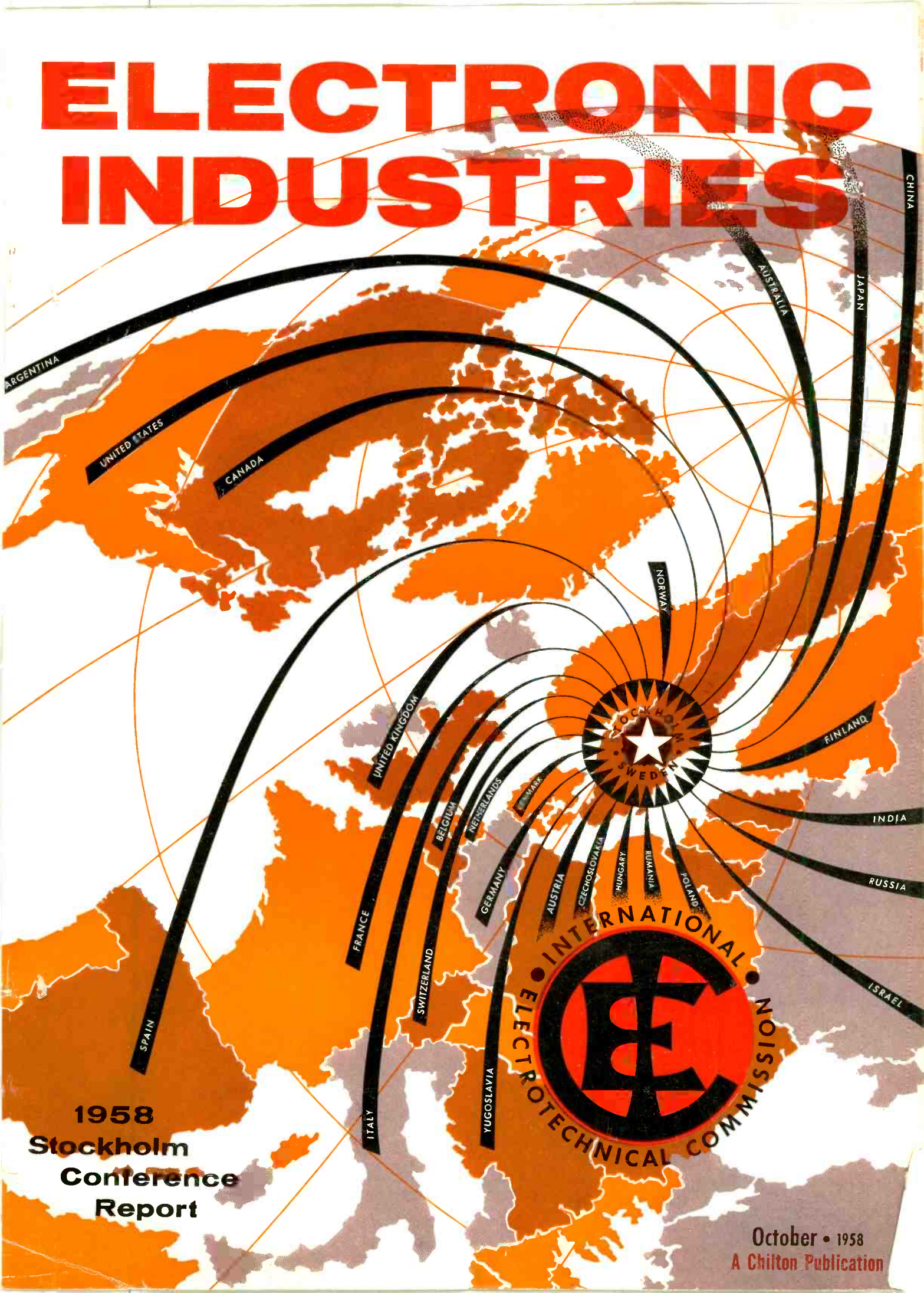
ELECTRONIC INDUSTRIES



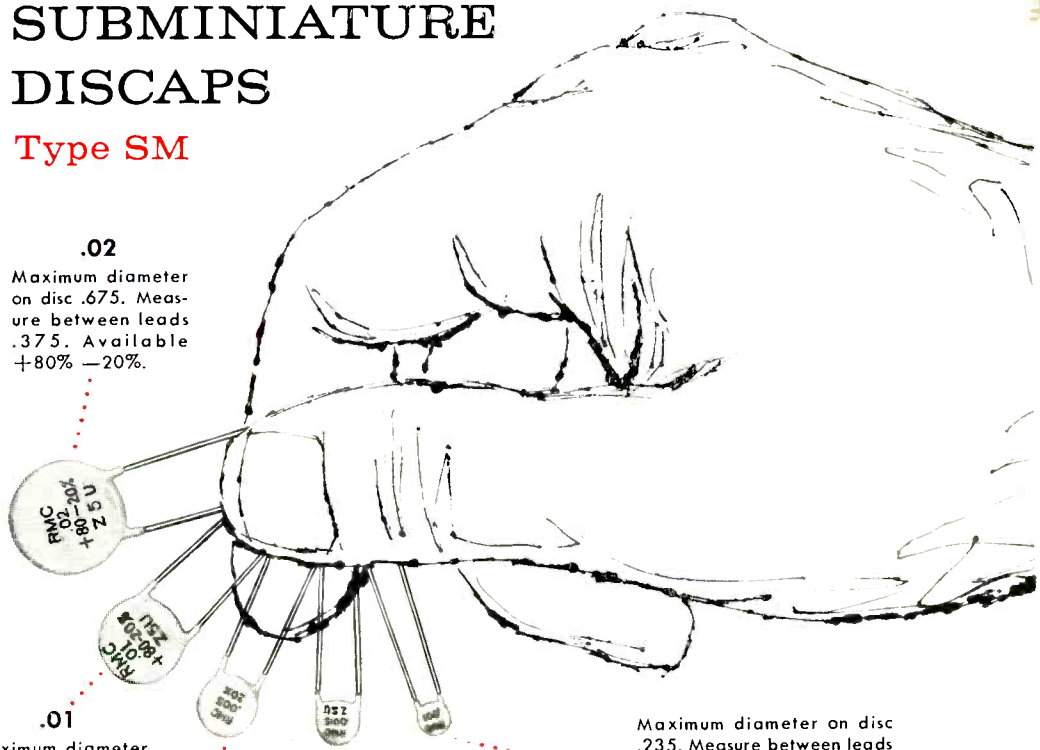
1958 Stockholm Conference Report

October • 1958
A Chilton Publication

...where space and quality are at a premium

SUBMINIATURE DISCAPS

Type SM



.02
Maximum diameter on disc .675. Measure between leads .375. Available +80% —20%.

.01
Maximum diameter on disc .510. Measure between leads .375. Available +80% —20% or ±20%.

.005
Maximum diameter on disc .390. Measure between leads. .250. Tolerance ±20%.

.0015
Maximum diameter on disc .290. Measure between leads .250. Tolerance GMV.

.001
Maximum diameter on disc .235. Measure between leads .150. Capacities available are 800 and .001. Tolerance GMV.

Type SM DISCAPS answer the need for ceramic capacitors in the small sizes required in many applications. These miniature capacitors are manufactured without sacrifice of quality, dependability, or electrical characteristics built in all DISCAPS.

Write for information.

SPECIFICATIONS

POWER FACTOR: 1.5% Max. @ 1 KC (initial)

WORKING VOLTAGE: 500 V.D.C.

TEST VOLTAGE (FLASH): 1000 V.D.C.

LEADS: No. 22 tinned copper (.026 dia.)

INSULATION: Durez phenolic (⅛" max. on leads) —vacuum waxed

STAMPING: RMC—Capacity—Z5U

INITIAL LEAKAGE RESISTANCE: Guaranteed higher than 7500 megohms

AFTER HUMIDITY LEAKAGE RESISTANCE: Guaranteed higher than 1000 megohms

DISCAP CERAMIC CAPACITORS

RMC

RADIO MATERIALS COMPANY
A DIVISION OF P. R. MALLORY & CO., INC.
GENERAL OFFICE: 3325 N. California Ave., Chicago 18, Ill.
Two RMC Plants Devoted Exclusively to Ceramic Capacitors
FACTORIES AT CHICAGO, ILL. AND ATTICA, IND.

Circle 1 on Inquiry Card, page 121

ELECTRONIC INDUSTRIES

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

Bread Costs More!

IF you are the head of a family that uses a loaf of bread each day you should be aware of the fact that you have just taken a cut of $7.30 in your annual income. The major bakeries in New York City and in Philadelphia have just announced price increases of two cents per loaf. The reason . . . passing along to the consumer the increased labor costs that new union contracts provide for. The spread of these increases nationally is inevitable. What's worse is that these increases might signify the beginning of another upward price spiral or a further cut in your annual income.

In a recently published booklet entitled "The Cruelest Tax" by Mr. T. V. Houser, Chairman of the CED (Committee of Economic Development) Subcommittee on Inflation, it is pointed out that over the period 1947-57 the inflationary price rises amount to some 26%. This is quite an item to reflect itself in your immediate purchasing power, your savings, your fringe benefits, your insurance and your old-age security. What can be done about it?

Being aware of the situation is a first step. Another is the announcement by the Gulf Oil Corp. that its plans to give organized labor a battle in the political arena. Senior Vice President Archie D. Gray recently in the *Washington Post* and *Times Herald* said "If we are to survive, labor's political power must now be opposed by a matching force, and there is no place in the United States where such force can be generated except among corporations that make up American business. . . ."

In T. V. Houser's booklet mentioned above, the following items are recommended to keep labor costs and prices from rising when demand is not excessive:

(a) Encourage as rapid a rise of productivity as possible—to maximize the increase of wage rates and other income that is consistent with over-all price stability.

(b) Strengthen competition in both business and labor markets to minimize the power of business or labor to charge excessive prices or wages.

(c) Expect both business and labor to exercise responsibility their powers over prices and wages and to do so in a manner consistent with price stability.

All of the steps outlined above make sense to us and we believe that they will make sense to you as well. But more than this . . . the items listed refer to the performance of action only as business or as labor "groups." Our past history reveals that America's greatest strength and her greatest successes have come when her people work individually and collectively for a common cause. We believe inflation is such a common cause . . . as important and in many respects similar to the cold war.

To us, as individuals, "awareness" is probably our best weapon. . . . Become aware of how many dollars you lose with each price increase on items you normally buy. Talk about these price increases with your associates, your friends and neighbors. Become more active in civic and political affairs. As more people become acutely aware of what inflation means to them in dollars new ideas and more direct action will be forthcoming.

The price of bread has gone up again . . . and we are already spending 26 cents out of every dollar for nothing. Let's stop it!

Copies of Mr. T. V. Houser's booklet "The Cruelest Tax" are available from the Committee for Economic Development, 711 Fifth Avenue, New York 22, N. Y. Cost is 50 cents per copy.

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ELECTRONIC INDUSTRIES

Vol. 17, No. 10 October, 1958

MONTHLY NEWS ROUND-UP

NEW PRODUCTS & TECH DATA

DEPARTMENTS

Highlights

Of This Issue

Design Nomographs for Transistor Narrow Band Amplifiers page 78

A handy short cut for transistor circuit designers, these nomographs have been designed to determine the optimum performance of a transistor as a narrow band amplifier in terms of its available or measurable operating parameters and a desired skew factor.

Spurious Response Tester page 85

The increasing use of highly selective oscillator circuits has made it important to be able to quickly determine the spurious responses in a given crystal, particularly under field conditions. This unique equipment, a test instrument for field use, uses a sawtooth signal to slowly sweep the crystal unit and provides synchronized display on an oscilloscope face.

An Inexpensive Ultra-linear Output! page 89

The husky audio output transformer, most expensive component in the hi-fi amplifier, can be replaced by a dual potentiometer, a twin triode vacuum tube and two resistors.

Radio Interferometers For Tracking page 94

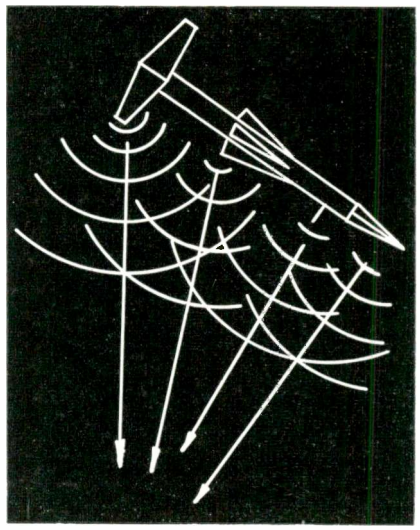
Radio phase-difference methods are being used to provide continuous airborne vehicle directors. A geometric method is one of the more common methods employed. A description of this method and over coming the problems encountered are discussed.

Dynamic Compression For Radar Receivers page 102

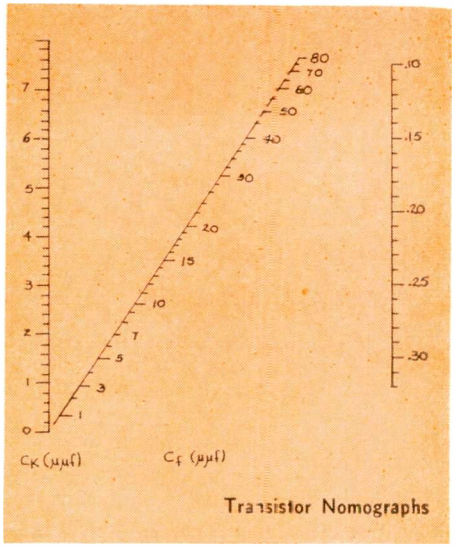
Graphical procedures aid the analysis of dynamic compression to provide the optimum use of the range of light output of the cathode-ray tube. Selection of the curve is discussed primarily in terms of the dynamic range of the input signals and the range of the output voltage as limited by the characteristics of the CRT.

Applications of Zener Diodes! page 108

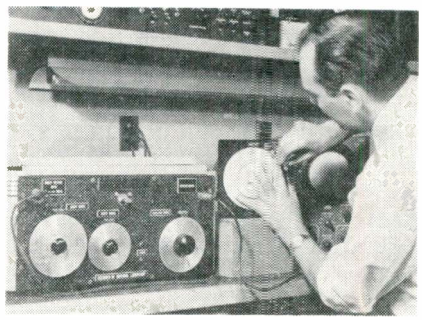
One of the newest of the electronic components, the zener diode offers high current handling capabilities in a small package, useful in the design of light weight, compact equipment. It is finding a wide variety of applications, as regulators and limiters, bias regulators and threshold controls.



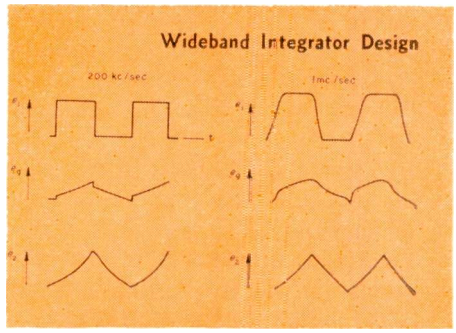
Radio Interferometers



Transistor Nomographs



Testing Spurious Response



COMING NEXT MONTH—"SURVEY OF MICROWAVE TUBES"

An up-to-the-minute treatment of one of the most progressive of the electronic arts. Microwave tubes are discussed in two general categories: the long-established klystrons, magnetrons and planar triodes; and the new fast-moving field of traveling wave, backward wave, and forward wave tubes. Points of general theory are discussed, together with descriptions of the advantages and disadvantages of each. Included is a comprehensive listing of all microwave tubes available—and a glossary of microwave tubes terms and abbreviations.

RADARSCOPE

FLYING "ROAD MAP"

Cockpit chart with automatic stylus marking helicopter's position is demonstrated by Capt. I. J. Kersey, of Airways Modernization Board. The new Bendix-Decca Navigator system is being checked out on N. Y. Airways helicopters as part of the AMB evaluation.

R & D EXPENDITURES are up an average of 4% this year over 1957, according to a recent survey by American Management Association.

SEMICONDUCTOR ART takes a significant stride forward through a new Sylvania development which produces highly purified silicon. By today's standards silicon is considered to be pure if a balance exists between its N type and P type impurities; actually it is truly pure only if it has been purged of both types of impurities. The Sylvania process achieves this for the first time, and permits the full potential of silicon to be realized in semi-conductor devices.

ELECTRONIC HIGHWAYS where the automobile driver hands over the control of his vehicle to automatic devices is described in a patent issued last month to RCA. A pair of sensing devices on the car follow a cable set into the roadway and control the steering. RCA has already demonstrated the system to a number of highway agencies.

FLYING "WEATHER SENSING" SYSTEM designed "to probe the atmosphere on a global scale" is under development for the U. S. Air Force. Boeing and Bendix Aviation will collaborate on the project in which four-engined Air Force jets will be equipped with multiple radars, instrument-packed rockets, atmospheric sensing equipment and electronic computers. They will be in continuous communication with ground stations that will process and relay weather data over a national network.

TEFLON-COATED METAL FOILS for capacitor and transformer applications developed by Materials Research Corp. fill the need for thin metallic tapes having good dielectric properties. The new MRC process produces an integral coating, also metal and Teflon react as one to temperature changes. Pinhole count is exceptionally low—at 200 v. a 0.3 mil coating on 1 mil copper tape reveals a pinhole density of 0.25/sq. ft.

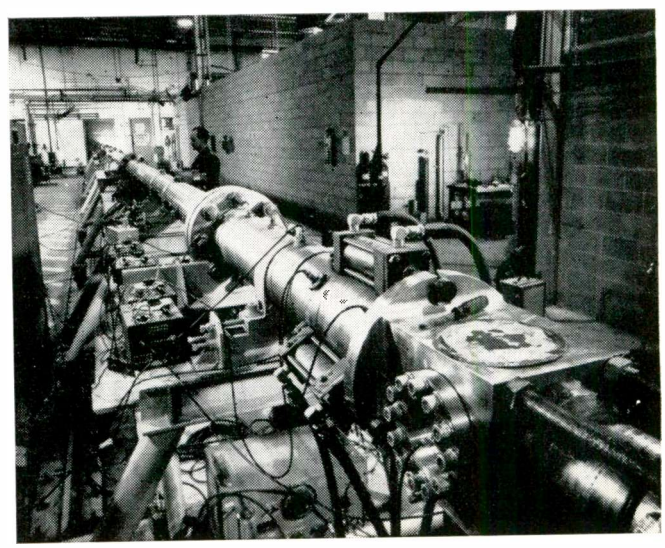
TRANSISTOR MARKET is estimated by Dr. W. J. Pietenpol, new vice-pres. of Sylvania's semiconductor div. at 225,000,000 units by 1963—a five fold increase over 1958 total.

COMMERCE DEPARTMENT has added a number of electronics items to the "positive" list — items which may be shipped to the satellites only under special license.

AUTOMATION EQUIPMENT drew a high level of interest at the Brussels Fair, leading observers to predict that Western Europe will see a widespread application of automatic controls during the next three to five years. Queries dealt primarily with optical design, machine tool control, photogrammetry, inventory control and highway design.

FOR SPACE TECHNOLOGY

This 120-ft. long shock tunnel at G.E., the largest in the country, is used to study space vehicle design requirements at velocities up to 25 times greater than the speed of sound for re-entry information.



FM BROADCASTERS are concerned that the proposals for wideband stereo multiplexing of the FM channels will wipe out the supplementary communications services now being offered or considered by many FM stations. At issue is the wideband multiplex stereo adapter, which utilizes a subcarrier at a center frequency of 50 KC. It would enable unauthorized listeners to receive communications presently supplied on a restricted basis.

MILITARY SPECS are now calling for transistor reliability on the order of .01% failure in 1,000 hours. Semiconductor scientists are working toward the goal of "absolute reliability." A basic problem says Dr. Bernard Jacobs, director of research at General Transistor Corp., is the prevention of contamination. And this is a question of better sealing.

HIGH DENSITY AIR TRAFFIC control tests are now beginning in the New York City area. Both military and civil aircraft are participating. The tests will determine employment procedures in a common civil-military air traffic control radar beacon system in high density areas. The Airways Modernization Board, which designed the system, is sponsoring and directing the tests.

MEDICAL ELECTRONICS is now being organized on an international basis. A group of 76 representatives from 11 countries met at the new Faculty of Medicine in Paris this summer to plan expanded international cooperation in the field of medical electronics.

FOURTH BRANCH of the Federal Government—a Permanent Council on Plans and Policies—was recommended by John L. Burns, pres. of RCA. The group, he urged, would be made up of top-ranking leaders from many fields. It would "establish farsighted objectives and plans which will not be affected in a major way by short-term considerations."

HIGH-ALTITUDE RESEARCH is being carried out by North American Aviation XSM-64 guided missiles as background for the design of the B-70, America's first 2,000 mph bomber under development at North American's Los Angeles Division. The XSM-64 flights at Cape Canaveral are gathering information on aerodynamics and other aspects of supersonic high-altitude flight.

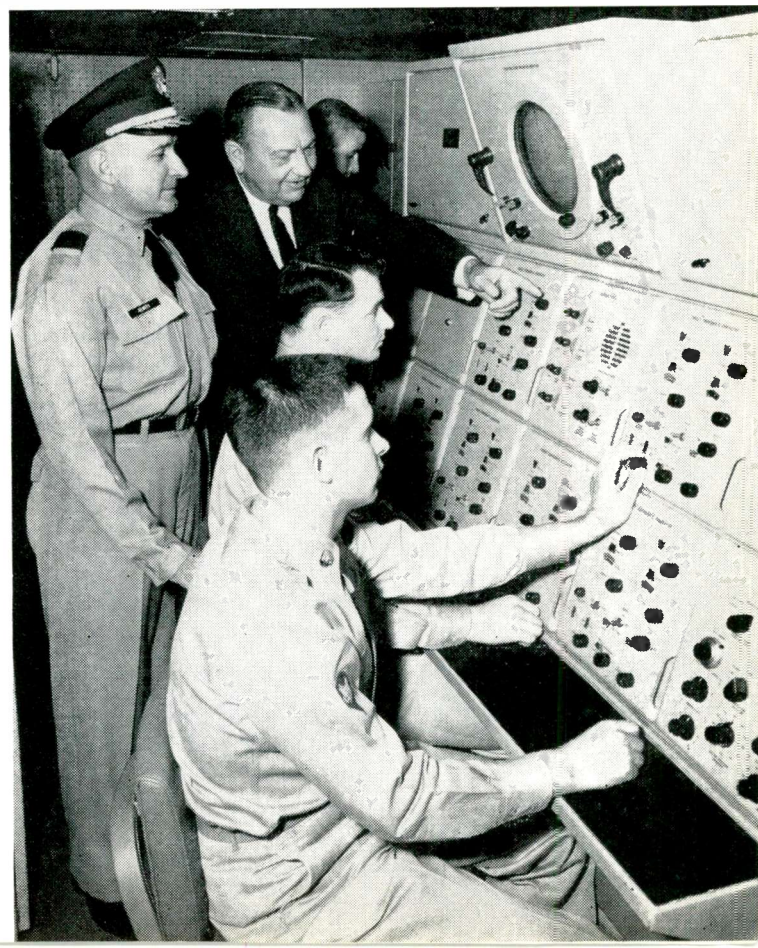
NEW INSULATION MATERIALS, derived from silicon, are producing electric motors that have theoretical life times of "over 1,000 years." Units were described to the recent National Conference on the Application of Electrical Insulation that have operated continuously at 300°C. for 6,600 hours, and for 8,000 hours at 280°C.

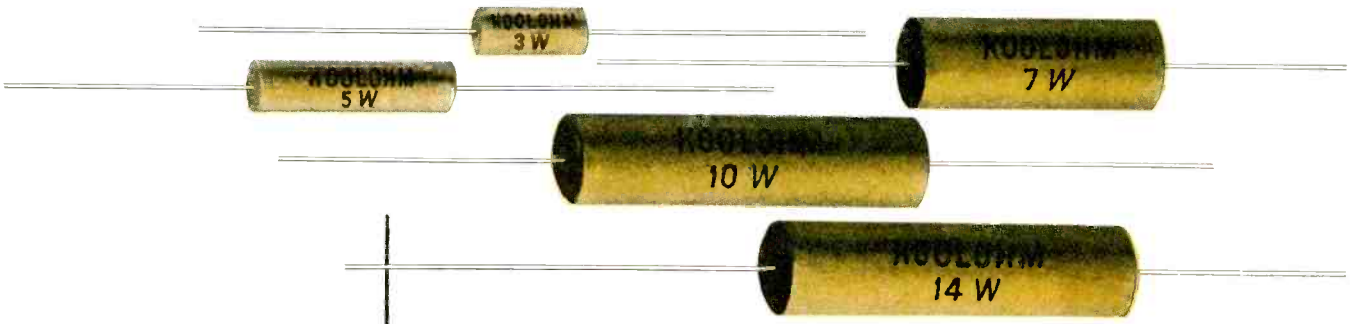
MISSILES will find many peaceful applications as well. Now in the design boards are missiles for fire fighting, particularly in airplane accidents, for mail carrying, and freight. Radioplane Division of Northrup Aircraft is working on a unique helicopter-missile that would need no pilot and can be used to dust crops from the air or lay ground cables. The missile fire engine is actually only a very short step from reality. In actual use it would be mounted on a control tower roof and would be directed to a craft site in a matter of seconds, to provide preliminary protection until the fire fighting equipment could arrive.

FOREIGN TV took its biggest spurt in history during the first quarter of this year when almost 2,100,000 new receiving sets went into operation. The Non-Communist world added 1,500,000 receivers in a three-month period and the Communist bloc countries 600,000, raising the combined total abroad to 18,478,800 as of March 31. It is estimated that by the end of this year 25,000,000 TV receivers will be in use abroad, a boost of 5,000,000 over the original expectations of 1958.

MISSILE-MAN TRAINER

New, mobile electronic trainer, developed and built by International Telephone and Telegraph Corp. to teach Nike missile-men and other anti-aircraft crews how to intercept enemy planes was unveiled by the Army. Checking missile crew are Brig. Gen. Robert A. Hewitt, CG of the 52nd Art. Brigade and ITT's T. M. Douglas.





ILLUSTRATED IN ACTUAL SIZE

KOOLOHMS

NEW SMALLER SIZE KOOLOHM® RESISTORS

with improved performance

Sprague's new smaller size Koolohm Resistors are designed to meet modern industrial requirements for insulated-shell power wirewound resistors that will perform *dependably* under the severe duty cycles encountered in heavy duty industrial electronic equipment.

