. Two and *only* two relays, one in each group, are activated when a decimal digit is stored. The bi-quinary numbers and their decimal equivalents are also shown in Table 1.

It is evident that this system requires more storage elements per digit of storage; however, it is claimed that this disadvantage is offset by (1) the automatic error check inherent in the two and only two relays being closed, and (2) the equipment needed for input-output translation between decimal and bi-quinary is extremely simple. The arithmetic processes in the bi-quinary system are identical to the decimal system with the added complication of carries between the binary and quinary portions of the number.

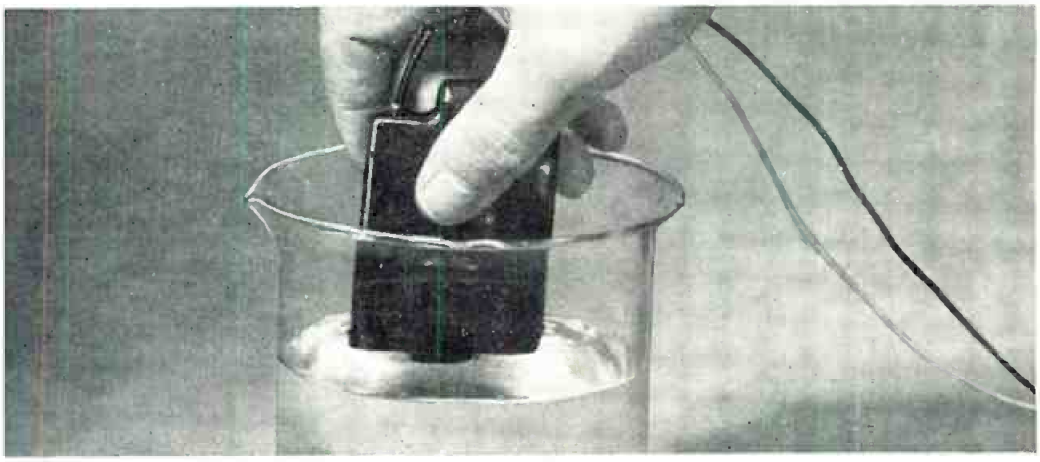
Radix Point

The radix point divides the integral and fractional portions of a number and may be fixed or floating. The floating radix point is a mechanism for expressing each number as an integral number plus a mantissa which designates the power of the base. For example, in the decimal system, 123.74 is represented as 12374,02. This is interpreted as 12374×10^{-2}. The floating radix point allows retention in the answer to an arithmetic operation of as many significant places as possible, and simplifies programming by the elimination of scale factors. Scale factors are multiplicative constants which serve to keep computational results within machine limits. The disadvantages of the floating radix point are (1) complex arithmetic and control cir-

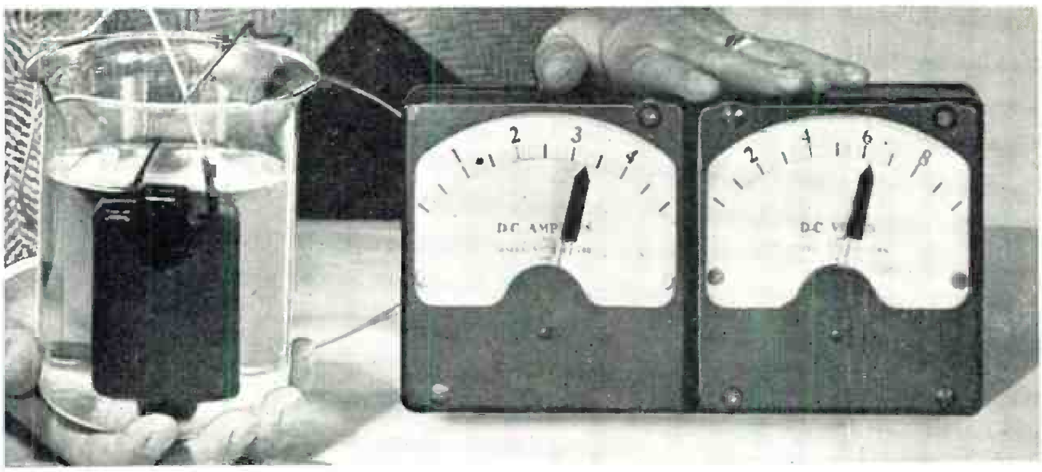
(*Continued on page* 118)



DRY G-E water-activated batteries are made dry, stored dry. Contain no electrolyte to leak or freeze. Demand no maintenance during storage other than normal precaution against moisture.



WET To activate, simply immerse in water. Batteries reach operating voltage as fast as 2 seconds . . . operate efficiently in extreme temperatures . . . are unaffected by external hydrostatic pressure.



POWER These silver-chloride/magnesium type batteries deliver up to 42 watt hours per pound and 3 watt hours per cubic inch, with nearly level power output over total operating life.

General Electric's

New Water-Activated Batteries Deliver up to 42 Watt Hours Per Pound!

WHERE CAN YOU USE G-E WATER-ACTIVATED BATTERIES? Probably wherever you need a versatile source of d-c power, wrapped inside a small, lightweight package.