NEW CONSTRUCTION IMPROVEMENTS

1. Leads are welded to drawn metal cap ends.
2. Ceron (ceramic insulated) resistance wire wound under controlled tension on special ceramic core. Makes possible multi-layer non-inductive windings as well as very high resistance value conventional windings.
3. Finished resistance elements are given unexcelled mechanical protection by non-porous ceramic outer shells—sealed with high temperature silicone end cement.
4. Insulated shell permits mounting in direct contact with chassis or "live" components.
5. *Aged on load* prior to final test and inspection to stabilize resistance value and assure outstanding performance on load-life tests!

The advanced construction of these improved Koolohm Resistors allows them to operate at "hottest spot" temperatures up to 350°C. You can depend upon them to carry maximum rated load for any given physical size.

SEND FOR ENGINEERING BULLETIN 7300—SPRAGUE ELECTRIC COMPANY
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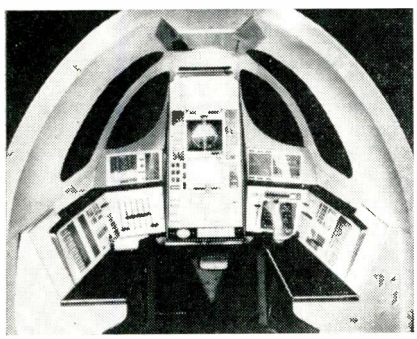
As We Go To Press...

Lear Delivers Space Ship Cockpit to AF

A full-sized cockpit mockup designed by Lear, Inc., for a hypothetical aircraft of the next decade was delivered to Wright Air Development Center earlier this month to support the USAF-WADC Whole Panel Study and Development Program. Designated the Mark III, the model represents the third and final phase of a year-long study by the Lear Advance Engineering Division to design and build a cockpit suitable for futuristic aircraft capable of operating in the Mach 5 range. Purpose of the study was to investigate the shortcomings of today's cockpits, to anticipate the problems that will exist in future aircraft and to advance some original thinking, which, with further research, should go far toward providing solutions to these problems.

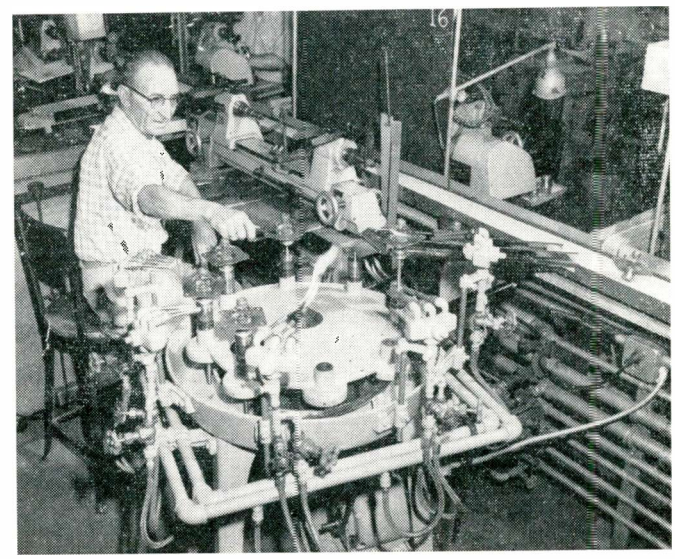


Cockpit of future space ship.

The Mark III cockpit is based on the pilot-manager design concept whereby the pilot, like the director of a corporation, is freed from those routine tasks best performed either by automatic devices or by the crew and is given, instead, basic and carefully-selected summary information from which he can make rapid and intelligent management decisions.

Each display is arranged in the cockpit according to the pilot's need. Vital information or information of an emergency nature is displayed in the center panel directly in front of the pilot, with less - frequently used indicators, dials and switches to the right and left. Related information is grouped together for quick assimilation by the pilot.

MICROWAVE TUBES



Automatic annealing machine, developed by Raytheon Mfg. Co. for its magnetron production, carries glass-to-metal subassemblies past gas jets. Heat is pinpointed and graduated to equalize stresses.

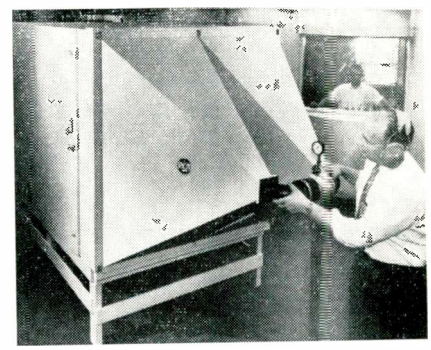
"Loudest Speaker," to Check Missile Gear

To test sensitive electronic gear for jet planes, missiles and rocket ships, engineers at RCA have developed a new device believed capable of producing the world's loudest controlled noise.

The Compressed Air Loudspeaker (CAL) can generate noise of 160 db, more than 10,000 times as intense as the bedlam of the heaviest street traffic, and 20,000 times as great as that of the typical television set at maximum volume.

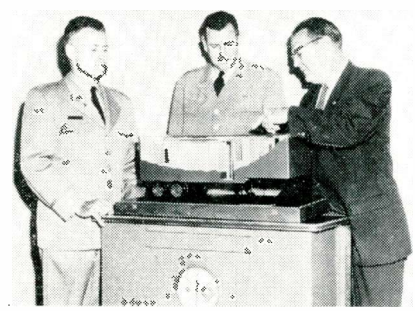
The unit is a plywood box measuring 5 x 5 x 6⅔ ft. with dual horns resembling a pair of overturned pyramids projecting from the box. Attached to the tip of each pyramid is a metal pipe leading to the CAL's "plumbing system."

While the modulated compressed air noise system is considered of great value for testing equipment, its developers also see its possibilities as a loudspeaker. The dual horn unit should prove useful in areas of extremely high noise levels—such as jet airfields, the flight deck of a jet-age aircraft carrier, in certain types of industrial plants, and in civil defense work. If opened up to its maximum capabilities, engineers believe that CAL could project the human voice a distance of 10 mi. or more.



RCA engineer A. L. Witchey adjusts the compressed air stream that generates noise in the two pyramidal loudspeakers.

ARMY'S MOBILE COMPUTER



MOBIDIC, the army's new mobile general purpose computer, is checked by Col. J. E. Kelsey, Brig. Gen. E. F. Cook, and A. L. Milk, vice-pres. of Sylvania. The all-transistorized digital computer fits into a 28-ft. trailer.

More News on Page 9

As We Go To Press . . .

Night Vision Device Uses Light from Stars

A new night vision device enables troops to see military objectives at night with the aid of light obtained from the stars.

Developed by the U. S. Army Engineer R & D Labs., Fort Belvoir, Va., and RCA, the new device is known as the "Cascaded Photosensitive Image Intensifier."

Heart of the instrument is a cascaded image tube, actually two tubes working in a series and operating through an optical system which focuses the light reflected from objects in the field. The first tube acts as preamplifier for the second which in turn further amplifies or intensifies the light and presents the image on the viewing surface. The tube is powered by current at approximately 25,000 volts, furnished by a compact six-volt battery through a system of transformers and transistors.

Possible civilian uses for the tube include its installation on an astronomical telescope to extend its range and sensitivity; in the making of certain x-rays using a substantially reduced level of radiation, or viewing of minute flashes of light emitted by nuclear particles, thereby giving scientists a better understanding of their behavior.

ADEQUATE WARNING

The beam from the radar set in the Douglas C-133A Cargomaster is detected by a new device worn by its designer, P. C. Barnes of Douglas. The alarm warns ground personnel to avoid high intensity radar beams.

More News on page 14

ELECTRONIC SHORTS

▸ A new method of training Nike missile-men simulates an attack. Housed in a 20-foot trailer, the trainer duplicates actual battle conditions. Under direction of a control officer, various combat problems are simulated with the device, exactly as they might occur in actual combat—including the first identification of an enemy plane, "jamming" of signals of the enemy, tracking of the aircraft, "firing" of a missile and "destruction" of the enemy plane. The device can inject six synthetic aircraft targets into the control radars, with each of the simulated targets having the characteristics of extremely fast, maneuverable planes.

▸ Techniques developed by RCA in the design and development of the Talos defense unit will play a vital role in the Ballistic Missile Early Warning System (BMEWS). The Talos defense unit is one of the most completely automatic launching and guarding systems for missiles. In response to warning signals from outlying outposts, it can load missiles, compute the proper points of interception, fire the weapons and guide them automatically to their targets without the help of a human hand.

▸ Radio equipment for a new street lighting system designed to make State St., Chicago, the world's most brightly-lighted avenue will be supplied by General Electric Company's Communication Products Dept. Beep signals similar to those transmitted by earth satellites will be the basis of the new radio-controlled system. Connected to the master control transmitter will be an automatic coding and timing device which will send out the proper beep code. Receivers located in the base of each light pole will pick up the signals, decode and amplify them and thereby control the lights.

▸ Although designed for national defense purposes, CONELRAD now will be used to distribute weather bureau warnings of impending disasters such as may be threatened when a hurricane suddenly changes course or speeds up faster than anticipated. Already this year, the CONELRAD facilities have been used effectively in several localities to warn of approaching tornados.

▸ Two hundred and fifty high school teachers have completed a special summer session mathematics course with an assist from closed circuit TV. Dr. Arnold Ross, head of the Notre Dame mathematics department, where the session was conducted, stated that Notre Dame officials have wished to try teaching via television for some time. Mathematics teachers make an especially valuable audience for the experiment because "they are not only interested in mathematics but also have a professional interest in teaching and teaching methods."

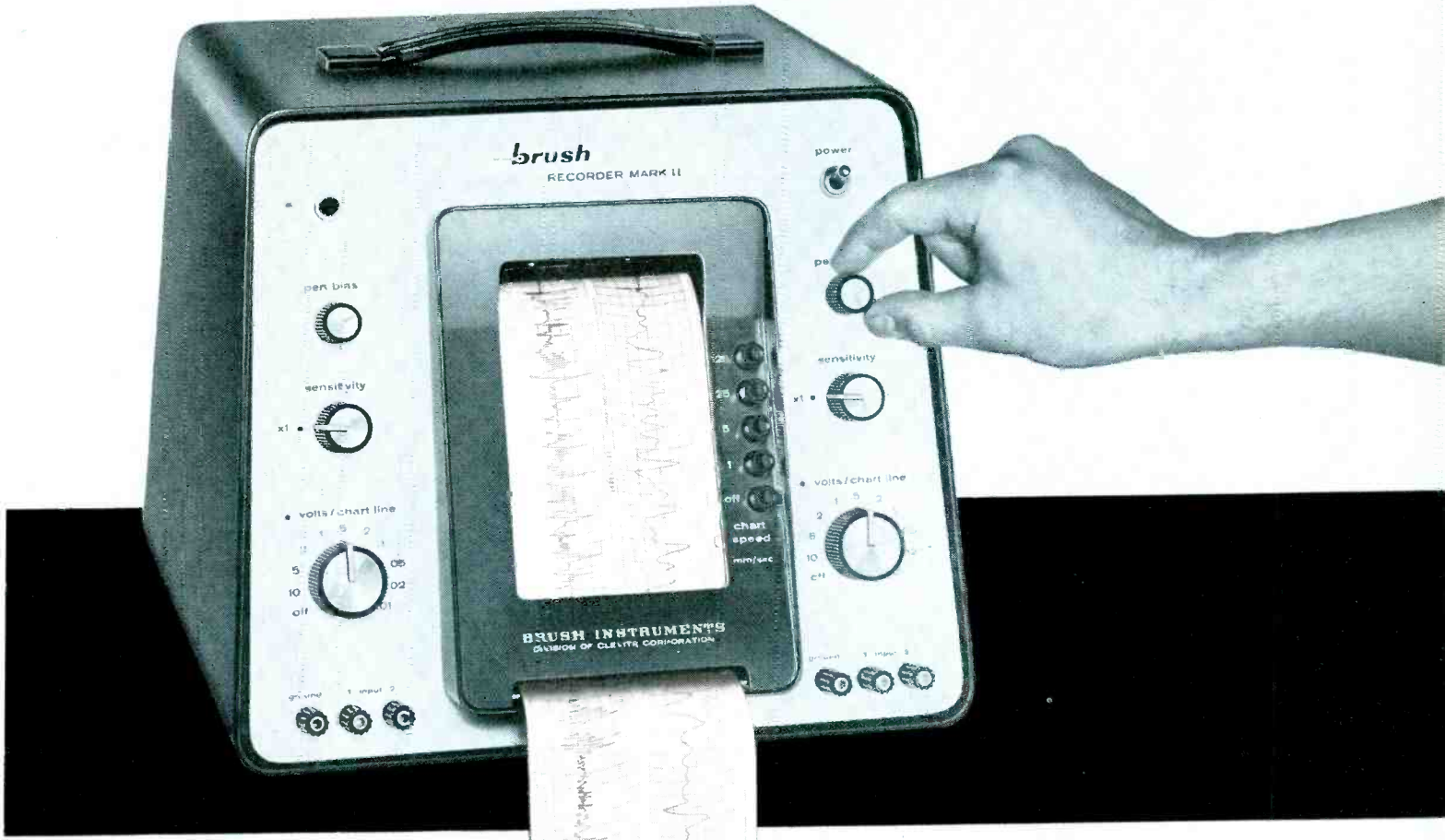
▸ A completely transistorized instrument system is being developed for a nuclear power reactor for the U. S. Army's cold-weather training station at Fort Greely, Alaska. The system, valued at over $100,000, will be capable of measuring accurately all neutron levels within the reactor proper. The station will be the first nuclear power facility in Alaska.

▸ The USAF's Air Defense Command has completed plans with the CAA for the joint use of military or civilian radar facilities in the control of air traffic throughout the U. S. The program is expected to be put into effect this fall. Similar plans are underway to provide joint radar control in Alaska and the Pacific. Thirty-one new high-powered, long-range radar facilities will be involved initially, with additional facilities scheduled for the future. The joint use program is expected to save millions of dollars in equipment, installation and recurring maintenance costs.

▸ Radio transmission tests using the moon as a passive relay station have been conducted recently by the Signal Communications Dept. of the U. S. Army Electronic Proving Ground and Collins Radio Co. These tests very probably represent the first time that intelligence, in this case radio-teletype, has been transmitted in the uhf region of 1000 MC over the nearly 500,000 mile distance from the earth to the moon and back.

▸ Elemental liquid fluorine, the most powerful of all known oxidizing agents, has been harnessed for space flight rocket propulsion by engineers of Bell Aircraft Corp. The chemical is so flammable it will ignite asbestos, leather, and even water on contact.

The New Brush Mark opens up whole new world of direct writing applications



Sensitivity
10mv/line (mm). Full scale deflection from chart center ± 200 mv.

Measurement Range
.010v. to 400v.

Input Impedance
5 megohm single-ended, 10 megohm balanced.

Frequency Response
D.C. to 100 cps.

Recording Channels
Four, 2 event channels and 2 analog.

Chart Speeds
1, 5, 25, 125 mm/sec.

Power Requirements
105-125v., 60 cps, 135 watts at 115v.

The portability and remarkable simplicity of the Brush Mark II make it practical to use *anywhere.*

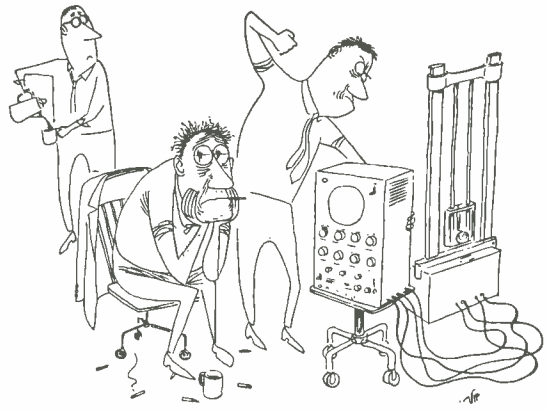
Wherever you work—in research, design and development, production, field testing—you get an immediate *ultralinear* record of performance . . for quick analysis and corrective action on the spot . . for study at a later date . . . for reproduction by conventional low-cost copy methods.

As foolproof as you'd hoped for, this recorder has built-in amplifiers, permanent calibration, instant paper loading and a "white glove" writing system. Use it as a recording voltmeter . . . as a supplement to your "scopes".

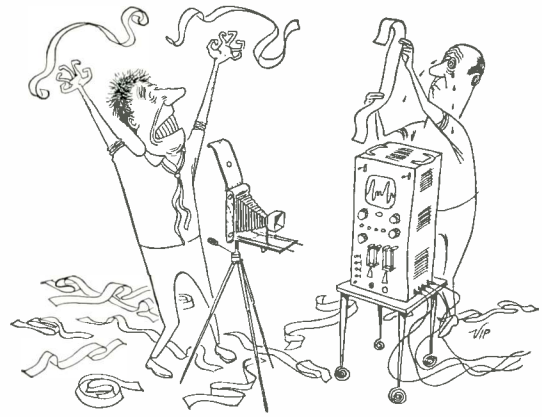
CALL-WRITE-WIRE for immediate shipment from stock — $1350 F.O.B. Cleveland.

brush INSTRUMENTS
DIVISION OF
3405 PERKINS AVENUE CLEVITE CORPORATION CLEVELAND 14, OHIO

Circle 7 on Inquiry Card, page 121

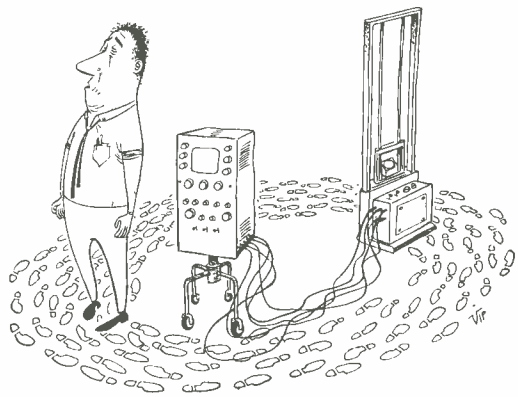


PROBLEM:
Wasted Effort in Capturing Transients

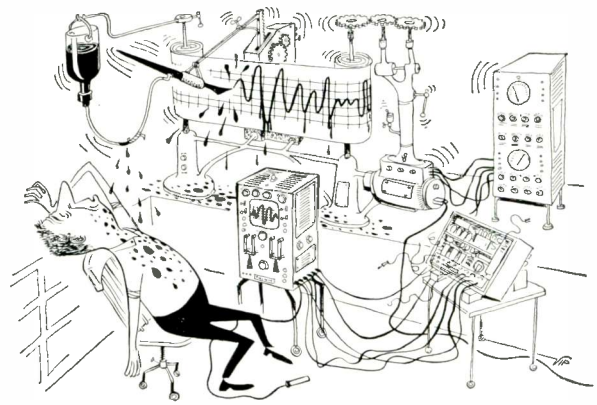


PROBLEM:
Wave-form Photography

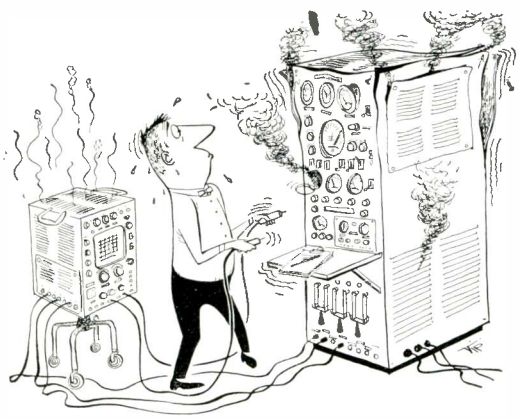
six not-so-funny problems...



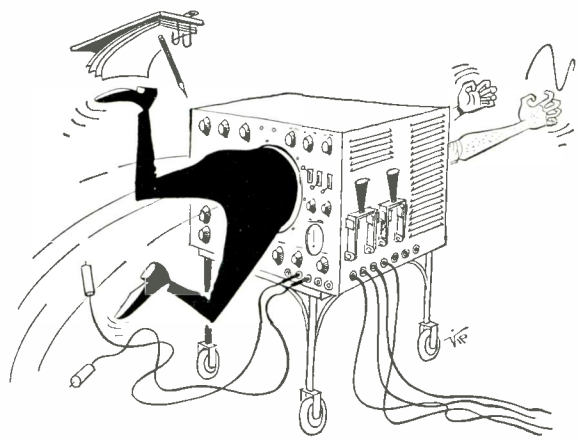
PROBLEM:
Duplication of Research Effort



PROBLEM:
Transient Analysis



PROBLEM:
Trouble Shooting

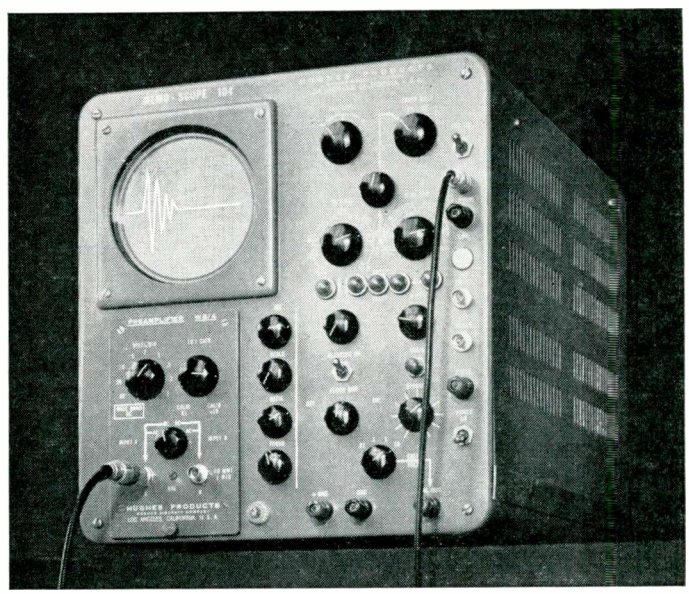


PROBLEM:
How to Capture Elusive Transients

...one happy solution

Has the analysis of non-recurring transients presented a perplexing problem to you? Are you using a conventional scope or recorder, which wastes time, money, and research dollars?

SOLUTION: The Hughes MEMO-SCOPE® oscilloscope freezes wave forms until intentionally erased. Selected transient information may be triggered externally or internally and retained for viewing. Successive wave forms may be written above, below, or directly upon the original information.



HUGHES MEMO-SCOPE OSCILLOSCOPE

SWEEP SPEED FOR STORAGE:
10 microseconds to 10 seconds per division (0.33").

FREQUENCY RESPONSE: DC to 250 KC down 3 db.

SENSITIVITY:
10 millivolts to 50 volts per division or with optional high sensitivity preamplifier 1 millivolt to 50 volts per division.

APPLICATIONS:
Trouble shooting data reduction equipment...switch and relay contact study... ballistics and explosives research... ultrasonic flaw detection... physical testing—shock—stress—strain.

If you haven't yet seen a demonstration of the MEMO-SCOPE oscilloscope, ask a Hughes representative to arrange one. He'll quickly do so—at your convenience—in your area. Please write to:

HUGHES PRODUCTS
MEMO-SCOPE Oscilloscope
International Airport Station, Los Angeles 45, California

Creating a new world with ELECTRONICS

HUGHES PRODUCTS

Circle 8 on Inquiry Card, page 121

THE LONG ARM OF

THE LABORATORY

He takes Laboratory designed electronic systems and evaluates them where they actually prove themselves. He makes this equipment produce everything that was designed into it. His title: Hughes Field Engineer.

Responsible for the modification and maintenance of complex Electronics Armament Systems and Guided Missiles, he keeps in the forefront of the newest electronics developments. Working with complete integrated systems, the Hughes Field Engineer learns how each component works toward the working, fighting total.

This highly respected professional engineer forms a critical link in a strong engineering chain. As an extension of the Hughes Research & Development Laboratories, it is his job to recommend modifications in the basic designs. At the same time, he maintains liaison with the manufacturing groups, making sure that the highest standards of reliability have been built into the system.

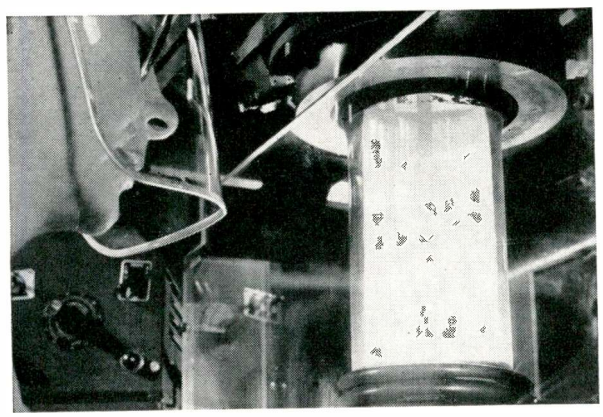
The chain of Research, Development, Manufacturing and Field Evaluation is also evident in other Hughes activities. The commercial products activity performs all these functions in the areas of electron tubes, semiconductor devices, and industrial systems and controls. The Ground Systems Division performs all phases on protective radar systems.

This attention to the highest standards of engineering, combined with the diversity and wide scope of activity, makes Hughes an ideal firm for the engineer or physicist interested in career advancement.

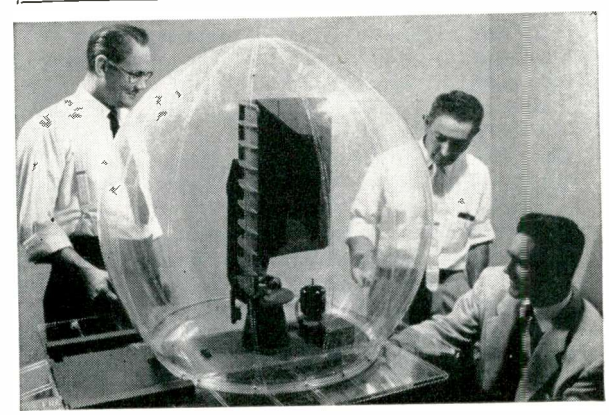
An immediate need now exists for engineers in the following areas:

Microwave Tubes	Radar
Engineering Writing	Communications
Semiconductors	Circuit Design
Field Engineering	Microwaves
Computer Engineering	Systems Analysis

Write, briefly outlining your experience, to Mr. Phil N. Scheid, Hughes General Offices, Bldg. 6-N-1, Culver City, California.



Molten Ladle of silicon is watched during first step in the precise manufacture of Hughes semiconductors. Constant innovations in Research, Development and Manufacture have positioned Hughes Products as a commercial electronics leader.