Delivering tremendous power for relative size and weight, these primary batteries can be used as "power packs" in any number of series, parallel, or series-parallel combinations you may need.

Though a wide range of ratings and sizes is available, G-E water-activated batteries can be designed in nearly any combination of sizes, weights, and ratings to fit your specific application.

Examine your power needs now. If space, weight, and exceptional reliability are critical, phone your G-E Apparatus Sales Office, today. A representative will be glad to give you additional information on how G-E water-activated batteries can help solve these problems.

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For descriptive bulletin GEA-6238A on G-E water-activated batteries, send coupon to:

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(*Continued from page* 116)

cuitry is required for determining and properly locating the radix point, and (2) storage capacity must be used for the mantissa. The placing of the fixed radix point has been argued similarly among machine designers as to whether it should be at the extreme left of the number, at the extreme right, or at some arbitrary intermediate position. At present, almost all digital computers use a radix point placed after the first digit on the left. The first digit is used for sign. Thus, the numbers able to be represented range from $1-x^{-n}$ to $-(1-x^{-n})$, i.e., from +.999 . . . 9 to —.999 . . . 9 in the decimal system or its equivalent in the radix system used. One of the chief advantages of this positioning is that multiplications can never result in numbers which exceed the capacity of a register since a product of 2 numbers, each less than unity, also must be less than unity.

* * *

Computer Directory

(*Continued from page* 85)

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Logistics Research Inc 2-3-4
141 S Pacific Ave Redondo Beach Calif
Magnasync Mfg Co Ltd 4
5546 Satsuma Ave N Hollywood Calif
Melpar Inc Div Westinghouse 4
Air Brake Co 3158 Arlington Blvd Falls Church Va
Monroe Calculating Machine Co 2
Hanover Ave Morris Plains NJ
Mountain Systems Inc 2-3-4-5
864 Franklin Ave Thornwood NY
Northrop Aircraft Inc 2-4
Hawthorne Calif
Norton Associates Inc 2-4
P O Box 96 Garden City NY
Polyphase Instrument Co 3
701 Haverford Rd Bryn Mawr Pa
Potter Instrument Co Inc 3-4-5
115 Cutter Mill Rd Great Neck NY
Radiation Counter Labs Inc 3
5121 W Grove St Skokie Ill
Radiation Inc 3
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Radio Corp of America 5
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(Continued on page 120)

Atomichron Measures Time Super-Accurately

Accurate and reproducible measurement of time and time intervals is now possible for scientific investigations with the development of the Atomichron by National Co., Inc., Malden, Mass. Also for use with communications and navigation systems, Atomichron is accurate to within 3 seconds per 100 years and more accurate than telescopic observations.

The fundamental escapement (time determining mechanism) in this device is the precessional motion of an electron in the cesium atom. This atomic standard of time may be operated by personnel not specifically trained in atomic beam techniques.

National Co. claims that Atomichron will increase speed and volume of long distance telephone communications; and result in extension of network TV, greater volume of industrial communications, and in extension of power control systems.

Computer Directory

(*Continued from page 119*)

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Div Sperry Rand Corp Univac Pk St Paul 16 Minn
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731 Arch St Phila 6
Skiatron Electronics & TV Corp 3-5
180 Varick St New York 14
Sylvania Electric Prods Inc 3-4
100 1st Ave Waltham 54 Mass
Taller & Cooper Eng'g 3
75 Front St Brooklyn 1 NY
Telemeter Magnetics Inc 3
2245 Pontius Ave Los Angeles 64
Transdye Corp 3-4
7337 Grand Ave Maspeth 78 NY
Underwood Corp 2
Computer Div 35-10 36th Ave Long Island City 6 NY
Valor Electronic Components Co. 3
5808 Marilyn Ave Culver City Calif
Wang Laboratories Inc 3
37 Hurley St Camhridge 41 Mass
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Friendship International Airport Baltimore 3 Md
Westinghouse Electric Corp 5
Electronic Tube Div Elmira NY

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(*Continued on page 122*)

Computer Directory

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Ferranti Electric Inc 1
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Florman & Babb 5
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* * *

Firms Expanding

The Philco Corp. has purchased the Sierra Electronic Corp., San Carlos, Calif., research and instrument mfg. concern. Willard Feldscher remains as V.P. and General Manager.

Standard Electronics Corp., Newark 5, N. J., has acquired the American Transformer Co. and appointed William Zillger as V.P. and General Manager.

Computer Transistor

(*Continued from page 39*)

ular case shown in Fig. 4, which involves current drive on the base, the fall time is appreciably longer than the rise time, particularly

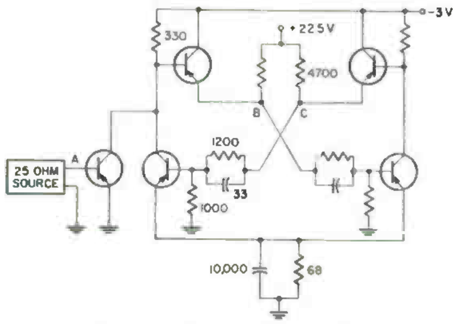


Fig. 6: Nonsaturating emitter-follower-coupled flip-flop.

when the transistor is hard in saturation.