Electronic Scanning Radar systems, a radically new concept in radar beam positioning, is currently being developed and manufactured by the Hughes Ground Systems Division.

the West's leader in advanced electronics

HUGHES

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

Circle 501 on "Opportunities" Inquiry Card, page 123

Coming Events

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

Sept. 29-Oct. 4: High Fidelity Show, Institute of High Fidelity Mfrs.; New York, N. Y.

Oct. 1-2: 4th Conf. on Radio Interference Reduction, Armour Research Foundation; Museum of Science & Industry, Chicago, Ill.

Oct. 1-2: Engineering Writing & Speech Symp., IRE; New York City.

Oct. 2: Section Meetings Calendar-Wichita Sect., Institute of Aeronautical Sciences; Innes-Colonial, Room 121 S. Broadway, Wichita, Kans.

Oct. 2: Section Meetings Calendar— Phila. Sect., Institute of Aeronautical Sciences; Penn-Sherwood Hotel, Phila., Pa.

Oct. 6-7: Symp. on Extended Range & Space Communications, IRE & G. Washington Univ., Lisner Auditorium, Washington, D. C.

Oct. 7-10: Industrial Film & A-V Exh.; Trade Show Bldg., New York City.

Oct. 8-10: 14th Annual Mtg., Canadian Electrical Manufacturers Assoc.; Sheraton Brock Hotel, Niagara Falls, Canada.

Oct. 8-10: Canadian IRE Conv. & Exposition; Automotive Bldg., National Exhibition Grounds, Toronto.

Oct. 13-14: Cleaning Electronic Device Components & Materials, ASTM; Franklin Inst., Philadelphia, Pa.

Oct. 13-15: National Electronics Conf., IRE, AIEE, & EIA; Hotel Sherman, Chicago, Ill.

Oct. 13-15: International Systems Mtg.; Penn-Sheraton Hotel, Pittsburgh, Pa.

Oct. 14-17: Midyear Mtg. of Recorder-Controller Sect., SAMA; Seaview Country Club, Absecon, N. J.

Oct. 19-24: 84th SMPTE Conv.; Sheraton-Cadillac Hotel, Detroit, Mich.

Oct. 20-22: URSI Fall Mtg., IRE; Penna. State Univ., University Park, Pa.

Oct. 20-22: 4th Annual Symp. Aeronautical Communication, IRE; Utica Hotel, Utica, N. Y.

Oct. 20-23: Annual Conf. of Int'l Municipal Signal Ass'n; Sheraton Hotel, Philadelphia, Pa.

Oct. 23-25: Fall Mtg. of Nat'l Society of Professional Engineers; San Francisco, Calif.

Oct. 23-25: Nat'l Simulation Conf., IRE; Dallas, Tex.

Oct. 26-27: Fall Mtg. of AIEE; Pittsburgh, Pa.

Oct. 27-29: East Coast Conf. on Aero & Navigational Electronics, IRE; 7th Reg. Armory, Baltimore, Md.

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

Oct. 28: Ultrasonic Mfrs. Ass'n Annual Mtg.; Hotel Cleveland, Cleveland, O.

Oct. 30-Nov. 1: Electronic Devices Mtg., IRE; Shoreham Hotel, Washington, D. C.

Nov. 6-7: 5th Annual Nuclear Science Mtg., IRE; Villa Hotel, San Mateo, Calif.

Nov. 10-14: NEMA Annual Conv.; Hotel Traymore, Atlantic City, N. J.

Nov. 17-21: National Plastics Conf., SPI; International Amphitheatre, Chicago, Ill.

Nov. 17-18: 6th Annual Conv., Soc. of Tech. Writers & Editors; Shoreham Hotel, Washington, D. C.

Nov. 17-20: Conf. on Magnetism & Magnetic Materials, AIEE, APS, IRE, AIME & ONR; Sheraton Hotel, Philadelphia, Pa.

Nov. 17-21: ARS Annual Mtg.; Hotel Statler-Hilton, New York, N. Y.

Nov. 18-20: 9th National Conf. on American Standards, American Standards Ass'n; New York, N. Y.

Nov. 19-20: N. E. Research & Eng'g Mtg. (NEREM), IRE; Mechanics Bldg., Boston, Mass.

Nov. 19-21: 11th Annual Conf. on Electrical Techniques in Medicine & Biology, IRE, AIEE & ISA; Nicollet Hotel, Minneapolis, Minn.

Nov. 20-22: 56th Mtg. Acoustical Society of America, with IRE; Chicago, Ill.

Nov. 20-23: Midyear Mtg. of Industrial Instrument Sect., SAMA; The Cloister, Sea Island, Ga.

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

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

Dec. 2-4: 3rd EIA Conf. on Reliable Electrical Connections; Dallas Tex.

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

Abbreviations:

ACM: Association for Computing Machinery
AIEE: American Inst. of Electrical Engrs.
ARS: American Rocket Society
ASTM: Amer. Society for Testing Materials
EIA: Electronics Industries Assoc.
IAS: Inst. of Aeronautical Sciences
IRE: Institute of Radio Engineers
ISA: Instrument Society of America
ISA: Instrument Society of America
NEMA: National Electrical Manufacturers Assoc.
ONR: Office of Naval Research
SAMA: Scientific Apparatus Makers Ass'n.
SMPTE: Society of Motion Picture & TV Engineers
SPI: Society of Plastics Industry
WCEMA: West Coast Electronic Manufacturers Assoc.

As We Go To Press (cont.)

Hoffman Labs Offers New Field Services

Hoffman Laboratories Division, Hoffman Electronics Corp., is now offering its field service facilities to industry on a nationwide basis.

Previously available only to the military, the Hoffman field services include repair, calibration and certification of test equipment and standards, overhaul and repair, field engineering, training and publications on electrical and electronic equipment. Both in-plant and on-the-job service is offered.

All plant facilities are cleared secret and provide resident government inspection.

Reliable Electrical Connections Conf.

The 3rd EIA Conference on Reliable Electrical Connections, to be held in Dallas, Tex., on December 2 to 4, promises to be very interesting. Papers being presented will cover all phases of electrical connections, including those located internally on electronic components. All attendants are requested to register as early as possible.

Int'l Transistor Meet

An International Convention on Transistors and Associated Semi-Conductor Devices, sponsored by the Radio and Telecommunication Section of The (British) Institution of Electrical Engineers, will be held from 25th to 29th May, 1959, at Earl's Court, London.

1959 COMING EVENTS

Jan. 12-13-'59: 5th National Symposium on Reliability & Quality Control, IRE, AIEE, ASQC & EIA; Bellevue-Stratford Hotel, Phila., Pa.

Mar. 2-6: Western Joint Computer Conf., IRE, AIEE & ACM; at Fairmount Hotel, San Francisco, Calif.

March 23-26: IRE National Convention. IRE; New York City.

Apr. 5-10: 5th Nuclear Congress, IRE & EJC; Cleveland, Ohio.

May 4-6: National Aeronautical Electronics Conference, IRE; Dayton, Ohio.

May 6-8: Electronic Components Conf., IRE, AIEE, EIA & WCEMA; Ben Franklin Hotel, Philadelphia, Pa.

ALL TIED UP WITH TRANSISTOR CIRCUIT DESIGN PROBLEMS?

NO NEED TO BE! *Plug in* your circuits, don't *design* them! Specify EECO T-Series *Germanium* Transistor Plug-in Circuits and concentrate on *system design* problems.

SAVE TIME! SAVE COST! SAVE SPACE!

Write today on your company letterhead for our complete EECO Transistorized Circuit Catalog No. TR-758.

CIRCUITS

A fully compatible series of transistorized digital circuits is available, including:

- FLIP-FLOPS
- ONE SHOT
- SQUARING AMPLIFIERS
- EMITTER FOLLOWERS
- DC "AND" GATES
- DC "OR" GATES
- PULSE "AND" GATES
- PULSE "OR" GATES
- RING COUNTER
- MULTIVIBRATOR
- PULSE AMPLIFIERS
- SHIFT REGISTER LOGIC

. . . Also Linear Amplifiers, Reset Generator, Blocking Oscillator, etc.

QUICK FACTS

Size: ⅞" dia. by 2-3/16" seated height.
Speed: 250 kc and up.
Temperature Range: —45°C to +65°C.

PACKAGE MODELS

"T"— Repairable, with dust seal.
"TE"— Encapsulated.

ENGINEERED ELECTRONICS Company

ENGINEERED ELECTRONICS COMPANY
(a subsidiary of Electronic Engineering Company of California)
506 East First Street • Santa Ana, California

See us at
NATIONAL ELECTRONICS CONFERENCE
Booth No. 40

Circle 9 on Inquiry Card, page 121

More materials: Rugged, versatile compositions to resist impact, stress, vibration, pressure, heat, thermal shock, wear, chemical reactions. Superior electrical characteristics for higher temperatures and frequencies.

More equipment: Complete and separate production facilities devoted exclusively to finer quality AlSiMag Aluminas.

More "know how": Years of experience in formulating and fabricating Aluminas. The wider range of exacting designs produced have led to new, improved techniques. Precision tolerances. Dependable uniformity. Constant research.

Bring your problem to the source most apt to supply the right answer! Send blueprint with details of operating procedure for complete information.

AlSiMag®

best source for ALUMINA CERAMICS

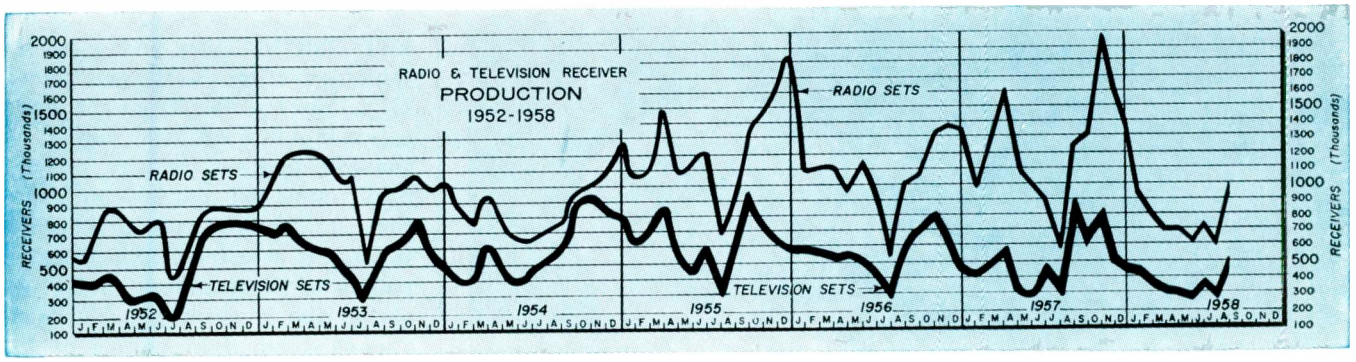
A Subsidiary of Minnesota Mining and Manufacturing Company

AMERICAN LAVA CORPORATION

CHATTANOOGA 5, TENN.
56TH YEAR OF CERAMIC LEADERSHIP

For service, contact Minnesota Mining & Manufacturing Co. Offices in these cities (see your local telephone directory): Atlanta, Ga. • Boston: Newton Center, Mass • Buffalo, N. Y. • Chicago, Ill. • Cincinnati, O. • Cleveland, O. • Dallas, Texas • Detroit, Mich. • High Point, N. C. • Los Angeles, Calif. • New York: Ridgefield, N. J. • Philadelphia, Pa. • Pittsburgh, Pa. • St. Louis, Mo. • St. Paul, Minn. • So. San Francisco, Calif. • Seattle, Wash. **Canada:** Minnesota Mining & Manufacturing of Canada, Ltd., P. O. Box 757, London, Ont. **All other export:** Minnesota Mining & Manufacturing Co., International Division, 99 Park Ave., New York, N. Y.

TOTALS



GOVERNMENT ELECTRONIC CONTRACT AWARDS

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

Amplifiers	497,559
Analyzers	197,998
Analyzers, spectrum	102,099
Antennas & accessories	240,965
Antenna towers & supports	80,816
Batteries, dry	2,121,493
Batteries, storage	245,717
Beacon equipment, radar	246,191
Cable sets, Interconnecting	109,732
Calibrators	39,771
Computers & accessories	4,189,593
Computers, airborne	28,799
Connectors	62,104
Converter equipment	456,299
Co-ordinate data equipment	1,048,800
Facsimile equipment	248,632
Filters	47,642
Generators, signal	365,291
Headsets	26,577
Indicators	325,826
Kits, computer modification	794,290
Kits, modification	32,860
Meters	26,038
Meters, vtvm	50,068
Networks	78,679
Oscillators	30,936
Oscillographs	45,360
Oscilloscopes	1,525,849
Power supplies	64,870
Radar equipment	2,316,928
Radio direction finders	2,114,651
Radio receivers-transmitters	50,350
Recorders & accessories	342,184
Recorders-reproducers	153,577
Relays	43,367
Relays, solenoid	35,316
Resistors	124,028
Semiconductors diodes	42,320
Spare parts	95,227
Stroboscopes	35,642
Tape, recording	72,444
Teletype equipment	441,612
Test equipment (various)	210,753
Testers	170,587
Testers, tube	59,512
Test sets	74,469
Test sets, radar	396,058
Test sets, radio	349,718
Tubes, electron	4,123,883
Wire & cable	435,288

TV-BROADCAST DATA

Total TV-broadcast revenues during the calendar year 1957 were $943.2 million, or 5.2% above the 1956 figure of $896.9 million. While revenues rose 5.2%, total television broadcast expenses increased 10.7%, from $707.3 million in 1956 to $783.2 million in 1957. The industry's broadcast profits (before Federal income tax) amounted to $160.0 million, a decline of $29.6 million (15.6%) from $189.6 million in 1956.

RADIO & TV SALES

	Television Sales	Radio Sales
January	581,486	534,640
February	448,727	420,065
March	416,756	538,963
April	243,132	402,283
May	237,189	411,659
June	250,362	656,728
July	279,010	488,495
TOTAL	2,456,662	3,452,833

—Electronic Industries Association

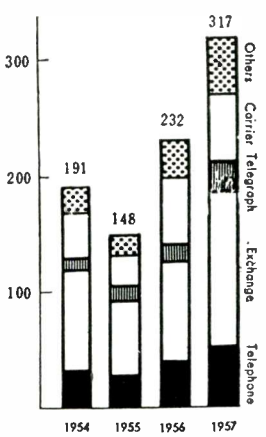
TRANSISTOR SALES

	1958 Sales (units	1958 Sales (dollars)	1957 Sales (units)
January	2,955,247	$6,704,383	1,436,000
February	3,106,708	6,806,562	1,785,300
March	2,976,843	6,795,427	1,904,000
April	2,856,234	7,025,547	1,774,000
May	2,999,198	7,250,824	2,055,000
June	3,558,094	8,232,343	2,245,000
July	2,631,894	6,598,762	1,703,000
TOTAL	21,084,218	$49,443,848	12,902,300

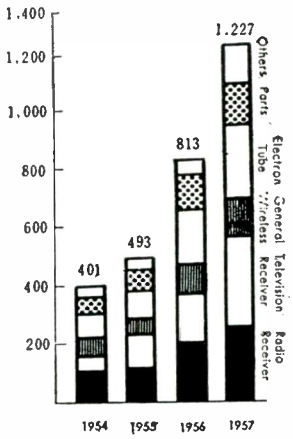
—Electronic Industries Association

JAPANESE MANUFACTURING—1957

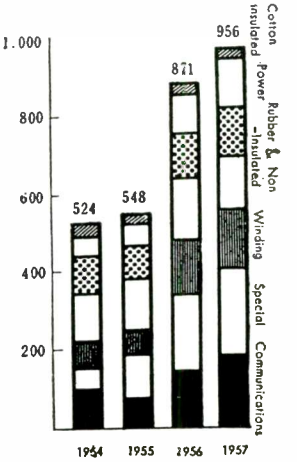
OUTPUT OF WIRED COMMUNICATIONS EQUIPMENT (Unit: Hundred Million Yen)



OUTPUT OF WIRELESS COMMUNICATIONS EQUIPMENT (Unit: Hundred Million Yen)



SHIPPING AMOUNT OF ELECTRIC WIRES AND CABLES (Unit: Hundred Million Yen)



—Japan Electric Industry

← Circle 10 on Inquiry Card, page 121

Tele-Tips

ELECTRONIC jury picker cut the job of selecting the Bergen County (N.J.) jury panels from six weeks to six hours. An IBM sorter did the job, picking its way through 3,300 punched cards containing the data on 15,000 prospective jurors. It selected two grand jury panels of 35 members each, then sorted the remaining 3,000 cards and selected eight panels of 275 potential members of petit juries.

FIRST SPACE MAN was graduated by U.C.L.A. Dr. Robert M. L. Baker received his Ph.D. in Space Navigation. He is the first graduate of the first and only space navigation course in the U. S.

PLACE YOUR BETS! At the Riviera Hotel in Havana guests can now play roulette without even getting out of bed. The rooms have been equipped with television sets that show exactly what is going on in the gambling room. Guests can place their bets by telephone.

COMPUTERS have added a new level of intelligence; they will now take verbal instructions from the operators. The Air Force's Air Materiel Command and Remington Rand have developed a method for using a limited vocabulary of English verbs to instruct business type computers. The new method, known as AIMACO (Air Materiel Command Automatic Compiler) will initially use 30 English verbs. It has the flexibility of enlargement to additional verbs as circumstances dictate. Its major contribution will be improving the understanding between management and computer programmers.

RUSTING RATES have been established for the entire U. S. Rust-Oleum Corp. found that it takes three years for rust to corrode a standard license-plate size steel panel in four cities, Buffalo and Rochester, N. Y.; Erie, Pa.; and Miami, Fla. The same steel panel

(*Continued on page* 22)

BURTON BROWNE/New York

NEW

FILTORS NEW MICRO-MINIATURE...THE MOST ADVANCED DESIGN

Filtors, the leading specialists in the development and manufacture of sub-miniature relays is proud to announce the addition of the new Powrmite micro-miniature relay to its existing line of traditionally outstanding relays.

In every field of achievement there is always one leader. In relays with highest available reliability the leader is Filtors, Incorporated. All of the experience and know how gained in attaining its position of leadership have gone into making Filtors new Powrmite micro-miniature relay *truly reliable* — again the leader in a field of many.

Leading manufacturers of hermetically sealed micro and sub-miniature relays.

FILTORS, INC.

Main office and plant: Port Washington, N. Y., POrt Washington 7-8220
West coast office: 13273 Ventura Blvd., Studio City, Cal., STanley 3-2770

VIBRATION UP TO 30 G's AT 2000 CPS.
70 G's SHOCK • 2 AMP OR DRY CIRCUIT
—65°C. TO +125°C.

Circle 126 on Inquiry Card, page 121

Electronic Industries' News Briefs

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

EAST

MANHATTAN PHYSICAL RESEARCH GROUP (MPRG) has been formed to aid those firms which require high-level technical knowledge in research efforts. Offices are at 556 W. 191 St., New York 40. Phone: SWinburne 5-3351.

STROMBERG-CARLSON has been awarded a $1.3-million USN contract for the production of marine mine detector equipment.

MINNEAPOLIS-HONEYWELL REGULATOR CO. has received an order for a nuclear simulator for training purposes from Syracuse University.

SPRAGUE ELECTRIC CO. has developed a new minified stable ceramic capacitor body of high dielectric constant. C40 Ceramic Body Formulation has 3 times the capacitance on a given disc size than was previously possible with Stabl-K Formulations.

THE BRISTOL CO. is making ¼-scale photoprints of its instrument line available to engineers, designers, and other persons concerned with instrumentation layout.

NARDA ULTRASONICS is now marketing a new water-wash detergent and degreasing solvent specially compounded for use in ultrasonic cleaning equipment.

BENDIX RADIO DIV. has received a purchase order from CAA's Aeronautical Center in Oklahoma City calling for more than half a million dollars worth of avionics equipment. It will be used for the expanded airway facilities checking program.

WESTINGHOUSE ELECTRIC CORP. has formed a highly specialized group to study overall requirements of future military activities and to plan an integrated approach to the weapon systems of tomorrow. Allen Chilton directs the new unit called Westinghouse Advanced Systems Planning (WASP) Group.

GEORGE A. PHILBRICK RESEARCHES, INC. has moved to its new location at 285 Columbus Ave., Boston 16, Mass.

BULOVA WATCH CO., INC. has been appointed a subcontractor for the Pershing missile's complete fuzing and arming system by the U. S. Army and The Martin Co. of Orlando, Fla.

A. B. DU MONT LABORATORIES, INC. have been awarded four contracts by the Navy: One, develop test equipment for SSB transmitters, another, $800,000, design and development of special short wavelength radar sets, a third, $386,000 production contract, nine universal missile test systems, and a fourth, $375,000, a compact meteorological radar set for storm and hurricane tracking.

RAYTHEON MFG. CO. is the recipient of a Signal Corps contract for mobile weather radar. A ruggedized version of the company's AN/CPS-9 weather radar, the equipment will be installed in standard military trailers and will feature demountable antennas.

KEARFOTT CO., INC. is participating in over 20 missile programs.

GULTON INDUSTRUMENTATION DIV. is the new name for the former Glennite Instrumentation Div. of Gulton Industries, Inc.

LOCKHEED AIRCRAFT CORP., GEORGIA DIV. has been awarded a USAF contract to study power operated hydraulic and pneumatic systems to be used in space vehicles.

VITRO LABORATORIES, a Div. of Vitro Corp. of America, has developed a wire-guided torpedo for the Navy's Bureau of Ordnance. Specially designed wire connects the Mark 39 torpedo to its launching vessel. Guidance commands are transmitted through the wire to the torpedo.

TRACERLAB-KELEKET has received a U. S. Army contract for research in mine detection. X-Ray detection of mines is the objective.

HOWELL-RONSET INSTRUMENT DIV. is the name of the newly-formed division of Kings Electronics Co., Inc. The new division will manufacture test equipment such as signal generators, power meters, flight analyzers, etc.

SCHAEVITZ ENGINEERING has completed its move from Camden to a new 50,000 sq. ft. plant in Pennsauken, N. J. The one floor building houses all offices, research, development and test facilities, as well as manufacturing operations.

CBS LABORATORIES is purchasing over 12 acres adjoining the present 11 acre site of the new Research Center on High Ridge Rd. in Stamford, Conn. The new lab will encompass research and development activities in the fields of military reconnaissance systems, acoustics, solid state and vacuum physics.

BRACH MFG. CORP., A DIV OF GENERAL BRONZE CORP., has expanded its magnetics program to include the manufacture of amplifiers and systems.

FLUORULON LABORATORIES, INC. has moved into new enlarged quarters to meet demands for its custom conversion of Teflon and Kel-F. The new building is on Passaic St. in Caldwell, N. J., directly opposite the Curtis-Wright Airport hangar and control tower.

MID-WEST

RCA SEMICONDUCTOR AND MATERIALS DIV. has established an East Central Sales Office at 714 New Center Bldg., Detroit. Paul M. Lufkin will be the resident field engineer of the office.

GENERAL ELECTRIC COMPANY will consolidate all operations of its Communication Products Dept., now located in four New York state cities, at an existing company plant in Lynchburg, Va.

BURROUGHS CORP., ELECTRODATA DIV. has established a new district sales office at Denver, Colo. which will serve the Rocky Mountain area. Charles V. Hoge will be in charge.

MINNESOTA MINING AND MFG. CO. (3M) has reduced the price of its "Scotch" brand #179 "VR" magnetic tape by 7%. This means that net price on the standard 64-min. roll has been cut from $306 to $282.90.

ELECTRO-VOICE, INC. recently played host to 25 of the nation's top Electro-Acoustic distributors attending the first Electro-Acoustic Sales and Engineering Seminar.

FAIRCHILD CAMERA AND INSTRUMENT CORP. has purchased the assets of the Acme Teletronix Div. of NEA Service, Inc. of Cleveland, Ohio. Acme Telectronic manufactured telephoto, facsimile transmitting equipment, and color scanning devices.

WEST

COHU ELECTRONICS, INC. has received new orders for electronic instruments to be used in the military defense program which amount to more than $500,000. The largest dollar volume order, over $300,000, came from the Martin Co. for DC amplifiers.

AMPEX CORP. reveals that color television can now be recorded magnetically on one Videotape Recorder and played back on any other. This interchangeability has been an everyday procedure with black and white but is new for color TV.

APPLIED RESEARCH LABORATORIES, have occupied a new 51,000 sq. ft. building in Glendale, Calif.

R/S ELECTRONICS CORP. has been awarded new development and production contracts totalling $100,000 by Convair Astronautics. The orders cover manufacture of i-f amplifiers for use in the Atlas ICBM.

LING ELECTRONICS, INC. has received new orders in excess of $500,000 for the company's high power vibration testing systems. The largest order was from the French Air Ministry for the purchase of a single vibration test system to cost more than $150,000.

PARABAM, INC. of El Segundo, Calif., has been awarded a contract for design and fabrication of 22 astrodome type tracking camera shelters by H. B. Zachry Co. of San Antonio, Tex.

SECODE CORP. is the new name for Electrical Communications, Inc. No changes in management are contemplated by the 31-year-old San Francisco electronics firm.

LOCKHEED MISSILE SYSTEM has unveiled plans for a new $7-million addition to its main plant at Sunnyvale, Calif. The additional 346,000 sq. ft. building will bring to 1,687,000 sq. ft. the total building space at the division.

DAYSTROM PACIFIC CORP. moved to 9320 Lincoln Blvd., Los Angeles 45.

SEQUOIA WIRE & CABLE CO. has acquired Hall-Scott Electronics of Burbank.

PACKARD-BELL ELECTRONICS CORP. was awarded a $300,000 contract by Aerojet-General Corp. to develop a missile impact prediction system for Cooke AFB.

INTERNATIONAL RESISTANCE CO. has formed a new District Sales Office to be located at the IRC Hycor plant, 12970 Bradley Ave., Sylmar, Calif.

BECKMAN INSTRUMENTS, INC. is the recipient of a $150,000 contract from Sunstrand Turbo, a division of Sundstrand Machine Tool Co., for an electronic system that will determine automatically the efficiency of the accessory power supplied of guided missiles prior to launching.

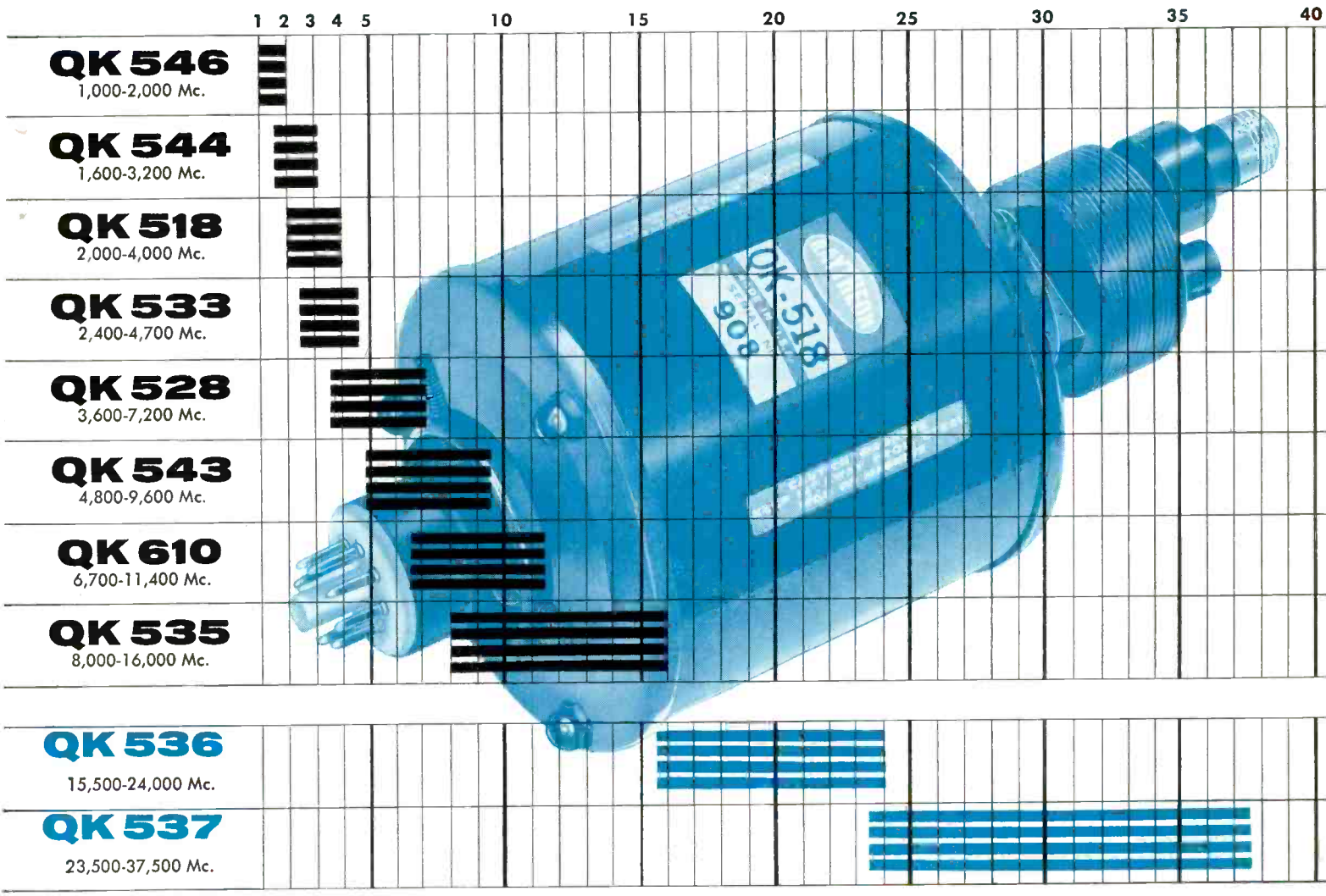
AMERICAN ELECTRONICS, INC., Los Angeles, has introduced a new line of static frequency converters. Power ratings range from 10VA to 2.5 KVA.

TEXAS INSTRUMENTS INCORPORATED has opened a new sales office of its Semiconductor-Components Div. at 317 Town and Country Village, Palo Alto, Calif. George Pantaze is the manager.

DEFENSE AND TECHNICAL PRODUCTS DIV. is the new name for Rheem Mfg. Co.'s Aircraft Div. at Downey, Calif.

Raytheon — World's Largest Manufacturer of Magnetrons and Klystrons

VOLTAGE TUNABLE
In Thousands—Mc.



NOW — 2 New Raytheon Backward Wave Oscillators DOUBLE FREQUENCY COVERAGE

Specifications — QK518. Frequency: 2,000-4,000 Mc. Rapid electronic tuning by varying delay line voltage from 150-1,500 v. Power output: 0.1 to 1 w. Complete with compact permanent magnet. Approximate maximum dimensions: 10" long, 4⅜" high, 4⅞" wide.

The most complete line in the industry now tunes from 1,000 to 37,500 Mc.

Wide, rapid electronic tuning — 1,000 Mc. to 37,500 Mc.—is one outstanding performance advantage in Raytheon's extending line of Backward Wave Oscillators. Others are: permanent magnet focusing; high signal-to-noise ratio; operation under conditions of amplitude or pulse modulation.

Raytheon Backward Wave Oscillators are gaining wide acceptance in microwave equipment applications as local oscillators for radar receivers and as signal generators.

Our development laboratories can tailor tubes for specific requirements including narrower band, lower voltage, or higher power for primary transmitter use. Any question you may have will be answered promptly, without cost or obligation.

RAYTHEON MANUFACTURING COMPANY

Microwave and Power Tube Operations, Section PT-54, Waltham 54, Mass.

Regional Sales Offices: 9501 W. Grand Avenue, Franklin Park, Ill. • 5236 Santa Monica Blvd., Los Angeles 29, Cal.

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

RAYTHEON

Excellence in Electronics

Circle 13 on Inquiry Card, page 121

Tele-Tips

(*Continued from page* 18)

will last more than 15 years in Tucson, Ariz,; Roswell and Santa Fe, N. M., the slowest rusting rate for the country. Rust-Oleum has compiled an Index of the 523 largest American cities, and the comparative rust rate for each city.

ELECTRONIC MONEY. One of the consequences of electronic progress foreseen for the future is a "moneyless society" in which each citizen will carry around a small printed circuit showing the amount of money he possesses. The printed circuit card would be handed over in place of money in stores, banks and other establishments. Special machines would deduct from the card the amount of the purchase and the name and address of the purchaser, and write in electronically the new balance. Designers for Industry, of Cleveland, has already designed and manufactured the cards.

ENGINEERS' JOINT COUNCIL is concerned over the frequent use of the phrase, "science and technology." The more accurate designation, they point out, is "science and engineering."

JACK BINNS never had it so good. The little fishing boat Skipper II, sinking off San Nicolas Island, Calif. sent out an SOS. The fishermen marveled at the response, which included:

The cruiser U.S.S. Los Angeles
The aircraft carrier U.S.S. Bonhomme Richard
The freighter P&T Adventurer
Two Coast Guard seaplanes
A Coast Guard cutter, which towed the craft and fishermen to port.

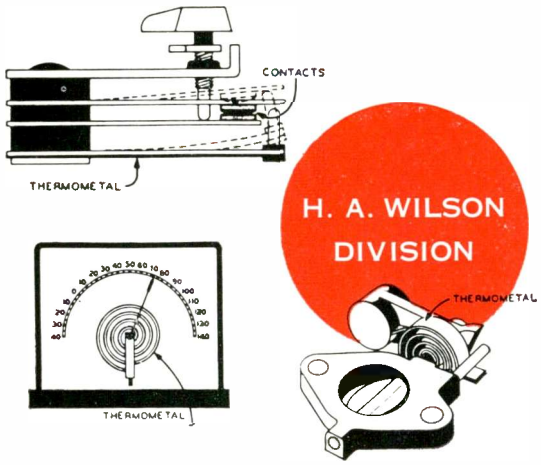
THE JET ENGINE of Republic's new F-105 fighter bomber chews up air at the rate of a million cubic feet per minute. Computers in the aircraft—seven of them—include an electronic co-pilot, automatic fire control, "toss bombing" computer, automatic radar system and other navigation and identification systems.

FOR A MIRROR BRIGHT FINISH

"SILVA-BRITE" SILVER PLATING PROCESS . . . Provides hard, bright, highly-ductile finish in stable deposits from flash to heavy. Water-clear solution enables plater to watch process; parts falling into tank may be recovered without contamination. Uniformly good results with current densities from 10 to 40 amperes per square foot; operation and control are non-critical, economical. Filtration through activated carbon removes organic contaminants; no purification downtime. Excellent throwing power, less tendency toward bath decomposition or fumes. Write for technical bulletin.

American Platinum & Silver Division, 231 New Jersey Railroad Avenue, Newark 5, N. J.

Circle 15 on Inquiry Card, page 121

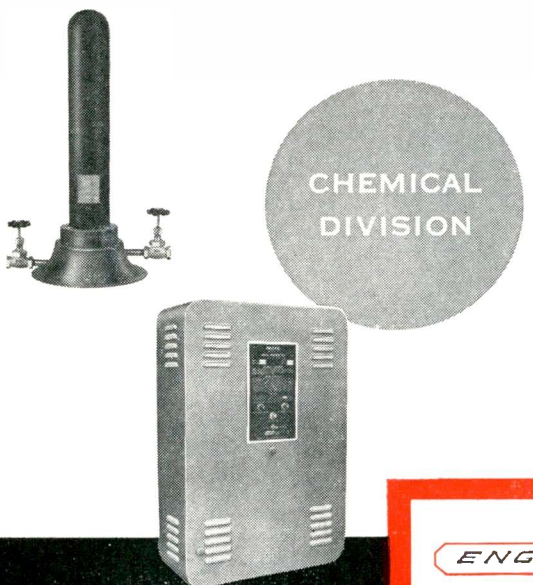


FOR CONTROLLING TEMPERATURE

THERMOMETAL® . . . for use in electrical appliances, thermal cutouts, heating controls . . . in any application involving the indication and accurate control of temperatures, electrical currents, voltages, etc. Supplied in strip form, rolled and slit to close tolerances and tempered to meet specifications. Also supplied as elements and sub-assemblies, with or without contacts attached, fabricated in accordance with specifications.

H. A. Wilson Division, U. S. Highway No. 22, Union, N. J.

Circle 16 on Inquiry Card, page 121



FOR PURIFYING AND PURIDRYING

DEOXO® PURIFIER . . . provides low-cost catalytic purification of hydrogen and other gases to the extent of less than one part oxygen per million. Requires no operating expense, no maintenance, no reactivation, no auxiliary heating, no water cooler. DEOXO® DUAL PURIDRYER . . . combines continuously-operating, dual tower, automatically-run drying unit with the features of Deoxo Purifier—catalytically produces pure, dry hydrogen, so pure it contains less than one part oxygen per million, so dry that it has a dew point of better than —100° F.

Chemical Division, 113 Astor Street, Newark 2, N. J.

Circle 17 on Inquiry Card, page 121

ENGELHARD INDUSTRIES, INC.

113 ASTOR STREET
NEWARK 2, NEW JERSEY

ELECTRONIC INDUSTRIES *International*

Nippon Kokan K.K.'s Mizue Works near Tokyo, Japan, will be the first overseas application of Westinghouse Electric Corporation's new Prodac, card programmed, control system and the Japanses steel industry's first automatic steel mill.

The U. S. Exhibit at the **27th International Trade Fair** at Izmir, **Turkey**, is outdrawing participants from other nations by a wide margin. Based on the theme "Modern Science and Technology Gives Us More and Better Products," the 1958 U. S. Exhibit is showing a variety of products, demonstrations and scientific methods that improve everyday living.

Details of the **European Common Market** including its effect on U. S. Business, particularly its marketing and manufacturing policies and the major restrictions and obstacles involved are contained in "The European Common Market: New Frontier for American Business." American Management Association, Inc., 1515 Broadway, Times Square, New York 36, N. Y.

Consolidated Electrodynamics Corp. announces the establishment of an International Dept. within its Marketing Division. The new department will handle export sales and foreign operations of the company's wholly owned subsidiary in **Frankfurt-Main, Germany**, GmbH. Rodney W. Meyer was named director and Wallace E. Kirby manager of the export office.

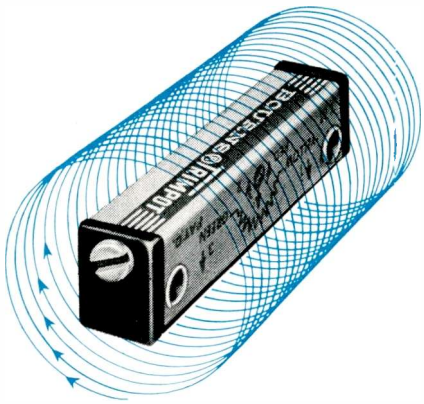
Sealectro, Inc., has appointed **Belram Electronics, Brussels, Belgium**, as rep in Belgium and Yugoslavia.

Ghana is interested in solar conversion devices. Minister of trade and industries, Kojo Botsio, received proposals on the use of solar devices from Hoffman Electronics' Semiconductor Division.

Radiovisor Parent Ltd., London, Eng., will represent Robotron Corp., Detroit, Mich., in the British Isles and Continental Europe, and Electrical Control & Engineering Ltd., Camperdown, Sydney, Australia, will handle the company's line in Asia, New Zealand, and Australia.

The Corblin Company of **Paris, France**, has designated The American Instrument Company, 8030 Georgia Ave., Silver Spring, Md., as sole U. S. distributor for Corblin diaphragm-type pumps and compressors.

Transradio Chilena, Cia. de Radiotelegrafia Ltda., has placed in commercial operation a Marconi HS 41 10kw H.F. ISB telegraph transmitter at **Santiago, Chile.**



YOU GET 33 TIMES THE ADJUSTABILITY WITH BOURNS POTENTIOMETERS!

Compared with the conventional single-turn rotary potentiometer, the adjustability of Bourns potentiometers is a 33:1 improvement. Providing 9000° of rotation instead of 270°, Bourns potentiometers *simplify* and speed up the adjustment or balancing of circuits. You can repeat any setting quickly and easily. Settings are virtually immune to shock, vibration and acceleration. Translatory action of wiper provides inherent stability. The rigidly mounted wiper is driven by a threaded stainless steel shaft, which is actuated by your screwdriver. No need to recheck settings after a lock-nut is tightened. There *isn't* any lock-nut. Available with printed circuit pins, solder lugs, or stranded insulated leads.

write for TRIMPOT Model Summary Brochure

BOURNS

Laboratories, Inc.

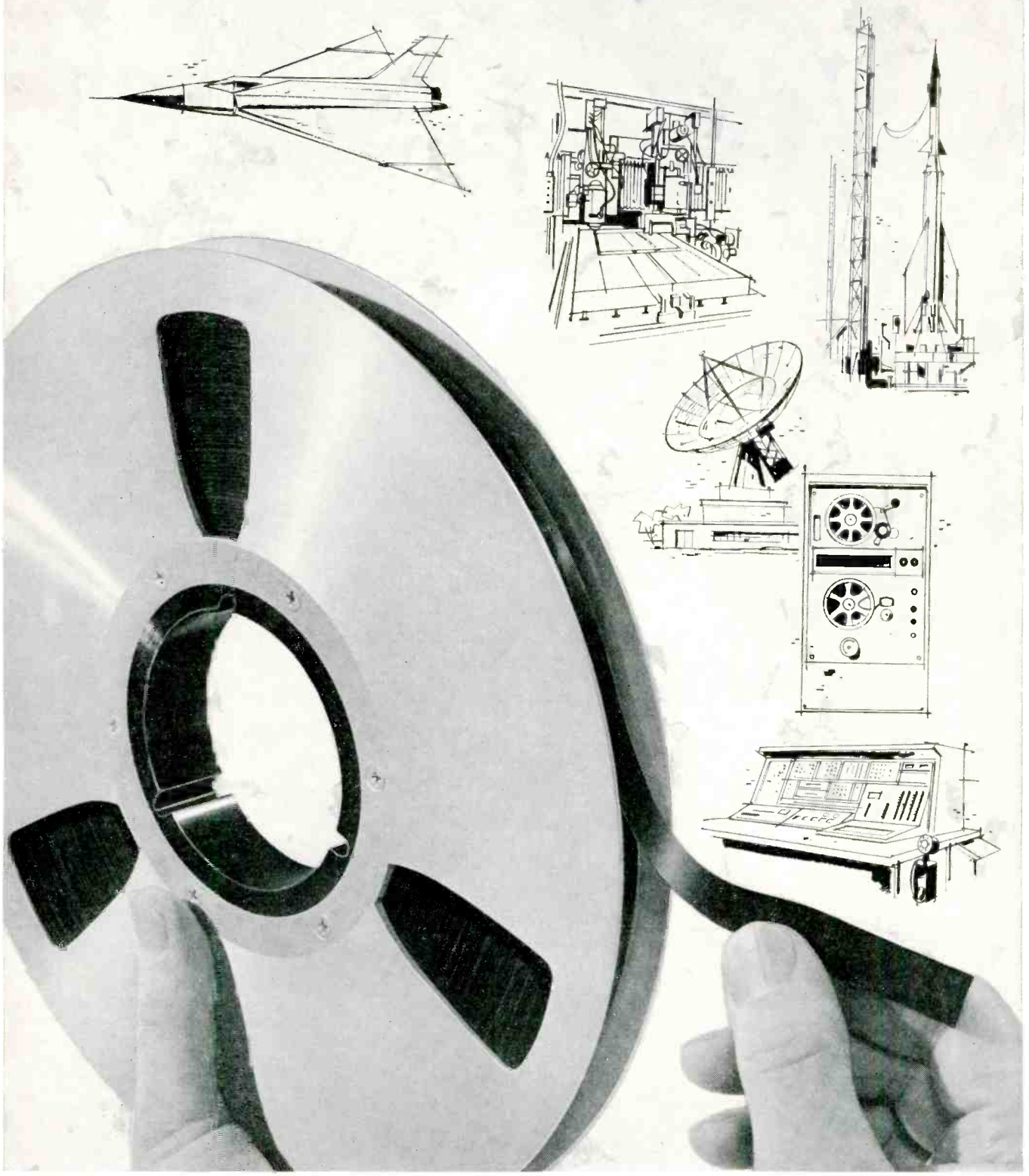
P. O. Box 2112-B • Riverside, California

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

Protected by U. S. Patents 2,706,230; 2,777,926. Other Patents Pending.

Circle 19 on Inquiry Card, page 121

TAPES YOU CAN



MINNESOTA MINING AND MANUFACTURING COMPANY

. . . WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

The term "SCOTCH" is a registered trademark of 3M Company, St. Paul 6, Minn. Export: 99 Park Avenue, New York. Canada: London, Ontario.

TRUST because only SCOTCH BRAND

REG. U.S. PAT. OFF.

Instrumentation Tapes assure absolute dependability inch after inch...reel after reel

You can't afford to compromise with accuracy, reliability and uniformity in critical recording work – instrumentation, computers, machine tool control and other technical applications. You need a magnetic tape of *proven* instrumentation quality, "SCOTCH" Brand Magnetic Tape.

These are precision tapes – engineered in the world's leading tape laboratories to meet your specific needs. You can *trust* "SCOTCH" Brand Instrumentation Tapes because they're made of only flaw-free materials and every reel put to more than 100 rigid quality control tests.

PHYSICAL AND MAGNETIC PROPERTIES OF "SCOTCH" BRAND MAGNETIC TAPES—INSTRUMENTATION QUALITY

Tape Number Description	108 Std. Instrumentation	109 Std. Instrumentation	128 Hi-Output Instrumentation	159 Extra Play Instrumentation
Physical Properties				
Backing Material	Polyester	Acetate	Polyester	Polyester
Thickness in mils				
Backing	1.45	1.42	1.45	.92
Coating	.55	.55	.65	.35
Ultimate Tensile Strength ¼" Wide — Room Condition	9#	5.8#	9#	7#
Yield Strength 5% Stretch in ¼" Width	5.4#	4.5#	5.4#	3.8#
Elongation at Break	100%	25%	100%	100%
Coefficient of Friction	0.33	0.33	0.30	0.33
Residual Elongation	0.5%	1.5%	0.5%	0.5%
Slitting Tolerances	+.000 ins. —.004 ins.	+0.0% —0.8%	+.000 ins. —.004 ins.	+.000 ins. —.004 ins.
Toughness				
Tear — grams	26	3	26	12
Impact — Kc — cms	100	20	100	70
Coefficient of Expansion* Humidity (units per % RH change)	1.1×10^{-5}	15×10^{-5}	1.1×10^{-5}	1.1×10^{-5}
Temperature (units per °F.)	2×10^{-5}	3×10^{-5}	2×10^{-5}	2×10^{-5}
Temperature Limits for Safe Use				
Low	—40°F.	—40°F.	—40°F.	—40°F.
High	+140°F.	+140°F.	+185°F.	+140°F.
†Relative Wear Ability	100%	100%	250%	100%
Magnetic Properties				
Intrinsic Coercivity (Hci) Oersteds Retentivity (Brs) Gauss	250 700	250 700	240 1100	240 1100
Remanence (Flux lines/ ¼" tape)	0.6	0.6	1.2	0.6
Relative Output in db at 1% distortion** 15 mil Wave Length	0	0	+6	0
Relative Sensitivity in db**				
15 Mil Wave Length	0	0	+3.5	+1.5
1 Mil Wave Length	0	0	0	+3.5
Erasing Field	1000	1000	900	800
Uniformity at 15 Mil Wave Length				
Within a Roll	±3%	±3%	±3%	±3%
Roll to Roll	±10%	±10%	±10%	±10%
Dropout Count*** Errors/1 Roll	1	1	1	1

*These coefficients are unitless and represent the change per % RH or degree Fahrenheit over the following ranges:
Humidity: 20% RH to 80% HR
Temperature: -30°F. to +130°F.

**At optimum bias for each tape type.

***Measured by recording 200 non-return pulses per inch on a 0.035" track. A reduction to less than 50% normal signal amplitude constitutes a signal error. Zero errors are measured by saturating the tape undirectionally. Each spurious signal greater than 10% of normal signal amplitude constitutes a zero error. Errors per roll based on recording 7 tracks on rolls ½" x 2500'.

†Relative wear ability is considered as 100% for 109 Tape. Relative output is established by 109 which is designated as zero. All other tapes are expressed as gradations from this reference point.

FREE BOOKLET! Get all the facts about America's most complete line of instrumentation quality tapes. Mail this coupon for your free specification catalogue.

Minnesota Mining & Mfg. Co., Instrumentation Tape Div.
900 Bush Avenue, St. Paul 6, Minnesota
Please send me a free copy of your instrumentation booklet.

NAME_____

POSITION_____

COMPANY_____

ADDRESS_____

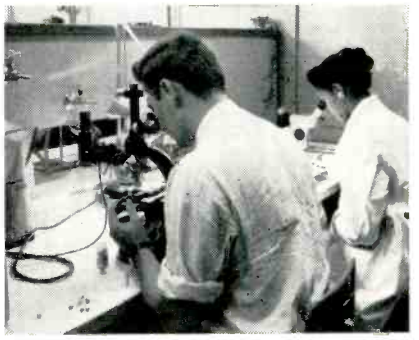
CITY_____ ZONE_____ STATE_____

Circle 20 on Inquiry Card, page 121

New Transistor Directly Replaces Vacuum Tubes

Among the new developments at General Transistor's research laboratory is a new high voltage npn germanium transistor designed specifically as a direct replacement for vacuum tubes without circuit changes. The new unit is designed for operation with a minimum of 90 v. supply voltage. It is particularly suitable for driving the Burrough's "Nixie" readout devices.

The new transistor becomes commercially available this month.



Research Laboratory at General Transistor

Among the other applications foreseen are as core drivers in computers, and other similar circuits where a high voltage driver is coupled to an inductive load.

General Transistor officials are almost equally enthusiastic over their new 4-layer germanium switch, a high voltage unit designed to drive computer cores. This unit, too, requires approximately 90 v. In computer applications, it has the advantages of shorter pulses, more positive "on," and faster switching.

A third unit developed in the G-T research labs is a new alloyed junction silicon straight inline transistor featuring very low saturation resistance. It is also designed for operation as a switching transistor.

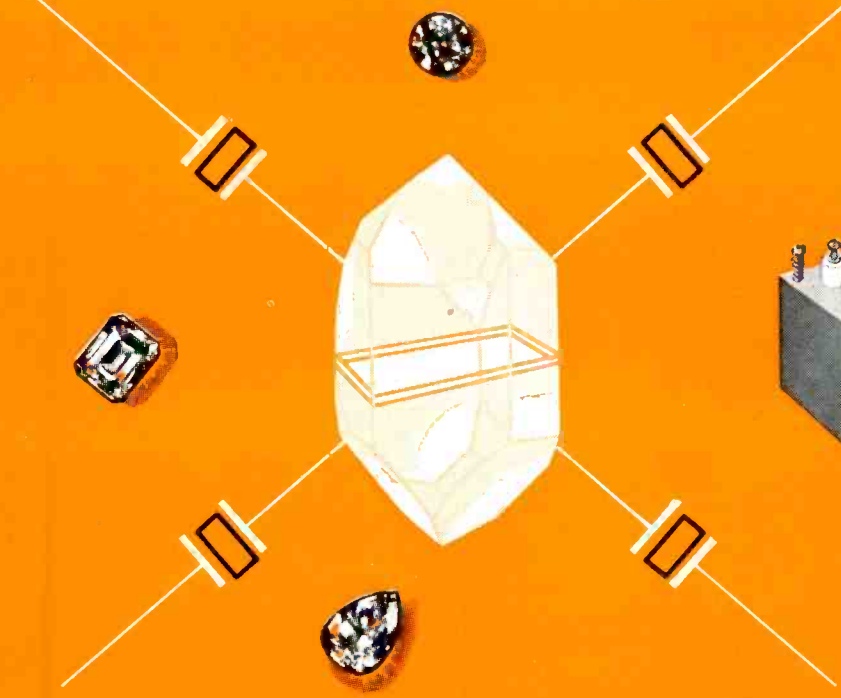
RCA to Manufacture Silicon Rectifiers

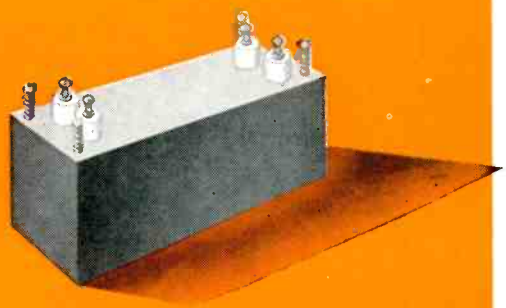
RCA is entering the silicon rectifier field. The introductory products are two departmental type silicon rectifiers of the diffused-junction type for use in the power supplies of TV and radio receivers, phonographs and other electronic equipment.