Because the method of presenting switching characteristics as in Fig. 4 gives such an excellent basis for quickly portraying rise time, fall time, and the effects of saturation, this type of figure will be used for showing different test conditions, and the characteristics of different types of transistors. The characteristics of 5 different L-5131

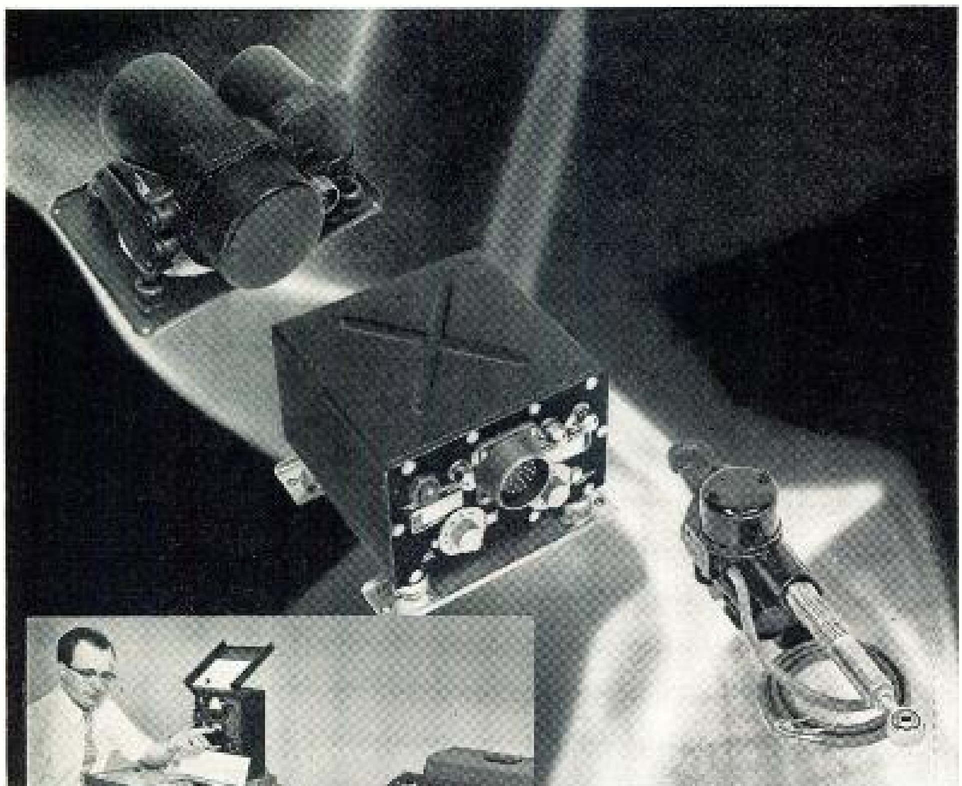
(*Continued on page 124*)

New Engineering Center

Technical and lab projects covering guided missiles, ground and airborne radar, aviation communications, and mobile two-way radio systems are housed in a 100,000 sq. ft. Engineering Center recently opened in Baltimore by the Radio Div. of Bendix Aviation.

Microwave Ground Breaking

Pres. Sigurd Varian uses parabolic reflector antenna to project a low-power radar beam with frequency of 10,000,000 KC for the ground breaking at Varian Associates' new microwave tube factory in Palo Alto, Calif.



(*Continued from page* 123)

microalloy transistors with current drive on the base are shown at the left in Fig. 5. These photographs show the degree to which the sum of delay time plus fall time can be counted on as constant.

Circuit Performance

The transient responses of 3 flip-flop circuits will be considered. Fig. 3 shows the schematics of direct-coupled and R-C coupled flip-flops, with transistor gates for setting included. The reset gating transistors have been omitted for clarity. On the right of each circuit in Fig. 3 are shown sketches of voltage wave-forms, with V_A the indealized input pulse that turns on the gating transistor, V_B the voltage at the collector of the gating transistor, and V_C the collector voltage of the transistor being turned off. Photographed waveforms considered subsequently appear as V_a, V_b, and

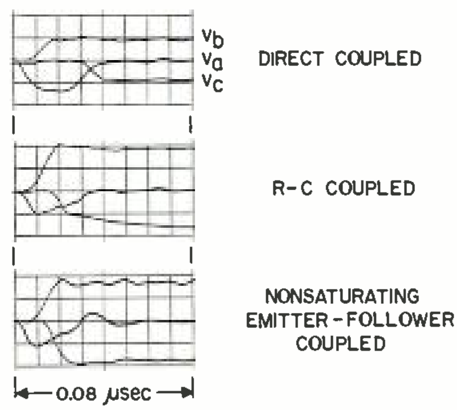


Fig. 7: Flip-flop switching waveforms with L-5131 Transistors.

V_c, of Fig. 3, because they have been shifted by the measuring oscillograph to a common reference line.