More News on page 38

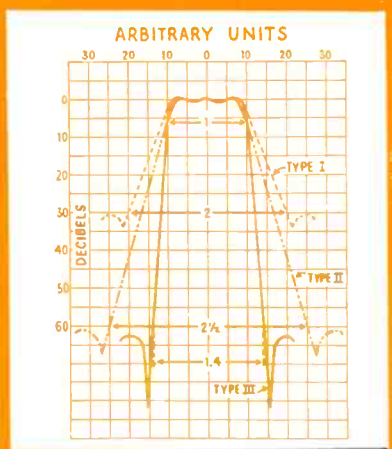
Crystal filters

by BURNELL & CO., INC.

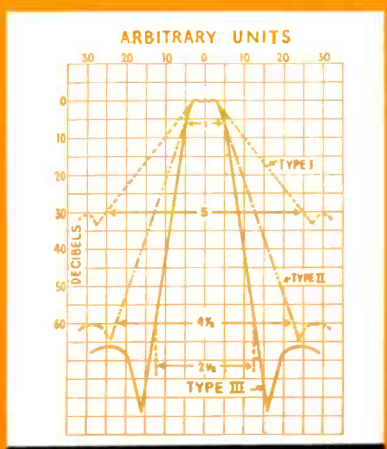




TYPICAL RESPONSE CURVES INDICATING THE VARIOUS SHAPE FACTORS AVAILABLE IN STANDARDIZED BURNELL CRYSTAL FILTERS



WIDE BAND CRYSTAL FILTER



NARROW BAND CRYSTAL FILTER

Burnell & Company is pleased to announce that it has expanded, in its new plant, the facilities of its *crystal division* for the production of crystal filters.

Like fine jewels, crystal filters are synonymous with stability, permanence and reliability. With the development of advanced production techniques and circuitry by Burnell & Co., they offer vast potential in electronic communications, telemetry, and remote control applications.

Depending on band width and frequency, they may be composed entirely of crystals, or in complex networks, combine quartz crystal elements with stabilized toroidal coils to produce the desired band width and shape factor. Frequency has been extended from low range to the megacycle spectrum so that Burnell Crystal Filters now provide the solution to myriad problems formerly insoluble with even the best of toroidal components.

Economical, standardized complex designs of lattice networks and their three terminal network derivatives preclude high developmental costs. Packaging encompasses a wide range in standard, miniature and sub-miniature sizes with considerable latitude in permissive impedance range from required transistor usage to pentode operation. Whether your crystal filter is of standard design or calls for custom specifications, our facilities are at your disposal. Write for new Burnell Crystal Filter Bulletin, XT-455.

Burnell & Co., Inc.

first in toroids, filters and related networks

Dept. I-10

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

PACIFIC DIVISION
720 MISSION ST.
SOUTH PASADENA, CAL.
RYAN 1-2841
TELETYPE: PASCAL 7578

Circle 22 on Inquiry Card, page 121

Personals

Owen E. Thompson is now an Applications Engineer for Secode Corp.

Robert J. Ehret, Senior Engineer at Ampex Corp., has been promoted to Staff Engineer. He holds 16 United States patents in the electronics field.

Jerome R. Steen has been appointed Engineering Reliability Specialist for the Ballistic Missile Early Warning System (BMEWS) Program of Sylvana Electronic Systems, a division of Sylvania Electric Products, Inc.

John A. Rhoads has joined Packard-Bell Electronics Corp. as Director of Engineering in the Technical Products Div. Prior to joining Packard-Bell he was associated with Collins Radio Corp. in Burbank, Calif.

J. A. Rhoads

J. P. Van Duyne

John P. Van Duyne has been appointed Engineering Manager of the Boonton Radio Corp. He was formerly Manager of TV Engineering for the Westinghouse Electric Corp. in Metuchen, N. J.

Hugh S. Christian is now Electronics Division's Chief Engineer for the Diamond Power Specialty Corp. He was formerly Chief of the Engineering Services Dept., Microwave Div. of Motorola, Inc.

Jack I. Stahl has joined Servo Corp. of America as Production Manager of their manufacturing division.

Dwayne W. Jensen has been appointed Director of Engineering of Tresco, Inc. He was previously on the staff of the Research Div. of Burroughs Corp.

Ray L. Reid has just been appointed Assistant Chief Engineer of Ling Electronics, Inc.

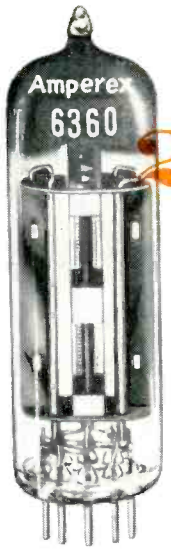
Bock Lee has been named Design Engineer in the Engineering Staff of Lynch Carrier Systems, Inc.

David L. Weeks is Project Engineer for the portion of the USAF's Dyna-Soar Program being performed by the Autonetics Div. of North American Aviation, Inc.

Circle 23 on Inquiry Card, page 121

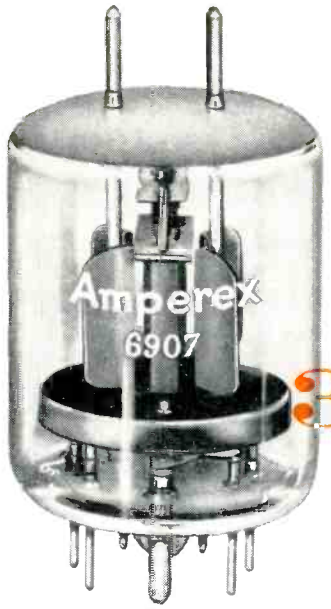
1

Amperex 6939
5 watts
total anode
dissipation



2

Amperex 6360
14 watts
total anode
dissipation



3

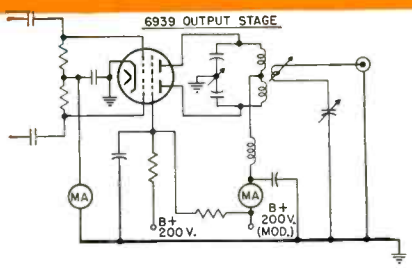
Amperex 6907
20 watts
total anode
dissipation

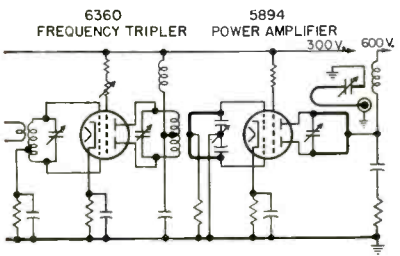
4

Amperex 5894
40 watts
total anode
dissipation

Compatibility

an Amperex® concept in tube design





	Type	Max. Power Input (watts)	Max. Power Output (watts)
1	6939	14 ICAS 12 CCS	7.5 ICAS 5.8 CCS
2	6360	30 ICAS 22.5 CCS	18.5 ICAS 14.5 CCS
3	6907	112 ICAS 90 CCS	67 CCS
4	5894	150 ICAS 120 CCS	96 ICAS 90 CCS

Presenting a Compatible Family of 4 Twin Tetrodes, Specifically Designed to Simplify Circuitry in Mobile VHF/UHF Transmitter Design

These four AMPEREX twin tetrodes, designed from the ground up as a compatible group, complement one another in electrical and mechanical characteristics. The designer of light VHF and UHF transmitting equipment in the 5 to 85-watt category can draw on this group for all of his power amplifier, oscillator, frequency multiplier and modulator requirements, with considerable benefit in design efficiency. He can (1) save entire stages in his transmitter, (2) reduce power consumption requirements and (3) generally optimize transmitter design. The superior performance and reliability of the AMPEREX twin tetrodes, particularly in the 460 Mc band, have made them the most widely accepted small transmitting tubes in the world for amateur, professional, military and airborne applications.

ask Amperex
about tubes and useful circuitry for VHF/UHF transmitters

AMPEREX ELECTRONIC CORP., 230 DUFFY AVENUE, HICKSVILLE, L.I., N.Y.
In Canada: Rogers Electronic Tubes & Components, 11-19 Brentcliffe Road, Toronto

Circle 24 on Inquiry Card, page 121

FOR TOP RELIABILITY

MILITARY AND INDUSTRIAL

HERMETIC AUDIO AND POWER COMPONENTS...FROM STOCK

UTC stock hermetic units have been fully proved to MIL-T-27A, eliminating the costs and delays normally related to initial MIL-T-27A tests. These rugged, drawn case, units have safety factors far above MIL requirements, and are ideal for high reliability industrial applications. Listed below are a few of the hundred stock types available for every application. **Industrial ratings in bold.**

Typical Miniature Audios

RC-25 Case
61/64 x 1-13/32 x 1-9/16
1.5 oz.

Type No	Application	MIL Type	Pri. Imp. Ohms	Sec. Imp. Ohms	Unbal. DC in Pri. MA	Response 2 db (Cyc.)	Max. level dbm
H-1	Mike, pickup. line to grid	TF4RX10YY	50, 200CT, 500 CT	50,000	0	50-10,000	+ 5
H-2	Mike to grid	TF4RX11YY	82	135,000	50	250-8,000	+18
H-5	Single plate to P.P. grids	TF4RX15YY	15,000	95,000 CT	0	50-10,000	+ 5
H-6	Single plate to P.P. grids, DC in Pri.	TF4RX15YY	15,000	95,000 split	4	200-10,000	+11
H-7	Single or P.P. plates to line	TF4RX13YY	20,000 CT	150/600	4	200-10,000	+21
H-8	Mixing and matching	TF4RX16YY	150/600	600 CT	0	50-10,000	+ 8
H-14	Transistor Interstage	TF4RX13YY	10K/2.5K, Split	4K/1K split	4	100-10,000	+20
H-15	Transistor to line	TF4RX13YY	1,500 CT	500/125 split	8	100-10,000	+20

Type No.	Application	MIL Type	Pri. Imp. Ohms	Sec. Imp. Ohms	Unbal. DC in Pri. MA	Response + 2 db (Cyc.)	Max. level dbm
H-20	Single plate to 2 grids, can also be used for P.P. plates	TF4RX15YY	15,000 split	80,000 split	0	30-20,000	+12
H-21	Single plate to P.P. grids, DC in Pri.	TF4RX15YY	15,000	80,000 split	8	100-20,000	+23
H-22	Single plate to multiple line	TF4RX13YY	15,000	50/200, 125/500	8	50-20,000	+23
H-23	P.P. plates to multiple line	TF4RX13YY	30,000 split	50/200, 125/500	8 BAL.	30-20,000	+19
H-24	Reactor	TF4RX20YY	450 Hys.-0 DC, 250 Hys.-5 Ma. DC, 6000 ohms 65 Hys.-10 Ma. DC, 1500 ohms				
H-25	Mixing or transistors to line	TF4RX17YY	500 CT	500/125 split	20	40-10,000	+30

Typical Compact Audios

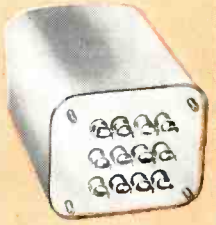
RC-50 Case
1-5/8 x 1-5/8 x 2-5/16
8 oz.

Typical Subminiature Audios

SM Case
1/2 x 11/16 x 29/32
.8 oz.

Type No	Application	MIL Type	Pri. Imp. Ohms	Sec. Imp. Ohms	Unbal. DC in Pri. MA	Response + 2 db (Cyc.)	Max. level dbm
H-31	Single plate to 1 grid, 3:1	TF4RX15YY	10,000	90,000	0	300-10,000	+13
H-32	Single plate to line	TF4RX13YY	10,000	200	3	300-10,000	+13
H-33	Single plate to low imp.	TF4RX13YY	30,000	50	1	300-10,000	+15
H-35	Reactor	TF4RX20YY	100 Henries-0 DC, 50 Henries-1 Ma. DC, 4,400 ohms.				
H-36	Transistor Interstage	TF4RX15YY	25,000 (DCR800)	1,000 (DCR110)	.5	300-10,000	+10
H-39	Transistor Interstage	TF4RX13YY	10,000 CT (DCR600)	2,000 CT	2	300-10,000	+15
H-40A	Transistor output	TF4RX17YY	500 CT (DCR26)	600 CT	10	300-10,000	+15

Type No.	HV Sec. CT	DC MA*	Military Rating Fil. Secs.	DC MA*	Industrial Rating Fil. Secs.	Case
H-80	450	120	6.3V,2A	**130**	**6.3V,2.5A.**	FA
H-81	500/550	65/55	6.3V,3A-5V,2A	**75/65**	**6.3V,3A.-5V,2A.**	HA
H-82	540/600	110/65	6.3V,4A.-5V,2A.	**180/100**	**6.3V,4A.-5V,2A.**	JB
H-84	700/750	170/110	6.3V,5A.-6.3V,1A.,5V-3A.	**210/150**	**6.3V,6A.-6.3V,1.5A.-5V,4A.**	KA
H-89	850/1050	320/280	6.3V,8A.-6.3V,4A.,5V-6A.	**400/320**	**6.3V,8A.-6.3V,4A.-3V,6A.**	OA



Typical Power Transformers

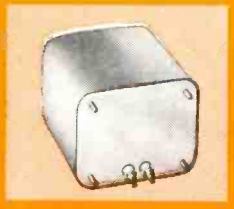
Pri: 115V 50/60 Cyc.
***Choke/Cond. inp.**

Type No.	Sec. Volts	Amps.	Test Volts	Case	Type No.	Sec. Volts	Amps.	Test Volts	Case
H-121	2.5	10(12)	10 KV	JB	H-131	6.3 CT	2(2.5)	2500	FB
H-122	2.5	20(26)	10 KV	KB	H-132	6.3 CT 6.3 CT	6(7) 6(7)	2500	JA
H-125	5	10(12)	10 KV	KB	H-133	6.3 CT	7(8)	2500	HB
H-130	6.3 CT	.6(75)	1500	AJ	H-134	6.3 CT	10(12)	2500	HA

Typical Filament Transformers

Pri: 105/115/210/220V except H-130 (115) and H-131 (115/220) 50/60 Cyc.

Typical Filter Reactors



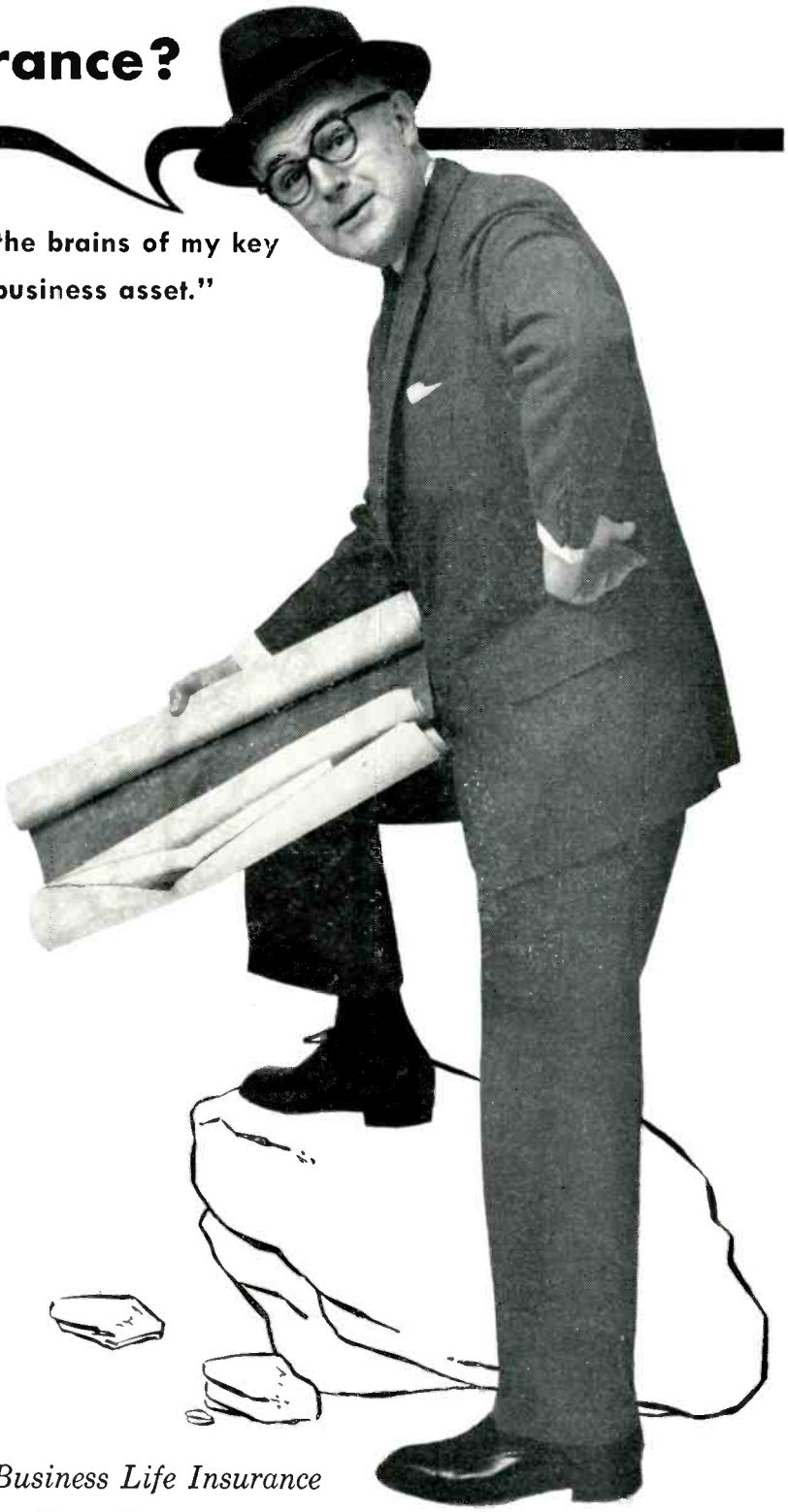
Type No.	MIL Type	Ind. @ MA Hys.	DC	Ind. @ MA Hys.	DC	Ind. @ MA Hys.	DC	Ind. @ MA Hys.	DC	Res. Ohms	Max. DCV Ch. Input	Test V. RMS	Case
H-71	TF1RX04FB	20	40	18.5	50	15.5	60	10	70	350	500	2500	FB
H-73	TF1RX04HB	11	100	9.5	125	7.5	150	5.5	175	150	700	2500	HB
H-75	TF1RX04KB	11	200	10	230	8.5	250	**6.5**	**300**	90	700	2500	KB
H-77	TF1RX04MB	10	300	9	350	**8**	**390**	**6.5**	**435**	60	2000	5500	MB
H-79	TF1RX04YY	7	800	6.5	900	6	1000	**5.5**	**1250**	20	3000	9000	7x7x8

And Special Units to Your Specifications

UNITED TRANSFORMER CORPORATION
150 Varick Street, New York 13, N. Y.
PACIFIC MFG. DIVISION: 4008 W. JEFFERSON BLVD., LOS ANGELES 16, CALIF.
EXPORT DIVISION: 13 EAST 40th STREET, NEW YORK 16, N. Y. CABLES: "ARLAB"

Circle 25 on Inquiry Card, page 121

Why SHOULDN'T I be interested in key man insurance?



"This is for sure . . . the brains of my key men are my biggest business asset."

Almost every company has one or more key men who are responsible for its growth and continuing success. If death takes one of these men, the company stands to lose money . . . at least until a replacement can be found and trained.

You can avoid such a loss through Ætna Life's Key Man Insurance Plan. This plan provides the ideal method of protecting the *living value* of the important men in your business. It gives you the money you will need . . . *when* you need it . . . in the period of adjustment and replacement.

And during the lives of key men, the insurance has important cash values, giving you larger lines of credit and lower rates of interest.

Thoroughly trained representatives in 91 agencies from coast to coast are ready to offer you this unusual Ætna Life Business Planning Service.

ÆTNA BUSINESS LIFE INSURANCE PLANS ARE SPECIALLY DESIGNED . . .

- To preserve PARTNERSHIP value when death comes to any partner.
- To preserve SOLE PROPRIETORSHIPS for heirs or selected employees.
- To preserve ownership values when death comes to any stockholder in a CLOSE CORPORATION.
- To indemnify any firm for the death of a KEY MAN.

Add Life to your Business with Ætna Business Life Insurance

ÆTNA LIFE INSURANCE COMPANY

Affiliates:

ÆTNA CASUALTY AND SURETY COMPANY
STANDARD FIRE INSURANCE COMPANY
Hartford, Conn.

Ætna Life Insurance Company
Hartford 15, Connecticut

Gentlemen:

Please send me a copy of your new business life insurance booklet "Will This Man Take Your Business With Him When He Dies?"

Name_____

Address_____

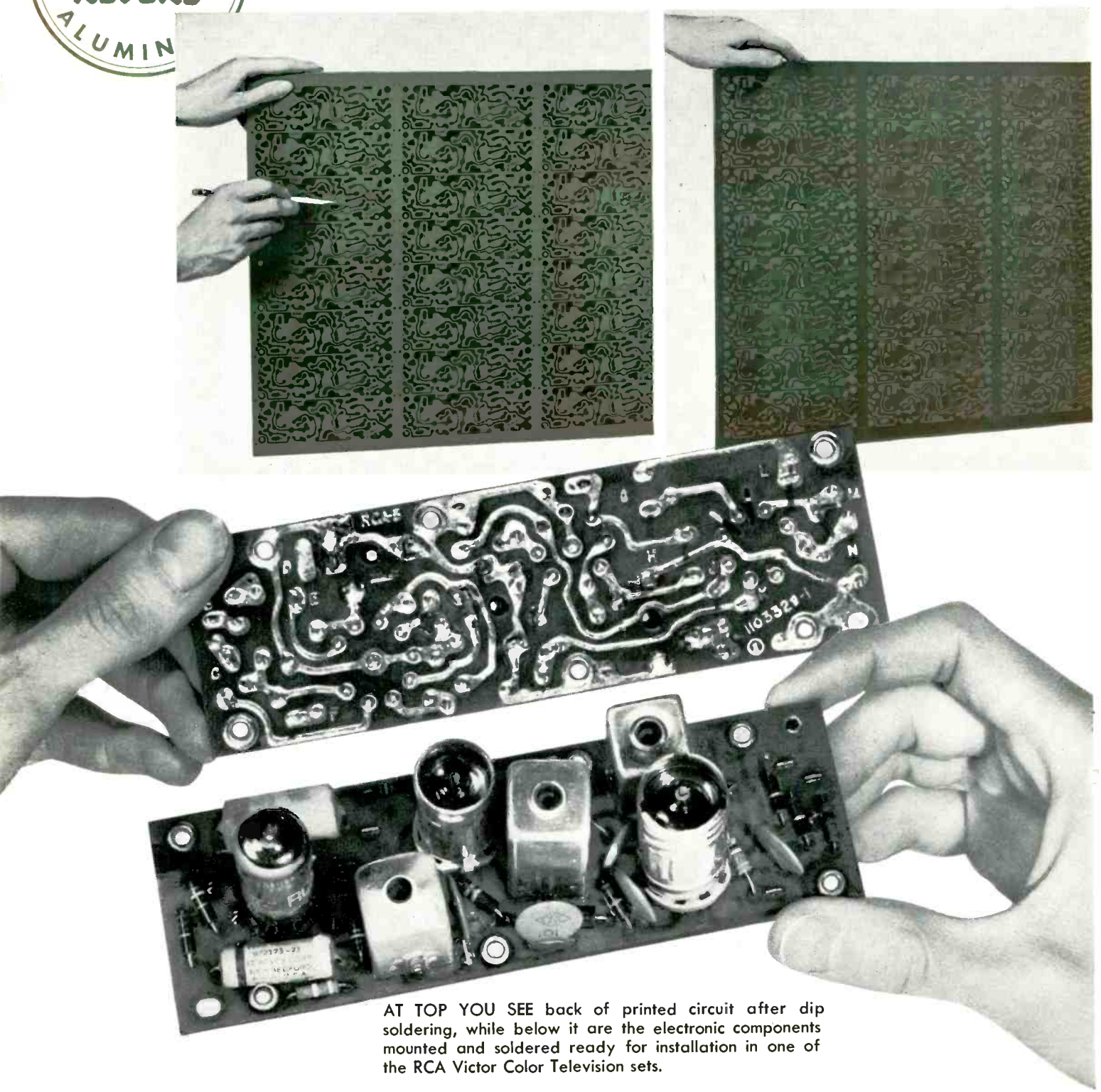
_____

RCA VICTOR USES

for its printed circuits in...

COPPER ★ BRASS ★ 18 01 ★ REVERE ★ ALUMIN

MULTIPLE PRINTED CIRCUITS showing laminated board using Revere Rolled Copper with resist applied (left) and with circuit etched (right).



AT TOP YOU SEE back of printed circuit after dip soldering, while below it are the electronic components mounted and soldered ready for installation in one of the RCA Victor Color Television sets.

REVERE ROLLED COPPER

In the type of color television set turned out by RCA Victor there can be no margin for error. That is why RCA Victor Engineers when they turned to printed circuits for their color TV sets thoroughly tested the various materials available. Here are the reasons they use Revere Rolled Copper:

1. Even the finest lines are comparatively free from pits, pinholes and other imperfections.
2. Thickness is consistently uniform without sacrifice of conductivity, resulting in etching at better production rates.
3. There are no peaks or valleys in its smooth, hard surface of uniform density. This permits resist to clean off easily because there are no pores to hold resist and cause trouble when soldering.
4. Revere Rolled Copper is relatively free from oxidation as it comes from the mill and is without lead inclusions. Has longer shelf life without the need for a major cleaning operation prior to soldering.
5. Its clean surface permits fluxes to wet readily.
6. In the automatic soldering operation it makes possible a uniform solder coat, free of skips or bald spots.

And these are the very reasons why you should insist that Revere Rolled Copper be specified by you when ordering blanks from your laminator.

It is available in unlimited quantities in standard coils of 350 lbs. in widths up to 38″ and in .0014, .0028 and .0042 gauges, weighing approximately 1 oz. and 2 oz. and 3 oz. per square foot or heavier if required. Many users have found that because of its unique characteristics 1 oz. Revere Rolled Copper can be used instead of the 2 oz. required when other kinds of copper are used, thus effecting still greater savings in material cost. Revere Rolled Copper exceeds requirements of standard specifications and meets Electrolytic Tough Pitch Copper ASTM B5 specification for purity with 99.9% minimum.