The nonsaturating emitter-follower-coupled flip-flop shown schematically in Fig. 6 uses the emitters of the emitter-follower transistors as the output points. In this circuit the bypassed 68Ω resistor is added to keep the collectors of all transistors negative with respect to the bases at all times, thus avoiding saturation in a manner described by McMahon.[1]

The switching waveforms of these flip-flops with L-5131 microalloy transistors are shown in Fig. 7. A number of points of interest are worthy of special mention. First of all, the delay time in the turnoff waveform of the direct-

(*Continued on page* 126)

PROBLEM #6

Experienced engineers throughout the country have shown a marked preference for Peerless products. They know the Peerless engineering staff is uniquely qualified to solve any transformer problem quickly and efficiently. Matchless experience is the result of a long history of successfully designing transformers to unusual and difficult specifications. Such experience combined with rigid quality controls and the most advanced production techniques achieves uniform quality and dependability in all Peerless products.

Design an hermetically sealed 400 cps output transformer for use in a servo amplifier with a high degree of feedback (Mu-β=100). Frequency response to be linear within 3 db from 200 cps to 170,000 cps, with no dips or peaks. Primary impedance to be 6,000 ohms, center-tapped, with a maximum DC resistance of 60 ohms. Primary OCL to be 4 henrys minimum when measured at 30V, 400 cps, and with 7.5 ma of DC flowing through the total winding. Secondary impedance to be 500 ohms, center-tapped, with a maximum DC resistance of 6 ohms. Secondary rated output to be 140V@ 400 cps into a 500 ohm load. Transformer efficiency to be 95% minimum. Ambient temperature range to be from —55°C to +105°C. Maximum altitude to be 70,000 feet. Casing to be in accordance with the applicable requirements of MIL-T-27, with preferred dimension limits to be 2½" x 2¾" x 2³⁄₁₆".

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Secondary: Three terminal, center-tapped winding, 500 ohms nominal impedance.
Secondary Resistance: 5 ohms.
Rated Operating Level: 140V, 400 cps across 500 ohm secondary load.
Efficiency: 96%.
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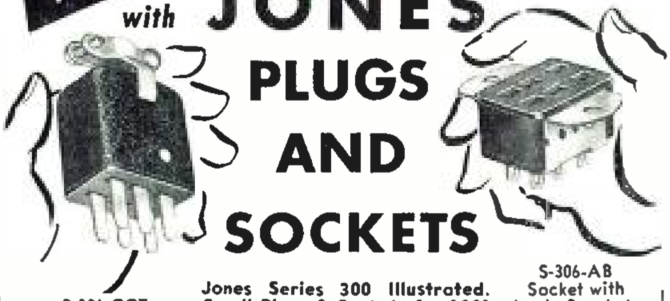

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(*Continued from page* 124)

coupled flip-flop is quite apparent. It should be noted that the input pulse must be at least as long as this delay time. Secondly, the long decay in the turnoff waveform of the R-C coupled flip-flop, resulting from the loading of the coupling capacitor, is very evident. Thirdly, it should be mentioned that the voltage swings are not calibrated from photograph to photograph, although the oscillograph gain was not changed in obtaining all the waveforms of a particular circuit. The output voltages of the R-C and emitter-follower coupled flip-flops are greater than those of the direct-coupled flip-flop. Finally, attention is called to the fact that the circuit transients of the nonsaturating emitter-follower-coupled circuit are ended within 25 µsec. following the start of the input pulse. This very satisfactory figure agrees with data taken on complementing (upset) versions of this circuit, which have been made to count at pulse rates in excess of 20 megapulses/sec.

[1] R. E. McMahon, Designing Transistor Flip-Flops, Electronic Design, vol. 3, no. 10, October 1955, p. 24.

About that Book

(*Continued from page* 50)

logs of the several hundred publishers who publish technical books, and learn what fields they seem to be interested in. Pick out the most logical one, and send off your material. You can be sure that he will want to see it, because new books are the life blood of the book publisher. If you get a rejection slip back with the material do not give up the struggle, since there are many reasons why he may not be able to use your book at this time. Choose another, and try again.

What to Look for in a Publisher

To choose the right publisher is of paramount importance, and the following four factors should be weighed:

1. Financial stability. Many authors think about this last, if they think of it at all; but to enter into an agreement with a firm that does not pay its royalties is much worse than useless.

2. The quality of the publisher's list. Most tend to specialize to some extent, and it is nearly always wise

to select a firm noted for the kind of book you have in mind.

3. The strength of the publisher's selling organization or channels of distribution. This would often exclude the very small or new firms.

4. The desirability of having a publisher who will take a personal interest in your work. This would sometimes exclude the very largest firms.

The advantages of remaining loyal to one publisher are many; the disadvantages few.

How to Submit Material

All publishers will give you a gold star if you will send in material that is neatly typed on one side of the paper only, with at least 1-inch margins on all four sides, on a fair grade of bond paper, 8½ x 11 in. size; double space your typing. The following check list will help:

1. Send the original, not a carbon, but be sure to retain a carbon copy at home.

2. All text references to tables,

(*Continued on page* 128)

(*Continued from page* 127)

footnotes, illustrations, bibliography, chapters etc., should be checked for accuracy.

3. Permissions must be obtained from copyright owner for all borrowed quotations and/or illustrations, and should be forwarded at time manuscript is released.

4. All photographs should be mounted on cardboard and protected by a sheet of paper pasted on the back and folded over the face of the picture.

5. Legends for illustrations should be typed on 8½ x 11 in. paper. one side, double spaced, with a triple space between each entire legend. The legend number and the number on the illustration must correspond.

6. A list of preferred spellings in the field of the text should accompany the manuscript. For example, the American Standards Assoc. has approved styles to follow for Physics, Refrigeration, Gear Engineering, Chemical Engineering, Thermodynamics, Hydraulics, and so on.

Your publisher will supply you with complete information as to his requirements in this regard, and it is often a great time saver to have and follow these details in writing your book. That is why it is important to approach the publisher prior to the actual writing, by sending the outline and a sample chapter upon which an agreement can be drawn up, and then with a contract signed, to go ahead and write your book.

Contract and Copyright Pointers

There are so many misconceptions about contracts and the copyright law that it is not possible to set it completely straight in this space. A complete and mutually satisfactory agreement between the author and the publisher should always be reduced to clear and understandable writing.

Equally important as the contract, which is after all a fairly well settled and routine matter in these days with a recommended or model agreement drawn up by the Author's Guild, is an understanding of the marketing procedure of the publisher and of his conception of the market for your particular

(*Continued on page* 138)

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Electronic Industries'

ANNUAL INDEX—1956

The annual Article index of ELECTRONIC INDUSTRIES & Tele-Tech 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.

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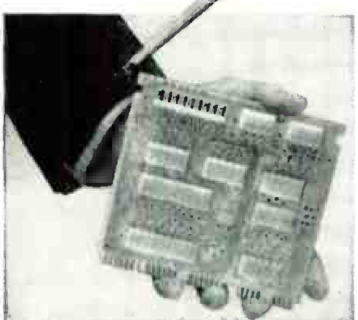
COMPONENTS, CHASSIS ELEMENTS

(Continued on page 132)



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REMOTE

TURNTABLES

EDITORIALS

GENERAL

INSTRUMENTS, MEASUREMENTS, TEST METHODS

MAGNETIC MATERIALS & AMPLIFIERS

MICROWAVES

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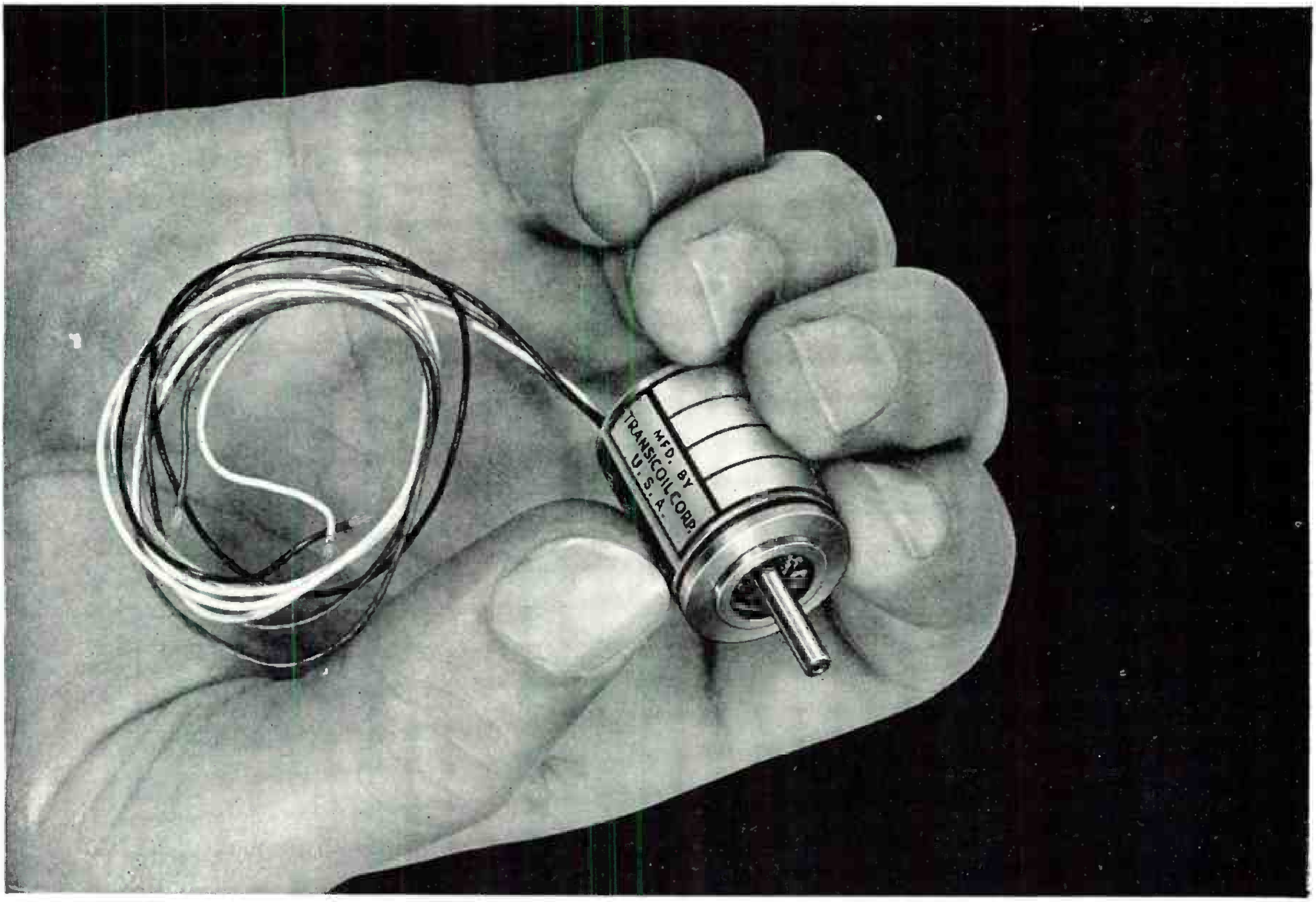