Consult your laminator regarding the use of Revere Rolled Copper for your printed circuits, or contact the Revere Representative nearest you through the yellow pages of your local telephone directory.

REVERE DOES NO LAMINATING OF PRINTED CIRCUIT BOARDS, MAKING ONLY THE ROLLED COPPER.

REVERE ROLLED COPPER CAN ALSO BE FURNISHED ROLLED DOWN TO .0006 FOR COIL WINDING APPLICATIONS.

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Rome, N. Y.; Baltimore, Md.; Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities, Distributors Everywhere.

COPPER * BRASS * REVERE * ALUMINUM

CLEVITE 'BRUSH'

High Resolution Magnetic Heads

WITH GAPS AS NARROW AS **20** MICROINCHES

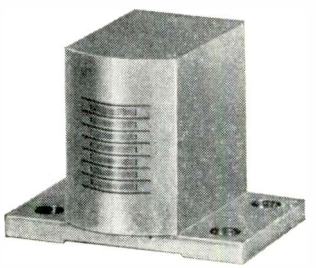
Clevite "Brush" high resolution magnetic heads permit major improvements in tape recording systems:

Greater packing density and/or higher frequency recording at your present tape or drum velocity. *Less volume of tape required.*

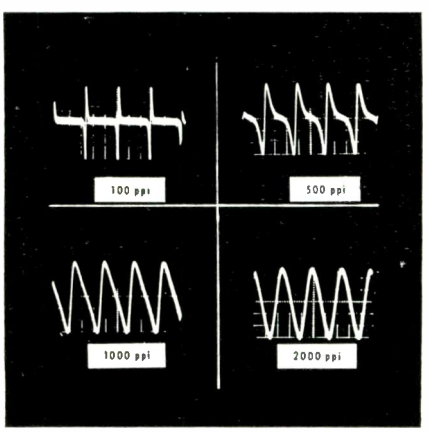
Up to 10 to 1 reduction in tape or drum velocity at your present frequencies or pulse repetition rate. *More recording time on the same length of tape.*

Reduced playback pulse width, allowing extended pulse width modulation (pwm) recording; for example, 5 microsecond pulse width at 120 inches per second tape velocity.

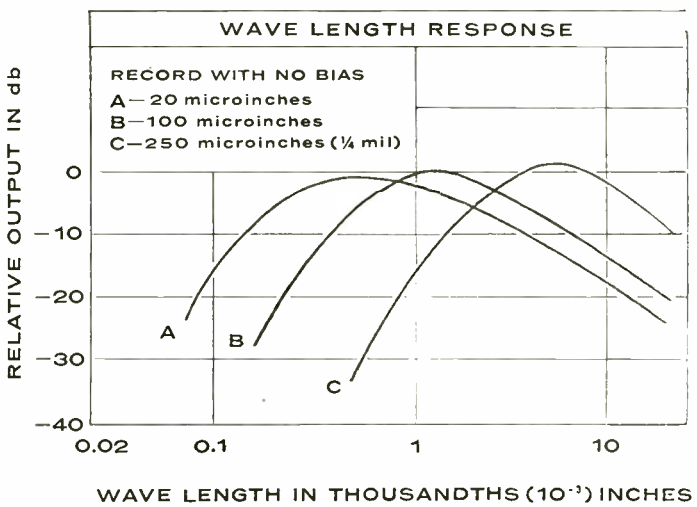
Special high resolution heads were developed by Clevite to meet specific customer applications. They are now commercially available in 2 to 32 channel form in a variety of mechanical configurations. These heads, slightly modified, may fit your present design requirements. One of our specialists will be pleased to discuss your application by detailed correspondence or personal visit. Write: Product Manager, Magnetic Heads, Clevite Electronic Components, 3311 Perkins Avenue, Cleveland 14, Ohio.



Typical Clevite narrow gap multi-channel head records more data on an equal length of tape.



Oscilloscope photos of pulse recordings on Clevite high resolution head. Pulse duration, 1 microsecond; tape speed, 60 inches/sec.



Clevite 'Brush' High Resolution Heads for radar recording • high density tape recording • high density drum recording • video recording • VHF instrumentation for missile telemetering

CLEVITE ELECTRONIC COMPONENTS

DIVISION OF CLEVITE CORPORATION

MAGNETIC HEADS
TRANSDUCERS
PIEZOELECTRIC CRYSTALS, CERAMICS AND ELEMENTS

3 New Midget Pliers by KLEIN

Here is a new line of genuine Klein Pliers in oblique and long nosed patterns specially designed for wiring modern electronic assemblies or doing any close work in confined space.

These midgets are hardly longer than your favorite package of cigarettes and their extremely small size will simplify many small close-tolerance jobs.

Available in oblique cutting, long nose with and without knurl, and end cutting pliers.

See your distributor.

No. 257-4 Oblique Cutting Plier. Size	4 in.
321-4½ Long Nose Plier	4½ in.
322-4½ (Without Knurl)	4½ in.
224-4½ End Cutting Plier	4½ in.

Available with coil spring

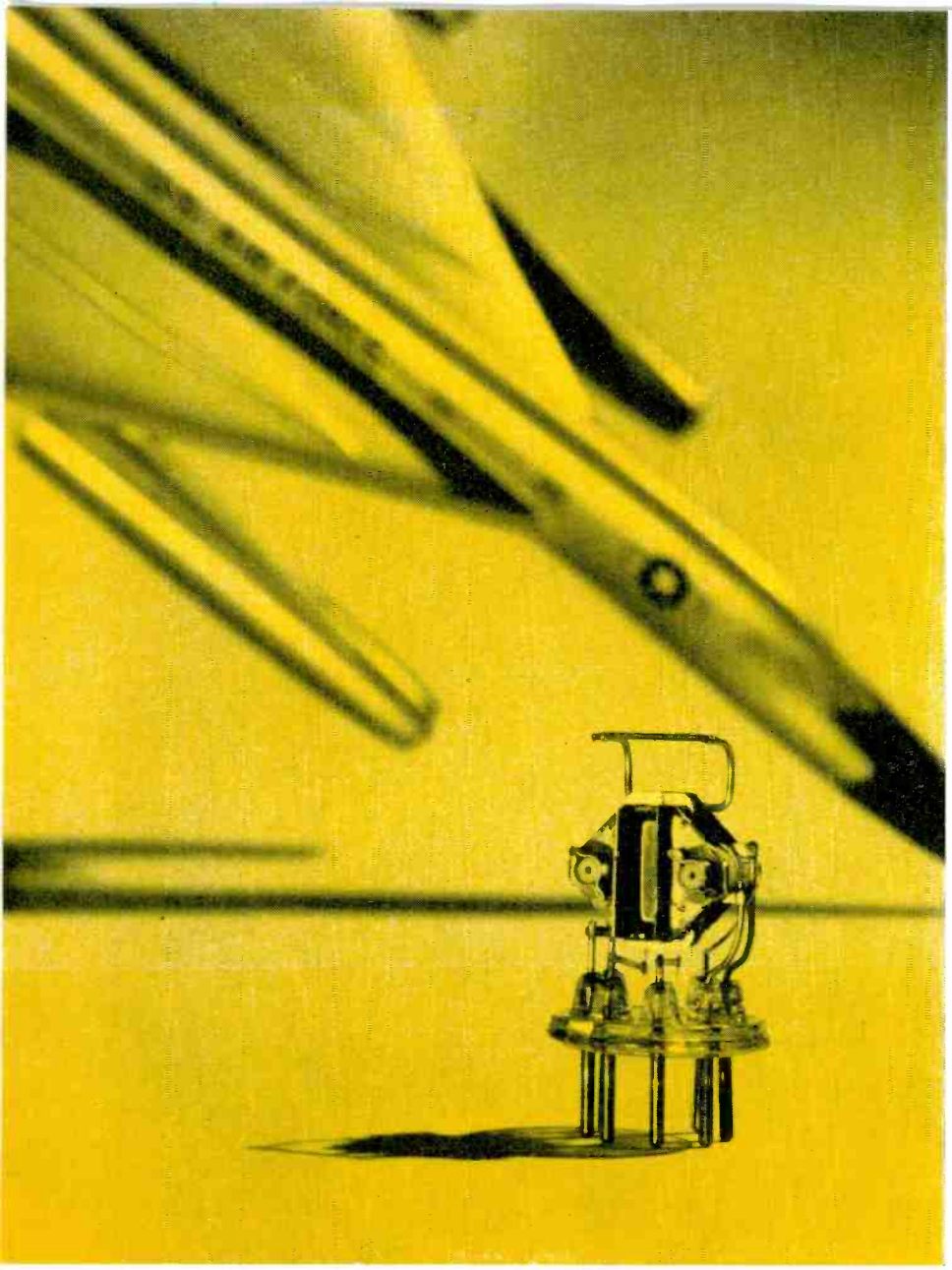
No. 257-4C Oblique Cutting Plier	
321-4½C Long Nose Plier	
322-4½C (Without Knurl)	
224-4½C End Cutting Plier	

Mathias KLEIN & Sons
Established 1857
Chicago, Ill., U.S.A.
7200 McCORMICK ROAD • CHICAGO 45, ILLINOIS

Free Bulletin on Klein Pliers
Bulletin 758 on Klein Pliers sent you on request.

Circle 26 on Inquiry Card, page 121

Snapshots of the Electronic Industries

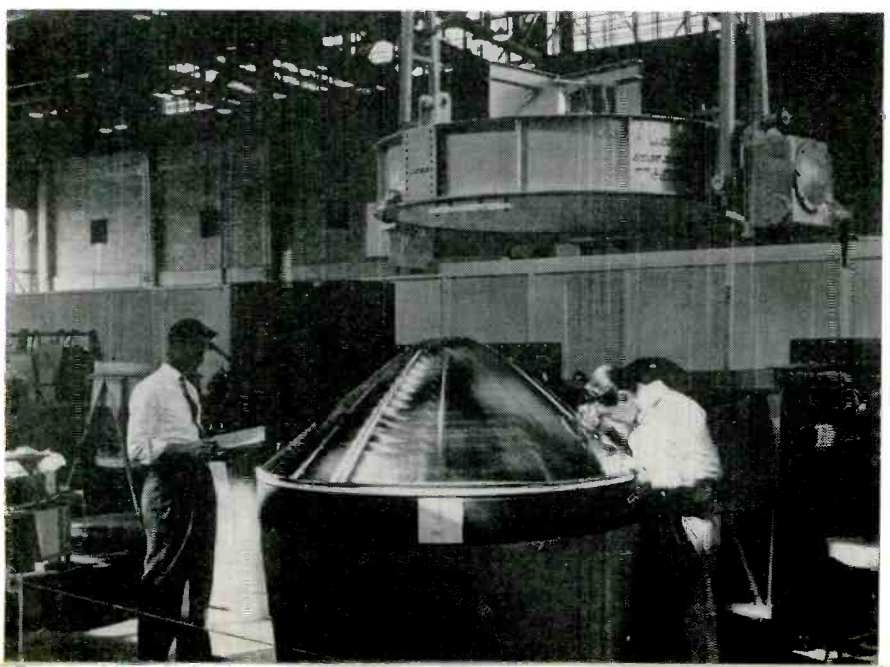


CERAMIC "STACKED" TUBE

This new Sylvania design uses a "planar" or sandwich-type structure in which the elements are stacked one atop the other. Ceramic spacers are used instead of conventional mica.

NOSE CONE CHECK-OUT

Two G.E. flight test personnel check out nose cone after it arrives at Cape Canaveral from the Missile and Ordnance Systems Dept. Phila. Check will assure it is operational.



MORE THAN MEETS THE EYE

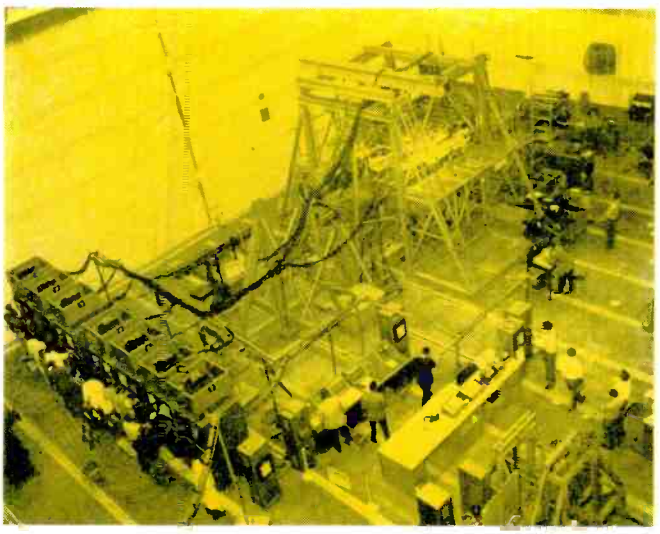
Clock-faced device (r) is a multi-position switch, literally no bigger than your eye. Avion Div. of ACF Industries makes it.

COMPUTER SIMULATION

R. E. Graham and E. E. David of Bell Labs prepare to photograph a reproduction of a TV picture processed by computer simulation.

SUPER ACCELERATION

Almost instant acceleration to 18 Gs—18 times the force of gravity—is achieved by this Lockheed X-7 missile as it blasts a scant distance of 2 ft. at Hollaman AFB.



MISSILE CHECK OUT

An IM-99 BOMARC missile section undergoes simulated flight conditions at Boeing Lab. Varying loads are applied at high temperatures.

HIGH SPEED PRINTER

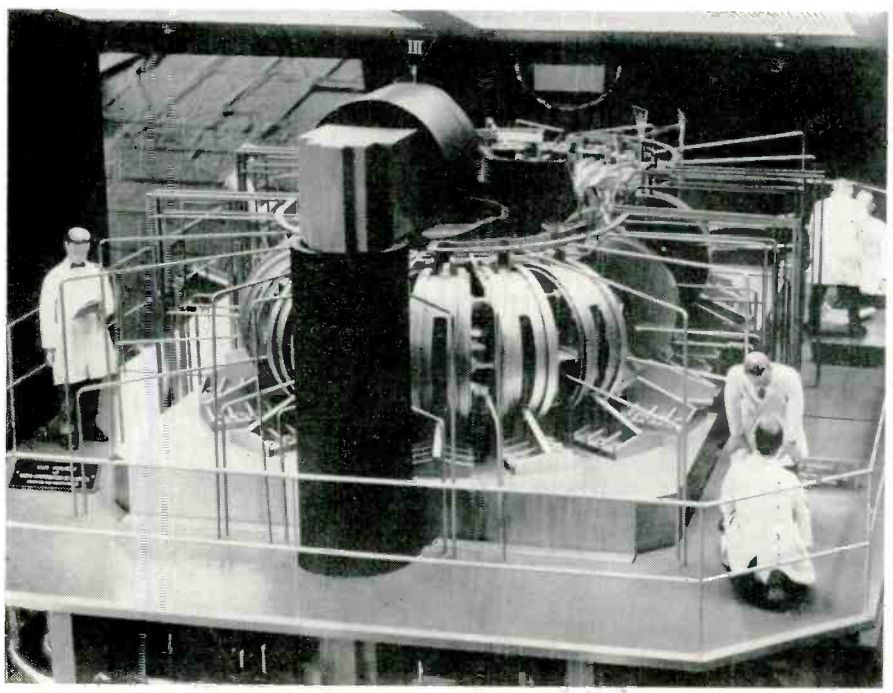
Dr. T. C. Fry, Maj. Gen. C. H. Mitchell and H. V. Widdoes watch Remington-Rand's new High Speed Printer in operation at Rome AF Depot.

SEARCH RADAR

Sperry engineer checks out search radar for B-58 Hustler. The radar is part of the plane's doppler-inertial navigation system.

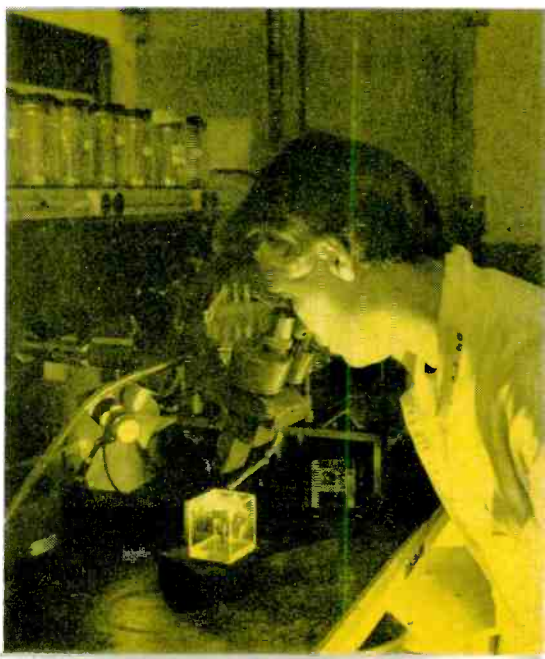
NUCLEAR "TEST TRACK"

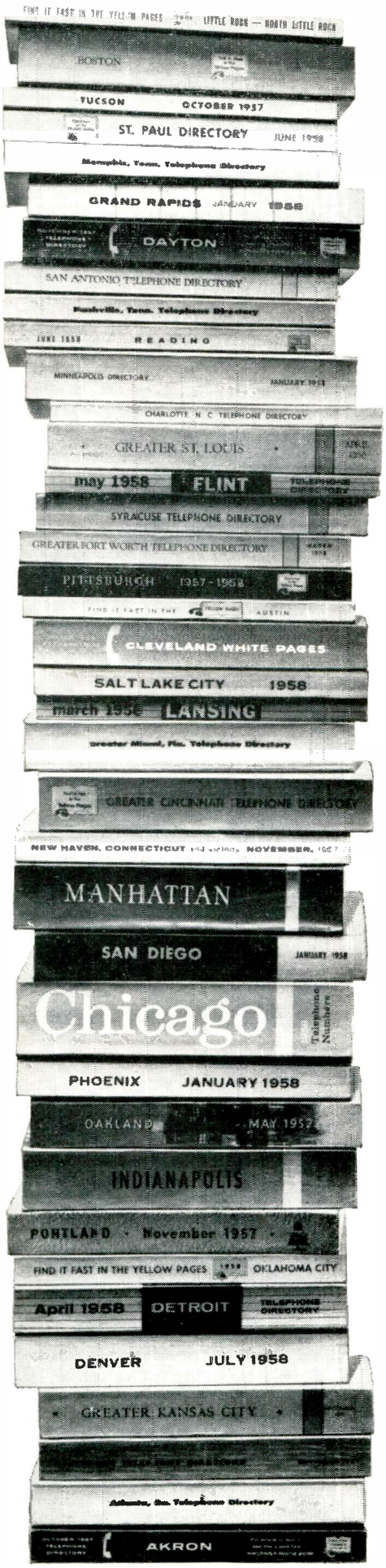
The "C Stellerator," shown here in model, will be installed at Princeton University for research into the fusion process. Allis-Chalmers and RCA are the prime contractors.



"WHISKERS"

A stereo-microscope is used by Boeing technician to investigate the growth of troublesome "metal whiskers" on potentiometer.





1 in 35,000,000

How the telephone switching system sorts numbers in seconds

When you dial out of town, the telephone switching system performs an amazing feat. It sorts out the one other number in 35 million you want, and connects you to it in seconds. The other telephone may be thousands of miles away.

Bell Laboratories engineers endowed this great switching network with almost superhuman capabilities. As you dial, the machine listens, remembers, figures out the best route, makes connections, alerts, reports, even corrects itself. If it detects trouble on the way, it files a report, then chooses other circuits and goes on to complete your call. All you are aware of is the end product—the completed call.

Yet at Bell Telephone Laboratories, switching engineers see the present system as only a beginning. Ahead they see—and are developing—new systems vastly more flexible and capable than today's. Nowhere in telephone technology is the challenge greater. Nowhere are dreams coming true faster.

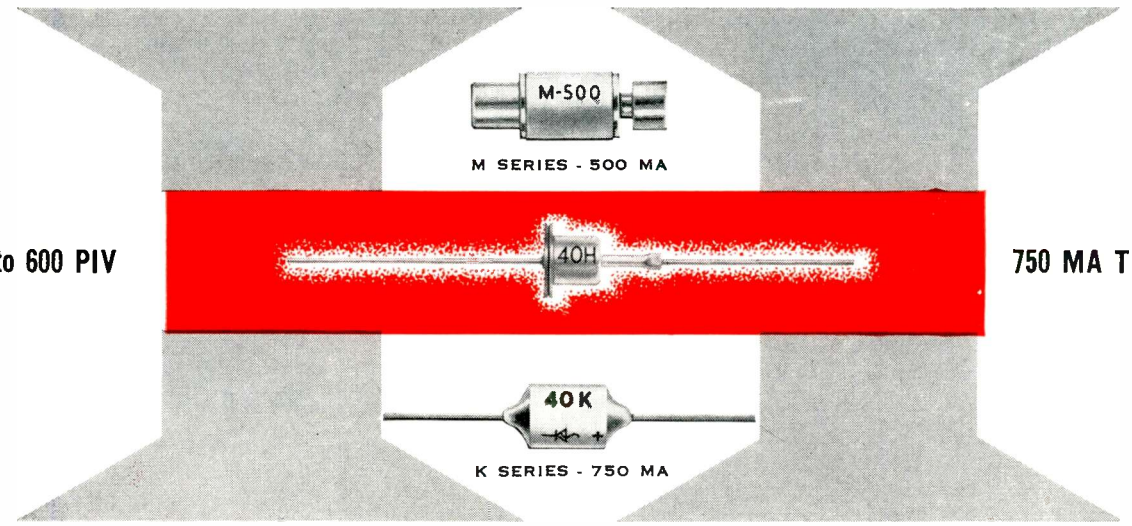
BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

These Bell Telephone System directories list some of the 35,000,000 telephones now linked by the Direct Distance Dialing system developed at Bell Laboratories. In seconds, this unique machine sorts out and connects you with precisely the number you want.

Announcing A NEW MEMBER OF THE Tarzian SILICON RECTIFIER LOW CURRENT FAMILY. . .

The H Series



RECTIFIERS ACTUAL SIZE

ELECTRICAL RATINGS
CAPACATIVE LOAD

S. T. Type	Max. Peak Inverse Volts	Max. RMS Volts	CURRENT RATINGS—AMPERES											
			Max. D. C. Load			Max. RMS			Max. Recurrent Peak			Surge 4MS Max.		
			55°C	100°C	150°C	55°C	100°C	150°C	55°C	100°C	150°C	55°C	100°C	150°C
10H	100	70	.75	.5	.25	1.875	1.25	.625	7.5	5.	2.5	30	30	15
20H	200	140	.75	.5	.25	1.875	1.25	.625	7.5	5.	2.5	30	30	15
30H	300	210	.75	.5	.25	1.875	1.25	.625	7.5	5.	2.5	30	30	15
40H	400	280	.75	.5	.25	1.875	1.25	.625	7.5	5.	2.5	30	30	15
50H	500	350	.75	.5	.25	1.875	1.25	.625	7.5	5.	2.5	03	30	15
60H	600	420	.75	.5	.25	1.875	1.25	.625	7.5	5.	2.5	30	30	15

Features

- High Reliability— Extra Heavy Duty Junction
- Hermetically Sealed Welded Case
- Small Size
- Low Price
- Mass Production
- Available from Stock in Many Ratings

Sarkes Tarzian, Inc.

RECTIFIER DIVISION

DEPT. EE4, 415 N. COLLEGE AVE., BLOOMINGTON, IND.

IN CANADA: 700 WESTON RD., TORONTO 9. TEL. ROGERS 2-7535 • EXPORT: AD AURIEMA, INC., NEW YORK CITY

Industry News

A. J. Kenerleber is now serving as Manager of General Electric's new television picture tube replacement plant in Augusta, Ga. Other GE appointments include: **A. A. Watson** to Manager-Marketing and Assemblies & Component Sales; and, **R. C. Wilson** to Manager-Manufacturing and Plant Operations. Both of these are at Distribution Assemblies Dept., Plainville, Conn.

Nathan H. Magida is now serving in the newly-created post of Manager of Product and Market Planning at Sorensen & Co., Inc.

N. H. Magida

W. J. Pietenpol

Dr. William J. Pietenpol has been appointed Vice President and General Manager of the Semiconductor Div., Sylvania Electric Products Inc.

Appointments in Varian Associates' Instrument Div.: **William Simons** to Manager, Spectrometer Products Development; **Robert Rorden** to Manager, Small Instrument Development; **William Neff** to Manager, Electro-Mechanical Development; and, **William Benninger** to Manager, Quality Control.

Walter N. Lundahl is now Operations Manager of the Frank R. Cook Co., Denver.

The new Director of Research at Ultronix, Inc., San Mateo, Calif., is **John C. Schweitzer**. Mr. Schweitzer was formerly associated with Boeing Airplane Co.

Burt L. Fielding has joined Dalmo Victor Co. as Manager of Engineering Sales for the Electronic Systems Div.

Abe Perlman has been appointed Production Manager of General Transistor Corp.

Z. W. Pique is serving in the newly-created post of Director of Sales for the Hughes Products Group of Hughes Aircraft Co. Mr. Pique was formerly with Texas Instruments, Inc.

Industry News

Dr. Charles F. Robinson fills the position of Chief Research Physicist after his promotion at Consolidated Electrodynamics Corp.

Earl Pollock, Director of Technical Services at Victoreen Co. is on special leave of absence for one year to direct the Oak Ridge Institute of Nuclear Studies in the use of radioisotopes in industry.

Edward G. Wildanger is the new Manager of the Applications Engineering Section at Ampex Coropration's Instrumentation Div.

Linwood A. Walters is serving as Director of Research and Development for National Vulcanized Fibre Co.

L. A. Walters

S. Ochlis

Samuel Ochlis has joined Epsco, Inc. as Sales Manager of the Instrument and Equipment Div. Mr. Ochlis was formerly Sales Manager at Arthur C. Ruge Assoc.