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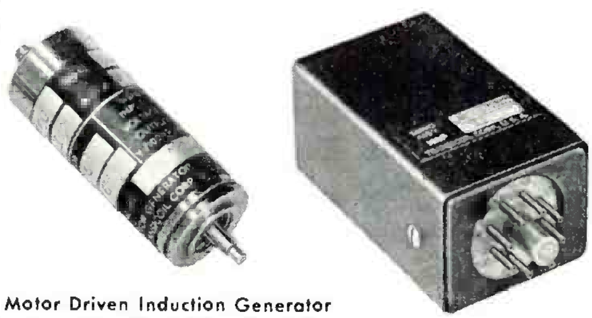

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Compared with a Size 9 control motor—until now, the smallest practical unit available—Transicoil's new Size 8 measures only 0.75 inches in diameter, 10% smaller, and weighs only 1.4 oz., 40% lighter. Yet it operates on standard voltages from 26 to 52 volts, and 52 volts with center tap, at 400 cps, permitting push-pull transistor application.

Hence, just as Transicoil's introduction of plate to plate wiring eliminated the transformer, once necessary in servo systems, the Size 8 units and transistor amplifiers mark another milestone in miniaturization.

This is just one more example of how Transicoil can solve your control problems whether they involve miniaturization or control complexity, and go on to manufacture systems and components of the utmost precision and accuracy. You pay only for results—on a fixed fee basis for equipment delivered and performing properly.

Technical data on the new Size 8 combination and the transistorized amplifier is yours for the asking. But you'll end up with a better system if you write outlining your servo control problem.

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Annual Article Index (Cont.)

Avco Units Discontinue Radio, TV Production

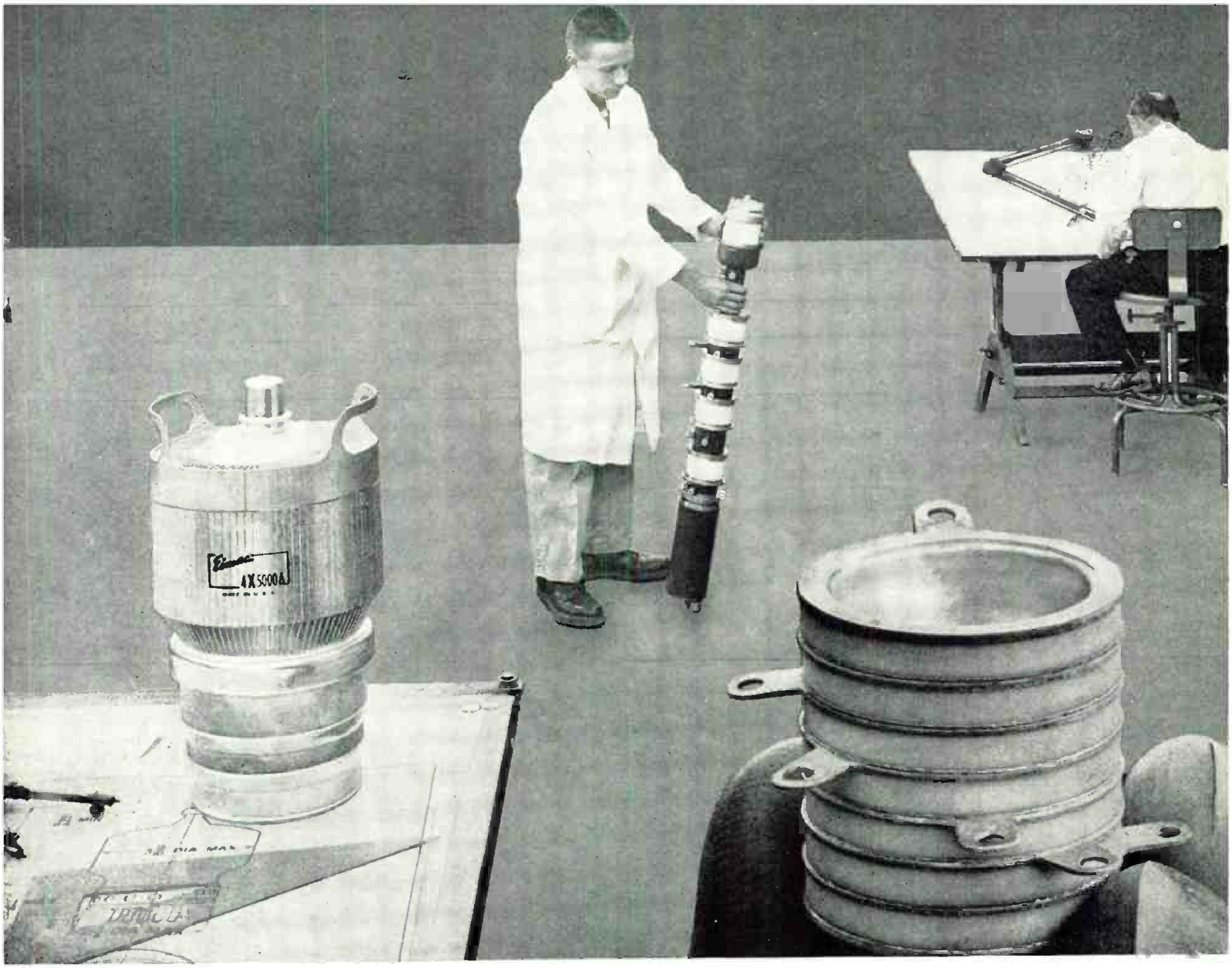
Crosley and Bendix Home Appliance Divs. of Avco Mfg. Corp. were to discontinue appliance, radio and TV receiver operations as of Nov. 30.

Avco said that move was made to eliminate "certain unprofitable operations" and to devote its resources to profitable and rapidly expanding commercial, industrial. defense and broadcasting operations. Special emphasis will be placed on developing defense operations and broadcasting business, Avco stated.

Electronic Ticket Plan

Over $2,000,000 is being spent by National Airlines to improve passenger service and install system-wide electronic reservations equipment built by Teleregister Corp., Stamford, Conn., an Ogden Corp. subsidiary. Cancelled space will thus be immediately available for re-sale and reservations may be obtained more quickly.

Called a Magnetronic Reservisor, the system will be installed in key cities such as New York, Philadelphia, Washington, New Orleans and Miami in time for heavy winter-time travel next year. Central electronic equipment will be in Miami.



Eimac ceramic tubes open up new horizons

The future of many electronic applications depends on the ability of the electron tube to overcome extreme shock and temperature barriers. Anticipating this need, Eitel-McCullough has extended its leadership in transmitting tubes to the development and production of ceramic tubes in the negative grid, klystron, rectifier, and receiving tube field.

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In its new ceramic line, Eimac is enabling the electron tube to overcome old barriers and establish new goals of performance and dependability.

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For further information on Eimac's full line of electronic tubes, contact our Application Engineering Department and ask for the new Quick Reference Catalog.

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(*Continued from page* 128)

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In addition to authoring your own book or magazine article, you may find opportunity to review manuscripts for publishers (if you are a recognized authority) and you may also be asked to contribute to books being done by a group of authors, work on a research paper or series, or become an editorial consultant. All these useful activities may be yours if you simply take the time to develop your writing ability, have something to say, and say it clearly. Perhaps the major reward is in your own satisfaction of your contribution to our technical and human progress in a world where books have led to a greater expansion of the human spirit through scientific and technical development. In any event you owe it to yourself to express your experience in black and white.

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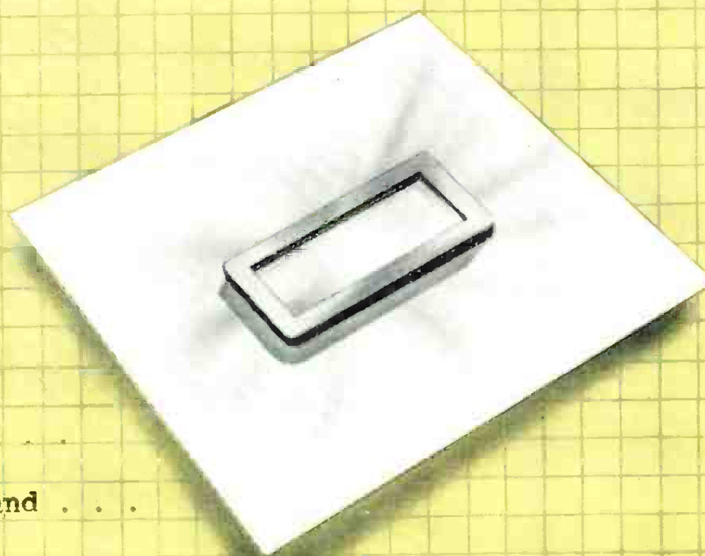