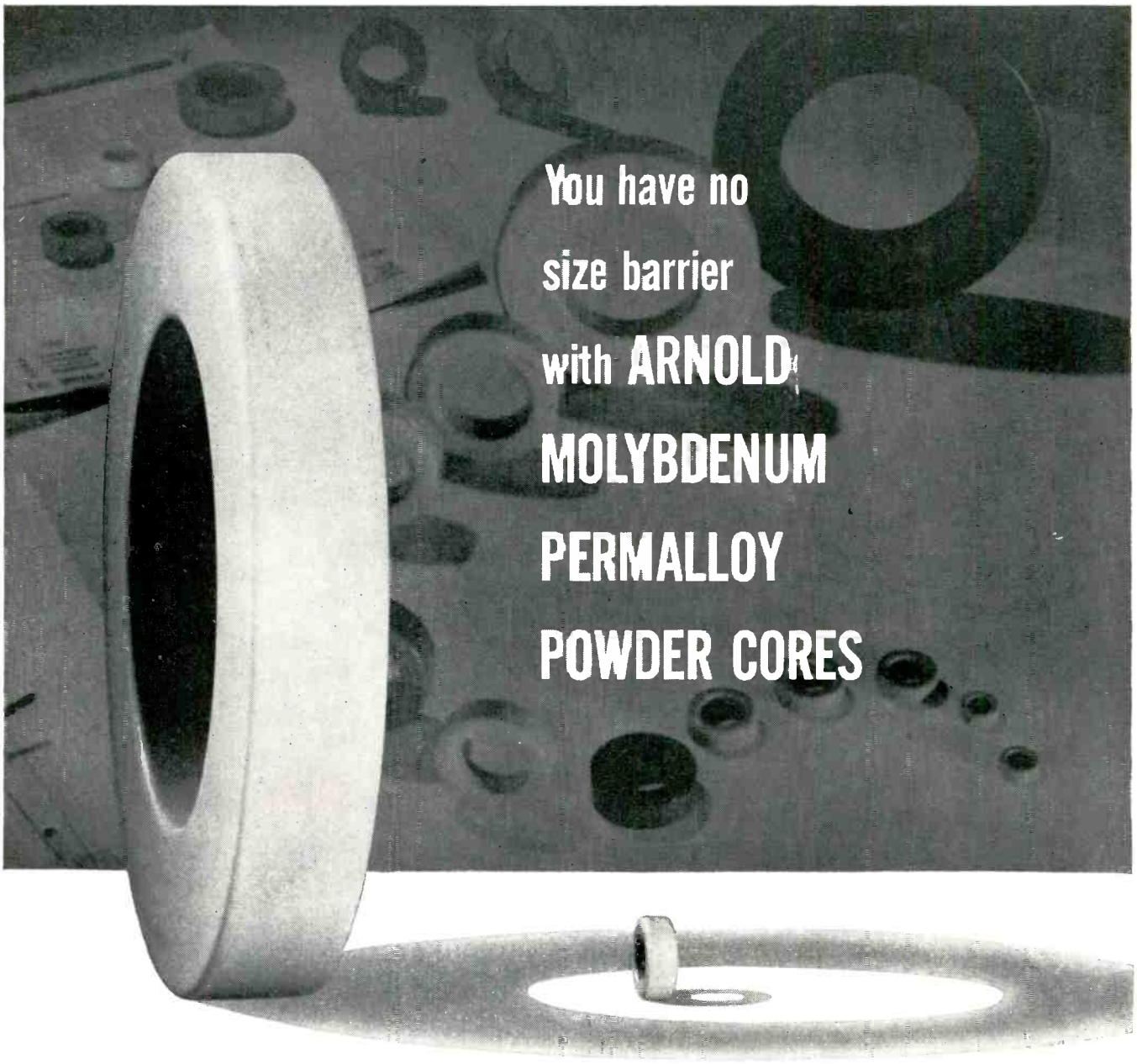
George F. Metcalf has been promoted to the newly-created office of Regional Vice President-Washington Defense Activities of the General Electric Co.

Richard R. Fidler will serve as Manager for the newly-organized advanced development-Data Conversion Dept. of the Data Processing Lab. of Sylvania Electric Systems.

Victor G. Aleshin is Varian Associates new Manager, Manufacturing, Instrument Div.

Ralph E. Grimm has advanced to the post of Director of Engineering for the Nems-Clarke Co. **George S. Vermilyea** joins the same company as Executive Vice President. Mr. Vermilyea was formerly associated with the International Business Machines Corp.

(*Continued on page* 50)



Starting with the smallest up to the largest, Arnold leads the way in offering you a full range of Molybdenum Permalloy Powder cores for greater design flexibility . . . from 0.500" O.D. to 5.218" O.D.

As long ago as 1953 Arnold pioneered and developed for production use the small "Cheerio" core illustrated above. Today, hundreds of thousands of Arnold "Cheerio" cores are filling the requirement for miniaturization in circuit design in industrial and military applications. And even smaller sizes have been developed by the Arnold Engineering Company and are available.

Arnold also is the exclusive producer of the largest 125 Mu core commercially available. A huge 2,000 ton press is required for its manufacture and insures its uniform physical and magnetic properties. This big core is also offered in the other three standard permeabilities of 60, 26 and 14 Mu.

Most core sizes can be furnished with a controlled temperature coefficient of inductance in the range of 30° F to 130° F. Many can be supplied temperature stabilized over the wide range covered by the MIL-T-27 specification of −55° C to +85° C . . . another of the special features only Arnold provides. ● Let us handle all your magnetic materials requirements from the most extensive line in the industry: Powder cores, tape cores, cast or sintered Alnico permanent magnets, and special magnetic materials.

For more information write for Bulletin PC-104B

Lists complete line of Mo-Permalloy Powder cores . . . available in 23 sizes from 0.500" O.D. to 5.218" O.D. Furnished also with various types of temperature stability from Type "A" unstabilized to Type "W" stabilized over the temperature range of −65° F to +185° F.

ADDRESS DEPT. T-810

WSW 6961 A

THE ARNOLD ENGINEERING COMPANY

Main Office & Plant: Marengo, Illinois

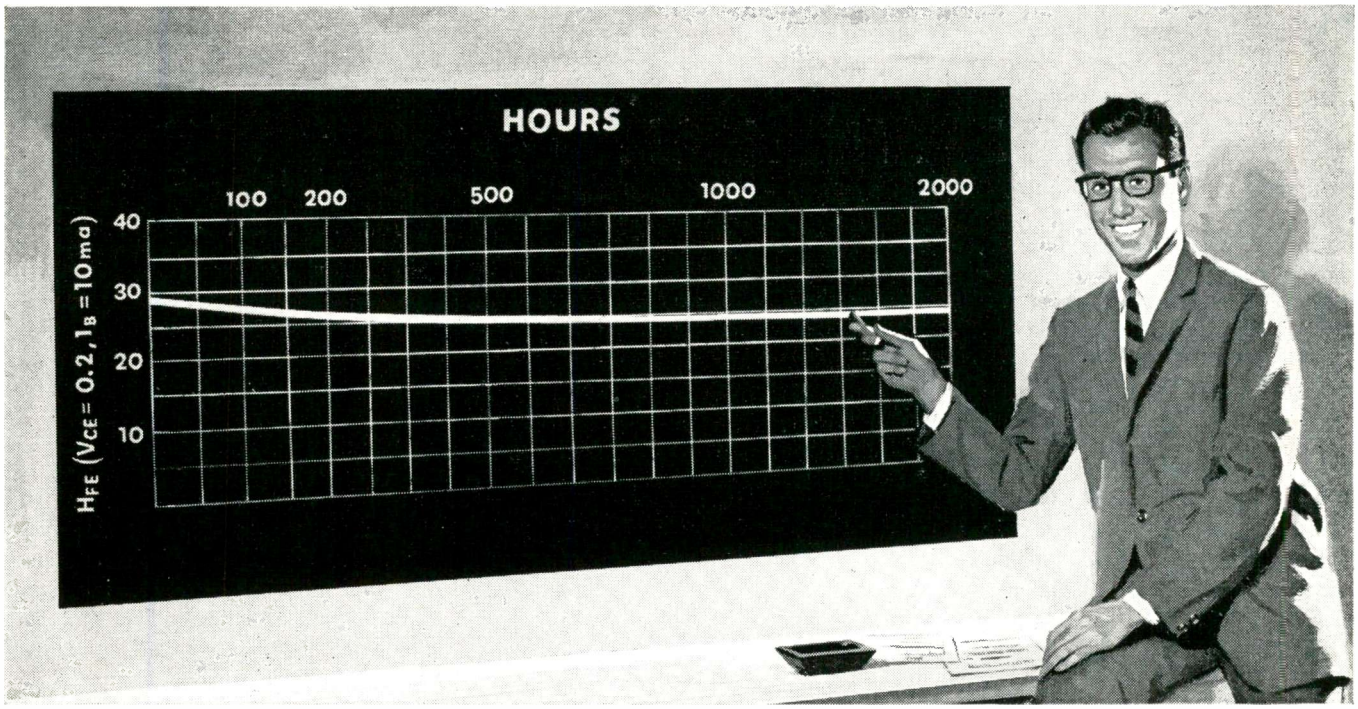
Repath Pacific Division Plant: 641 East 61st Street, Los Angeles, Calif.

District Sales Offices:

Boston: 49 Waltham St., Lexington Los Angeles: 3450 Wilshire Blvd.

New York: 350 Fifth Ave. Washington, D.C.: 1001-15th St., N.W.

SYLVANIA–NPN SWITCHING TRANSISTORS

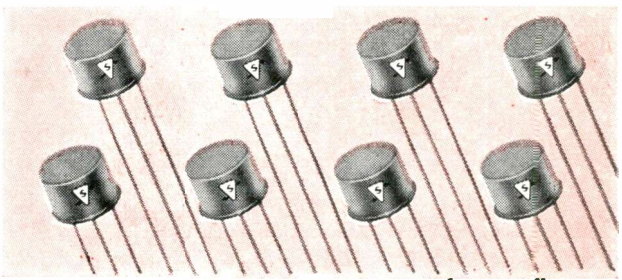


...still holding the line at 2000 hours

Eight new high stability NPN switching transistors designed for wide application in low and medium power switching circuits, are now available from Sylvania. They increase to 15, the total number of NPN switching types in the Sylvania line. Most of the units now have passed 2,000-hour evaluations and are continuing to maintain the high Beta stability and fast rise time so important in switching applications.

The fifteen NPN germanium transistors include both *base-on-the-can* types with *150 mw and 200 mw dissipation* and *base-off-the-can* types with *100 mw dissipation*.

Each of the types features the Sylvania welded hermetic seal for full protection against humidity and other environmental conditions and meets JETEC TO-5 and TO-9 dimensions. For further particulars on the entire line, contact your Sylvania representative or write Sylvania direct.



Type	Max. Dissipation at 25° Ambient	Max. Junction Temp. (°C)	Max. I_c (ma)	Current Gain h_{FE}	Max. Rise Time, t_r
2N439	100 Mw	85	100	40	2.5 usec
2N556	100 Mw	85	200	50	3.5
2N557	100 Mw	85	200	30	6.5
2N558	100 Mw	75	200	75	3.5
2N576*	200 Mw	100	400	40	2.0
2N576A*	200 Mw	100	400	60	2.0
2N587*	150 Mw	85	200	30	2.0
2N679*	150 Mw	85	100	20	2.0
2N312	100 Mw	85	200	20	1.5
2N356	100 Mw	85	500	30	2.0
2N357	100 Mw	85	500	30	1.2
2N358	100 Mw	85	500	30	0.8
2N377*	150 Mw	100	200	40	2.5
2N385*	150 Mw	100	200	70	–
2N388*	150 Mw	100	200	110	1.0

*Base internally connected to the case

SYLVANIA

SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway, New York 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd., P. O. Box 1190, Station "O," Montreal 9

LIGHTING • TELEVISION • RADIO • ELECTRONICS • PHOTOGRAPHY • ATOMIC ENERGY • CHEMISTRY-METALLURGY

Do You Have Critical Filter Problems?

SANGAMO MAY HAVE THE ANSWER TO YOUR PROBLEM

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

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

BASIC OPERATIONAL AND DESIGN SPECIFICATIONS:

Meet applicable requirements for military apparatus.

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

Operate at signal level as low as 10 microvolts.

Must be well shielded against external fields.

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

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

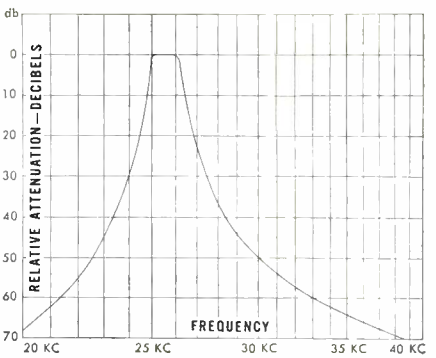
The phase shift, from one production filter to another, shall not vary more than 5° at any point in the 25 KC to 26 KC bandpass.

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

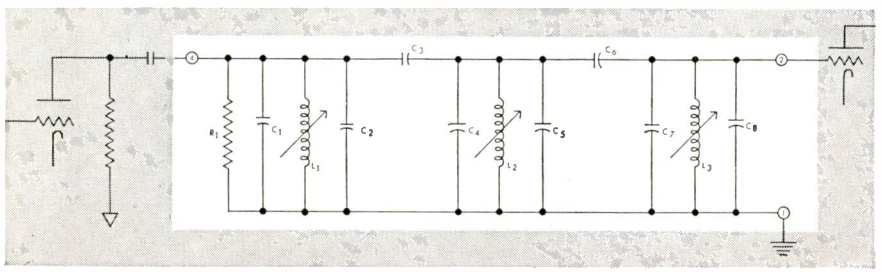
Temperature range 0° to 85°C.

SANGAMO SOLUTION TO PROBLEM

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



Relative response curve of this Sangamo bandpass filter.



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

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

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

SC58-5

Manufacturing Semiconductors, other Electronic Parts calls for ultra-pure B&A® "Electronic Grade" Chemicals

Impurities in the chemicals you use may be a hidden cause of poor quality and high rejection ratios for semiconductors and other electronic parts. That's why you need ultra-pure B&A "Electronic Grade" chemicals. Developed especially for the electronic industry by America's leading producer of laboratory and scientific chemicals — Baker & Adamson—they are distinguished by carefully controlled assay and remarkably low limits on impurities.

For example: the exceptional purity of B&A "Electronic Grade" Solvents is made possible through a new analytical technique involving resistivity measurements to detect and control trace impurities. This special quality control method for B&A "Electronic Grade" solvents eliminates one more variable in the production of electronic devices and significantly reduces rejection ratios.

Many B&A "Electronic Grade" chemicals are now available. They are listed here. To meet special needs, other high purity chemicals can be custom-made to your specifications.

B&A "ELECTRONIC GRADE" CHEMICALS

- Acetone
- Aluminum Nitrate, Crystal and Basic
- Barium Acetate
- Barium Nitrate
- Calcium Nitrate, Tetrahydrate
- Carbon Tetrachloride
- Ether, Anhydrous
- Hydrofluoric Acid, 48%
- Hydrogen Peroxide, 3%
- Hydrogen Peroxide, 30%
- Hydrogen Peroxide, 30% "Stabilized"
- Methyl Alcohol, Absolute (Methanol) "Acetone Free"
- Propyl Alcohol, Iso
- Sodium Carbonate, Monohydrate
- Strontium Nitrate
- Trichloroethylene

Other B&A chemicals for electronics include:

- Metallic oxides, carbonates and oxalates for ferrite cores
- Fluoborates for plating printed circuits
- Sulfur hexafluoride for gaseous insulation

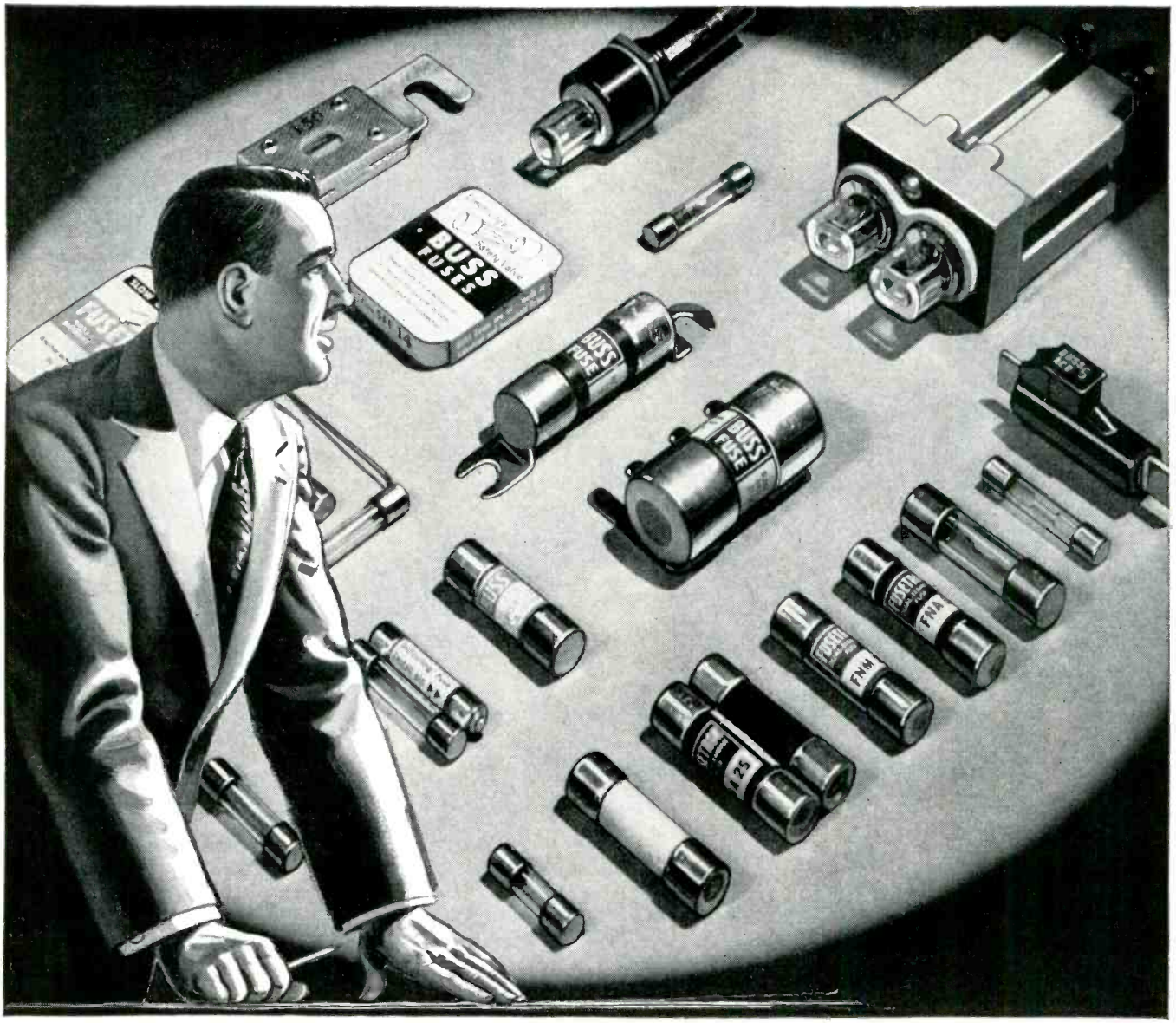
Write today for free folder describing the full B&A line of "Electronic Grade" chemicals, their uses and advantages.

BAKER & ADAMSON®
"Electronic Grade" Chemicals

Allied Chemical

GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N. Y.

Circle 33 on Inquiry Card, page 121



BUSS Fuses provide Maximum Protection *against damage due to electrical faults*

When an electrical fault occurs, BUSS fuses quickly clear the circuit. By preventing useless damage, BUSS fuses help to get your equipment back in operation sooner. Users of your equipment are safeguarded against the expense of unnecessary repair bills.

BUSS fuse dependability also prevents needless blows that 'knock' equipment out-of-service without cause. Users are protected against irritating and often costly shutdowns due to faulty fuses blowing when trouble does not exist.

Electronic Testing Assures Dependability in BUSS Fuses

Every BUSS fuse is tested in a sensitive electronic device that automatically rejects any fuse not correctly calibrated, properly constructed and right in all physical dimensions.

By specifying BUSS fuses, you are providing the finest electrical protection possible, — and you are helping to safeguard the reputation of your product for quality and reliability. To meet your needs, the BUSS fuse line is most complete.

If you have an unusual or difficult protection problem . . . let the BUSS fuse engineers work with you and save you engineering time. If possible, they will suggest a fuse already available in local wholesalers' stocks, so that your device can easily be serviced.

For more information on BUSS and FUSETRON Small Dimension fuses and fuseholders, write for bulletin SFB.

Bussmann Mfg. Division McGraw-Edison Co., University at Jefferson, St. Louis 7, Mo.

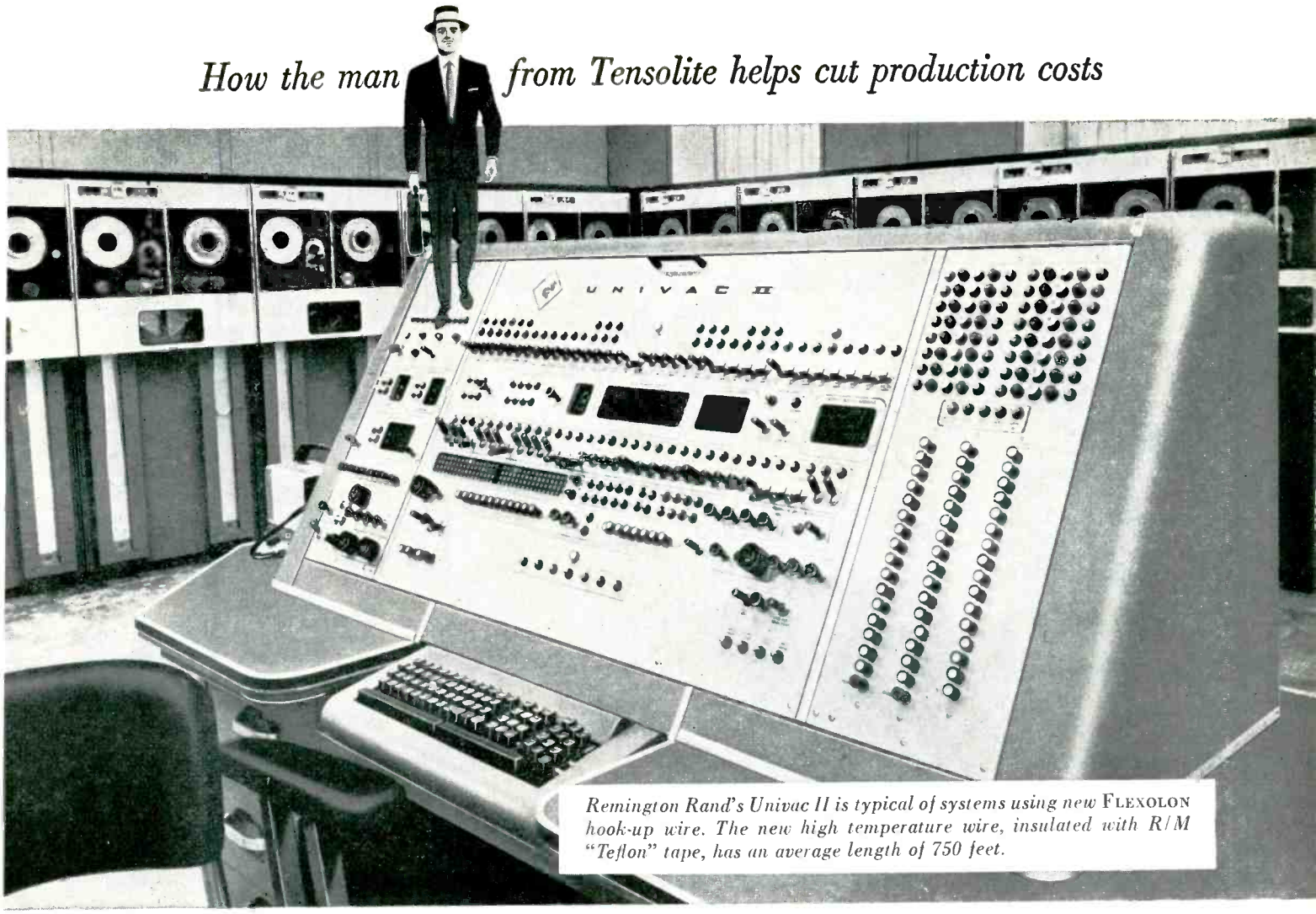
BUSS fuses are made to protect – not to blow, needlessly

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

A COMPLETE LINE OF FUSES FOR HOME, FARM, COMMERCIAL, ELECTRONIC, AUTOMOTIVE AND INDUSTRIAL USE.

1058

How the man from Tensolite helps cut production costs



Remington Rand's Univac II is typical of systems using new FLEXOLON *hook-up wire. The new high temperature wire, insulated with R/M "Teflon" tape, has an average length of 750 feet.*

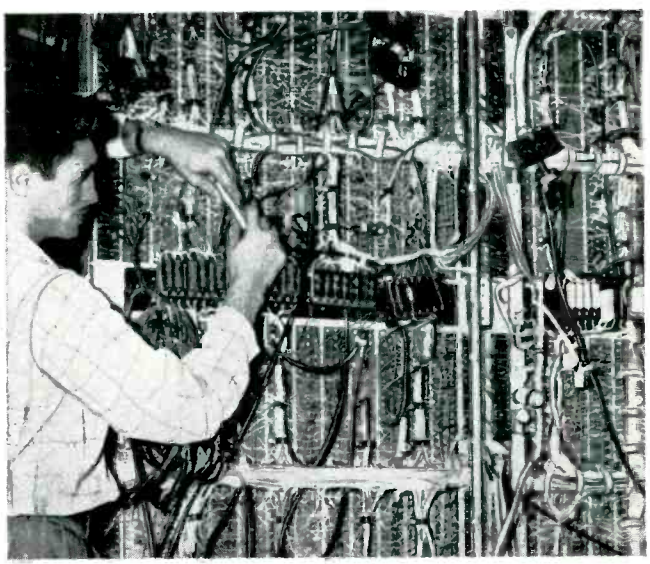
New FLEXOLON hook-up wire with R/M "Teflon" tape reduces wire scrap up to 90%

New FLEXOLON high temperature hook-up wire, insulated with Raybestos-Manhattan "Teflon" tape, is setting economy records throughout industry. At Remington Rand, where FLEXOLON wire is used in Univac II, its guaranteed 250-foot minimum length has drastically reduced wire scrap.

Another manufacturer reports a 90 per cent scrap reduction with FLEXOLON wire. A user of 3-foot lengths, he formerly obtained 16 pieces from each 50-foot length of ordinary wire. Two feet ended up as scrap. By switching to FLEXOLON wire, he now obtains 83 pieces from each guaranteed 250-foot length, with only one foot wasted. This is just 1/10 of his former scrap.