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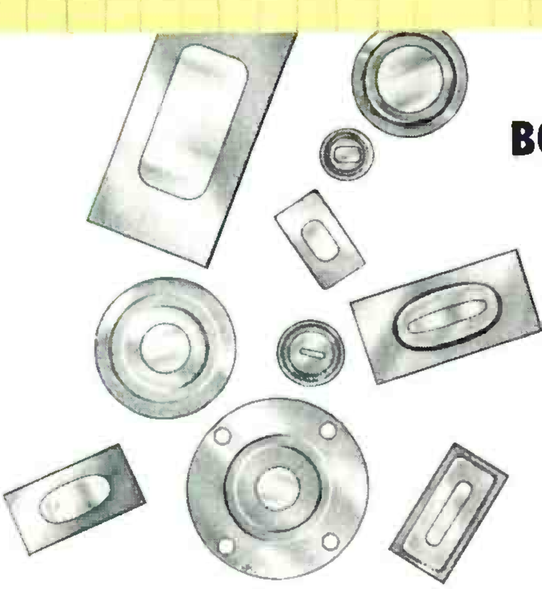
Truly nonresonant to handle higher powers . .

Pressure differential: 17 lbs./sq. in. . .

Solders directly to waveguide flange . . .



BOMAC produces a complete line of windows

Bomac manufactures a complete line of mica, glass, or ceramic pressurizing windows for all waveguide sizes — and offers experience and facilities unmatched in the industry for developing special windows to meet individual requirements. Bomac pressurizing windows are pressure and vacuum-tight — shock and vibration-proof — built to withstand pressures of 45 Psi, or more, and temperature ranges of −55° C to 100° C.

Write today for complete specifications. **Bomac Laboratories, Inc.**

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RCA PREFERRED TUBE TYPES PROGRAM

answer to a growing design problem

...in home-entertainment receivers

RCA meets the needs of TV, AM, FM
r designers and manufacturers... with
' and up-to-date Preferred Tube Types
lored to the industry's requirement for
*num number of tube types having the
t over-all usefulness.*

introduced by RCA in 1940, the Pre-
Tube Types Program aimed at concen-
production on the most useful radio
r types to improve tube quality by
more efficient production runs—and to
e tube availability by decreasing stock-
uirements. Was it effective? Yes! By
l of 1940, five million receivers had
signed and built around 36 RCA Pre-
Tube Types—and 20 receiver manufac-
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y—after two years of careful engineer-
lysis of radio *and* TV requirements—
ffers a comprehensive selection of 61
d Tube Types capable of handling virtually every TV, AM, and FM receiver circuit function now covered by hundreds of types available to the industry. The benefits to you: (1) Lower tube costs, (2) More uniform tube quality, (3) Standardization on fewer types of circuit components, (4) Better tube availability and faster delivery to support continuous production schedules, (5) Simplification of stocking and warehousing problems, (6) Increased customer satisfaction through ready tube availability from RCA Tube Distributors.

So whether you are interested in black-and-white or color TV receivers, portables or car radios, AM or FM sets or phono amplifiers, it will pay you to design around RCA Preferred Tube Types. For technical data on any Preferred Tube Type, refer to your RCA Tube Manual or RCA Receiving Tube Handbook. For further details on the RCA Preferred Tube Types Program, call your RCA Field Representative.

RCA Preferred Tube Types for Radio Receiver Applications

Rectifiers and Diode Detectors	Converters	Amplifiers, Oscillators, and Mixers					Output Amplifiers
		Triodes		Pentodes			
		Twin	With Diodes	Sharp Cutoff	Remote Cutoff	With Diode	
5Y3-GT 6AL5 12X4 35W4	1R5 6BE6 12BE6 6X8	6CG7 12AX7	6AV6 12AV6 12BF6	1U4 6AU6	1T4 6BA6 12BA6	1U5	3V4 6AQ5 35C5 50C5 12AB5

RCA Preferred Tube Types for TV Receiver Applications

Amplifiers and Detectors					Deflection Oscillators & Control Types	Sound and Video Detectors
IF	Video	Audio	Deflection	HV Reg. Type		
3CB6 6CB6 3AU6 6AU6 3BZ6 6BZ6	6AW8-A 12BY7-A	5AQ5 6AQ5 6AV6	6S4-A 6W6-GT 12W6-GT 6CM7 6DQ6-A 12DQ6-A 6CD6-GA 6CB5-A**	6BK4**	6CG7 3BY6 6BY6 6CM7	3AL5 6AL5 3DT6 6DT6

Tuner Tubes		Rectifiers		
RF Amplifiers	Osc.-Mixers	High Voltage	Low Voltage	Damper Types
6BZ7 3BC5 6BC5	2AF4-A* 6AF4-A* 6U8 6X8 5CG8 6CG8	1B3-GT 3A3** 1V2**	5U4-GB	6AX4-GT 12AX4-GTA 6AU4-GTA

*For UHF Oscillator **For Color TV only

NEW RCA BROCHURE ON PREFERRED TUBE TYPES

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