Although a minimum 250-foot length is guaranteed, the average distribution of new FLEXOLON wire is approximately 750 feet, assuring even greater savings. Longer lengths of FLEXOLON hook-up wire will also cut your production costs by minimizing set-up time on automatic equipment.

To learn the many other benefits of FLEXOLON hook-up wire . . . its greater dielectric strength, extra flexibility, higher average concentricity . . . call the man from Tensolite. Or write for informative FLEXOLON hook-up wire bulletin.



Univac engineer wires central computer with new FLEXOLON *high temperature hook-up wire. Greater flexibility of the new wire also reduces wiring time.*

Tensolite INSULATED WIRE CO., INC.

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

FLEXOLON is a trademark of the Tensolite Insulated Wire Co., Inc.

TEFLON is a registered trademark of the Du Pont Company

Circle 35 on Inquiry Card, page 121

Industry News

Harold P. Field recently assumed the duties of Director of Marketing of the Electronics Div. of Stromberg-Carlson.

Robert Erickson has joined Beckman Instruments, Inc. as Executive Vice President.

At Electra Mfg. Co., **Richard R. Burton** has been promoted to Vice President of Electronic Sales and **James M. Rice** to Assistant Sales Manager of the Electronic Div.

Robert A. Bailey is now serving as Director of Marketing for the Industrial Products Div. of International Telephone and Telegraph Corp.

D. C. Duncan is filling the new corporate post of Director of Contract Sales at the Helipot Div. of Beckman Instruments, Inc.

D. C. Duncan

J. T. Cataldo

J. T. Cataldo will now perform the duties of Vice President in charge of sales at International Rectifier Corp.

RCA Semiconductor and Materials Div. appointments, Engineering Dept.: **B. V. Dale** to Manager, Modules Engineering; **Dr. F. E. Vinal** to Manager of Materials Engineering; and, **D. H. Wamsley** to Manager, Semiconductor Engineering.

William Brown comes to Magnetic Research Corp. as Manager of Sales. He was formerly with Norden-Ketay.

Allen M. Creighton will head the new Combat Surveillance Group at Motorola's Western Military Electronics Center.

Brig. Gen. K. E. Fields, U.S.A. (Ret), former General Manager of the AEC, has been elected Executive Vice President of International Standard Electric Corp, overseas subsidiary of IT&T Corp.

6528 medium mu, high current, twin power triode for series regulator service!

Volume output makes Tung-Sol/Chatham 6528 available for widespread use!

Enthusiastic acceptance of the 6528 Twin Power Triode forced rapid expansion of production quotas, in turn resulting in lower manufacturing costs. These savings are reflected in lower prices to the user making Type 6528 economically practical for a vast number of new industrial and military applications.

Type 6528 requires fewer passing tube sections . . . permits lower range control circuits . . . and combines low internal tube drop with top control sensitivity — a definite advantage over previous series regulators. Also, 6528 triodes may be used in parallel or separately. This simplifies circuitry . . . saves space.

DESIGN FEATURES OF TUNG-SOL/CHATHAM TYPE 6528!

1. Hard glass envelope permits full out-gassing . . . takes higher temperatures without gas evolution . . . increases thermal shock resistance.
2. Zirconium-coated graphite anodes assure excellent gettering. Graphite virtually unaffected by heat.
3. Oversize cathodes provide adequate emission reserve . . . eliminate standby deterioration.
4. Extra-rugged grids. Sturdy chrome-copper side rods support gold-plated molybdenum lateral wires.
5. Overall ruggedness. Metal snubbers and ceramic insulators support mount. Heavy button-stem has rigid support leads.

Tung-Sol Electric Inc. specializes in special-purpose tube development . . . can match any design requirement you have. For full data on Type 6528 . . . to fill any power tube socket . . . contact: Tung-Sol Electric Inc., Newark 4, N. J. Commercial Engineering Offices: Bloomfield and Livingston, N. J.; Culver City, Calif.; Melrose Park, Ill.

TYPE 6528 RATINGS

Max. plate dissipation per tube	60 watts
Max. plate dissipation per section	30 watts
Max. steady plate current per section	300 ma.
Max. plate voltage	400 volts
Max. heater cathode voltage	300 volts
Amplification factor*	9
Transconductance per section*	37,000 μmhos

**Average characteristics at $E_b = 100v$, $E_c = -4v$, $I_b = 185$ ma.*

TUNG-SOL®

Circle 37 on Inquiry Card, page 121

TEN-TO-ONE THE Copper Clad Laminate YOU WANT IS HERE!

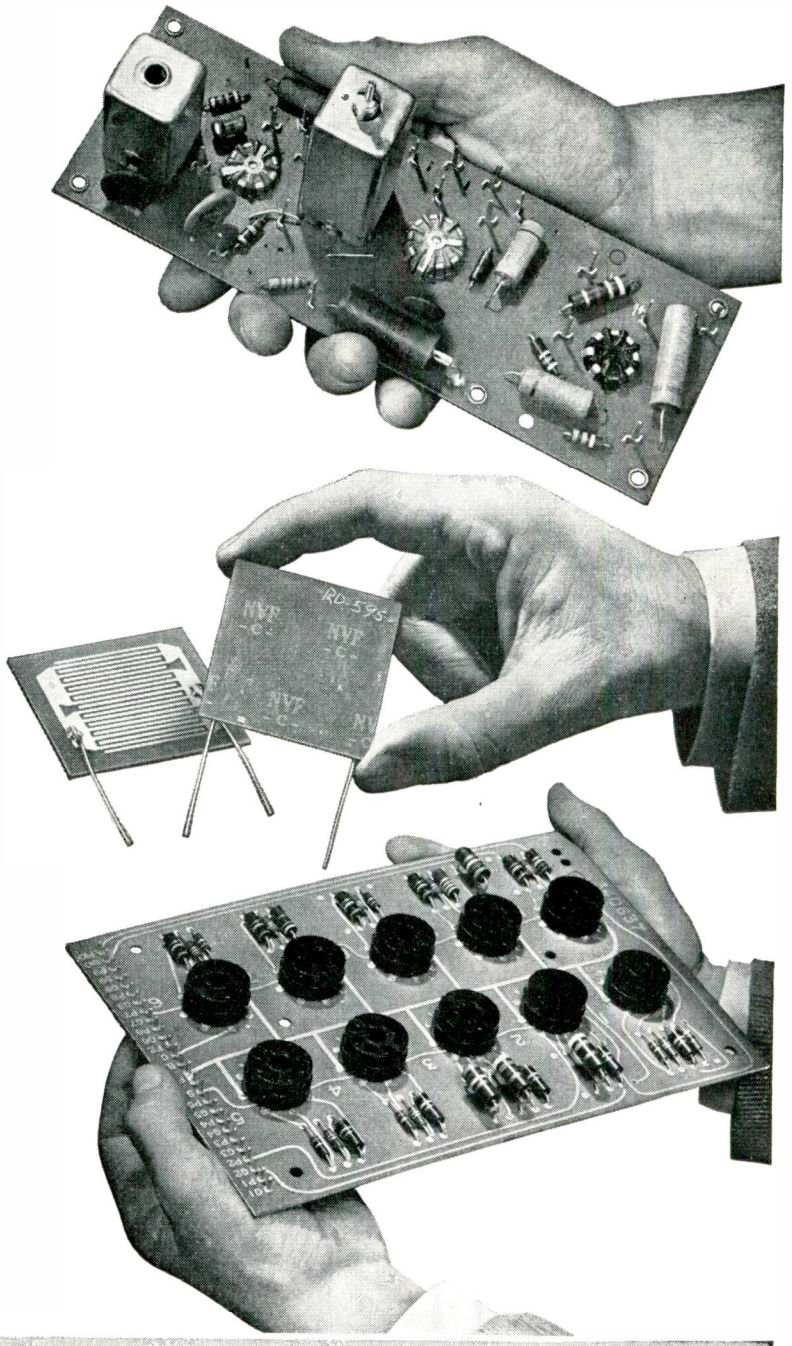
From these ten basic PHENOLITE® Grades, you can select the base material, resin, properties and price to fit your present printed circuit need.

If your problem is finding a suitable cold-punch material, try samples of XXXP-470-1. It's designed for use in automated production equipment. If you are looking for higher heat resistance, check Grades G-10 and G-11.

Out of National's research laboratories come new advances every day. See your National Representative about new products and applications. He can keep you posted on the full line of PHENOLITE Laminated Plastic, Vulcanized Fibre and National Nylon for electronic applications across-the-board. In the meantime, write for our new "PHENOLITE Copper Clad Data" folder. Address Dept. F-10.

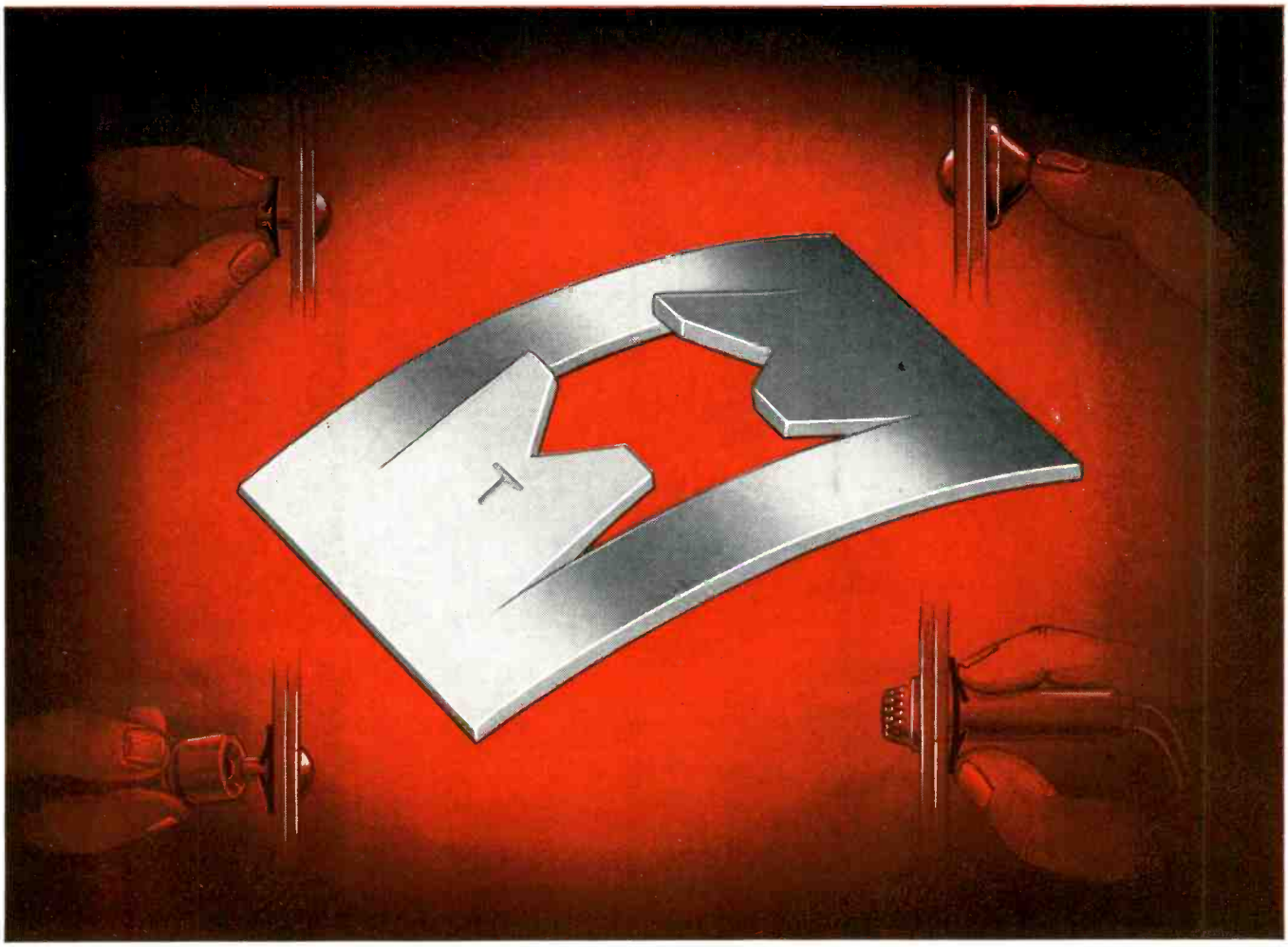
NATIONAL
VULCANIZED FIBRE CO.
WILMINGTON 99, DELAWARE

In Canada:
NATIONAL FIBRE COMPANY OF CANADA, LTD., Toronto 3, Ontario



TYPICAL TEST VALUES ON COPPER CLAD PHENOLITE

GRADE	PROPERTIES OF BASE MATERIAL					COPPER CLAD PROPERTIES				RELATIVE COST
	Dielectric Constant	Dissipation Factor	Moisture Absorption	Flexural Strength	Maximum Operating Temperature	Copper Bond Strength		Hot Solder Resistance	Surface Resistance	Based on XXXP on Arbitrary Scale of 1
	10^6 Cycles	10^6 Cycles	1/16", % 24 Hrs	Psi	Degree F	Pounds to Pull 1" Strip		Secs to Blister 1" Square > Greater Than	Megohms, Etched Retma Comb Pattern, 96 Hrs/35°C/90% RH	1/16" Thk. 1 Oz. Copper 1 Side
						1 Oz	2 Oz			
P-214-B-1	5.3	.040	2.20	18,000	250	8	11	>10@ 475°F	100,000	.81
XXP-209-G-1	4.6	.037	1.30	17,000	250	8	11	>10@ 475°F	200,000	.92
XXP-239-1 PHENOCLAD	4.2	.035	0.67	15,500	250	8	11	>10@ 475°F	200,000	.92
XXXP-219-C-1	4.5	.030	0.70	15,500	250	8	11	>10@ 475°F	500,000-1,000,000	1.00
XXXP-455-1	4.0	.026	0.55	23,500	250	8	11	>10@ 475°F	1,000,000-1,500,000	1.00
XXXP-470-1	3.7	.027	0.48	14,000	250	8	11	>10@ 475°F	300,000-500,000	1.00
N-1-852-1	3.3	.030	0.20	16,000	165	8	11	>10@ 450°F	2,000,000	2.69
G-5-813-1	6.8	.018	1.00	55,000	300	8	11	–	–	2.98
G-10-865-1	5.2	.012	0.13	60,000	250	10	15	>30@ 500°F	1,500,000-2,000,000	3.49
G-11-861-1	4.9	.015	0.17	60,000	300	10	15	>30@ 500°F	2,000,000	3.55



Another Tinnerman Original...

Tinnerman Push-On **SPEED NUTS**®
fasten with a "bite" that can't shake loose

In a split-second, this low-cost Tinnerman Push-On SPEED NUT arches its spring-steel back, then bites hard to make a positive attachment on unthreaded studs, rivets, tubing, nails, jewels, small housings.

Application is easy—finger pressure starts it; a push with a simple hand tool locks it under live spring tension. No threads to worry about, no spot welding, no riveting, no special inserts, bushings or washers necessary. Elimination of extra parts and assembly operations may save you up to 50% or more in fastening costs.

Push-On SPEED NUTS lock on everything from thermoplastics to die-cast, chrome-plated steel. Hundreds of variations to fit any shape or size stud —from very small diameters to larger rectangular shapes. Some Push-Ons have "caps" that cover exposed shaft, axle or stud ends.

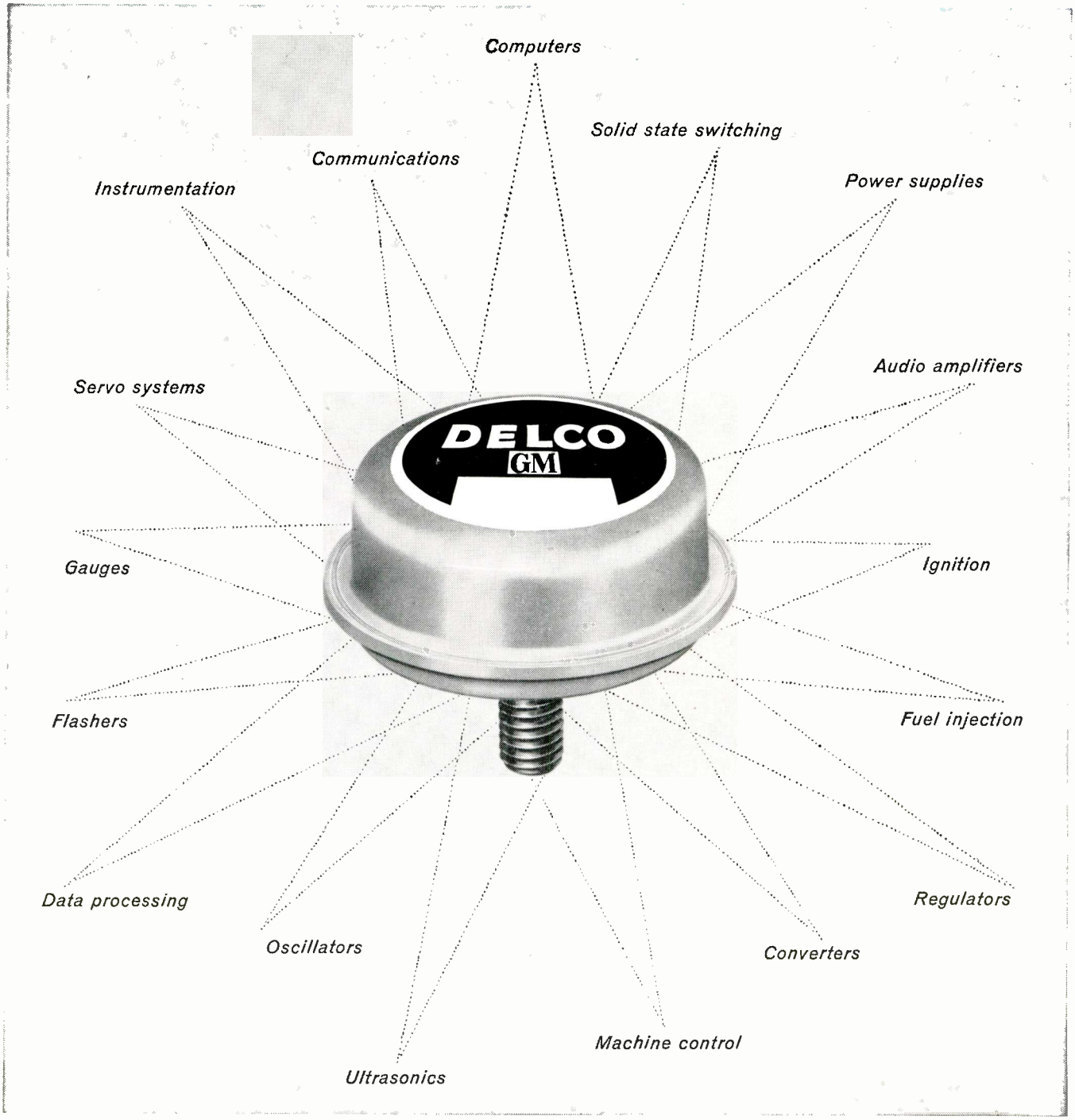
Check Sweet's Product Design File, section 8-T. Or look under "Fasteners" in the Yellow Pages and call your Tinnerman representative for complete information and samples. Or write to:

TINNERMAN PRODUCTS, INC.
Dept. 12 • P. O. Box 6688 • Cleveland 1, Ohio

TINNERMAN
Speed Nuts®

FASTEST THING IN FASTENINGS®

CANADA: Dominion Fasteners Ltd., Hamilton, Ontario. GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S. A., 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Mecano-Bundy GmbH, Heidelberg.



Wherever you require high power, consider

DELCO HIGH POWER TRANSISTORS

Thousands of Delco high power germanium transistors are produced daily as engineers find new applications for them. In switching, regulation, or power supplies—in almost any circuit that requires high power—Delco transistors are adding new meaning to compactness, long life and reliability.

All Delco transistors are 13-ampere types and, as a family, they offer a collector voltage range from 40 to 100 volts. Each is characterized by uniformly low saturation resistance and high gain at high current levels. Normalizing insures their fine performance and uniformity regardless of age. Also important—all Delco transistors are in volume production and readily available at moderate cost.

For complete data contact us at Kokomo, Indiana or at one of our conveniently located offices in Newark, New Jersey or Santa Monica, California. Engineering and application assistance is yours for the asking.

BRANCH OFFICES

Newark, New Jersey
1180 Raymond Boulevard
Tel: Mitchell 2-6165

Santa Monica, California
726 Santa Monica Boulevard
Tel: Exbrook 3-1465

DELCO RADIO Division of General Motors
Kokomo, Indiana

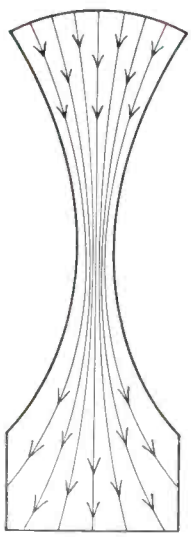
IMMEDIATE DELIVERY

15kw S-Band Amplifier Klystron has **no heavy magnets**

Exclusive Space-Charge Focus cuts weight to only 6½ lbs.

SAS-61 SPECIFICATIONS

Frequency Range . . . . 2700 to 2900 mc
Heating Time . . . . . 90 sec.
Peak Power Output . . . 15kw
Maximum Drive Power . 30w
Power Gain . . . . . 30 db



New Space Charge Focus principle of beam control is shown in diagram. New Sperry tube design utilizing this principle reduces size, weight, power consumption and cooling needs.

Available for immediate delivery, Sperry's new S-band transmitting tube is a 3-cavity pulse amplifier of high gain and extra-long service life.

Exclusive Sperry Space-Charge Focusing design eliminates heavy, cumbersome magnetic structures—a feature of prime importance in equipment design. Although the SAS-61 weighs only 6½ lbs., its sturdy construction withstands extreme vibration and environmental conditions.

Main applications for the SAS-61 are as an output tube in low-power radars, or as a driver for higher-powered klystrons in radar and linear accelerator systems. Its unusually long service life, however, makes it highly desirable for any application requiring 15 kw in the S-band. The SAS-61 with its internal tunable cavities is a *complete* microwave unit. No external equipment is required.

Sperry can deliver SAS-61 tubes in quantity at once. Write or phone your nearest Sperry district office.

ELECTRONIC TUBE DIVISION

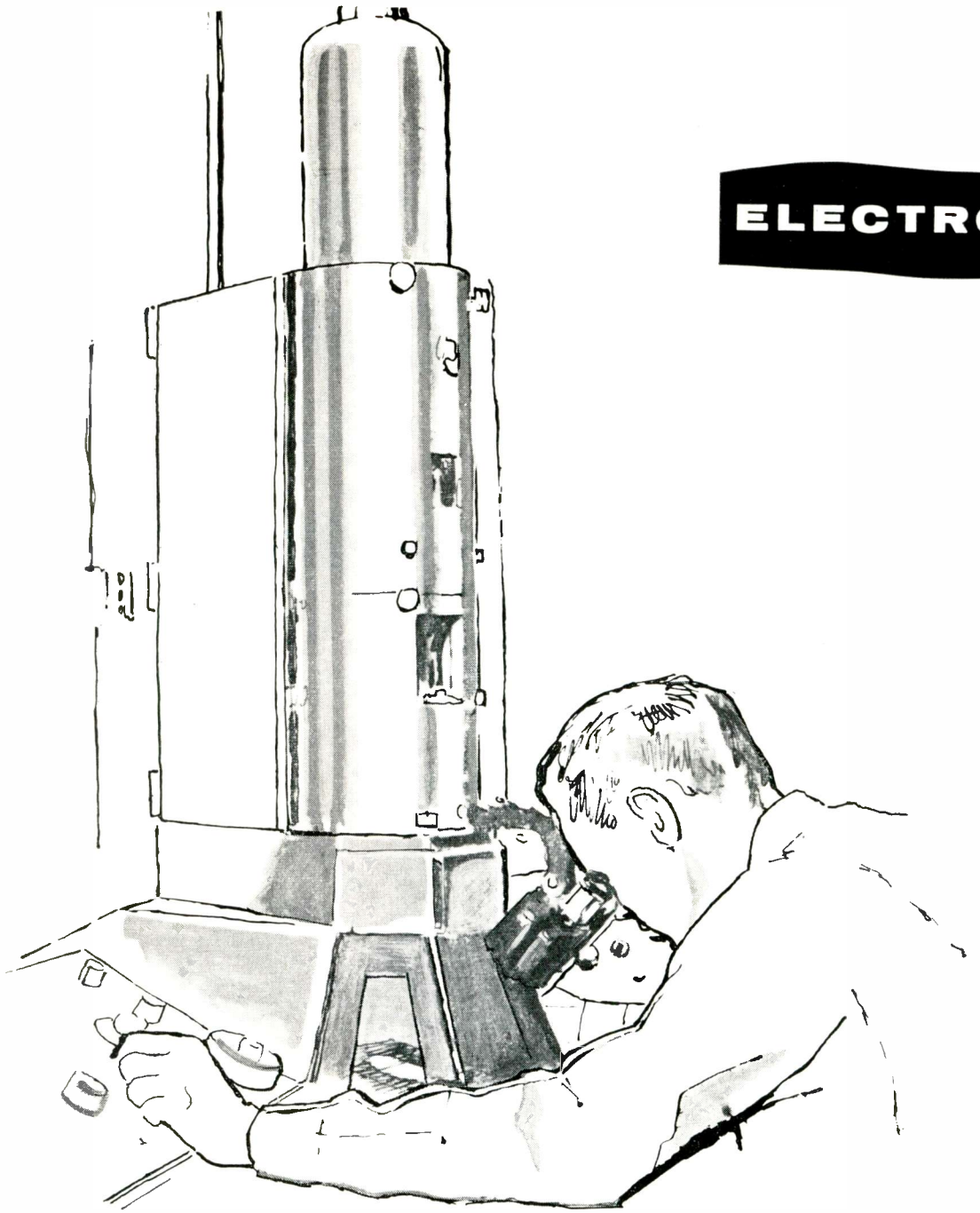
SPERRY GYROSCOPE COMPANY

Great Neck, New York

DIVISION OF SPERRY RAND CORPORATION

CLEVELAND • NEW ORLEANS • BROOKLYN • LOS ANGELES • SAN FRANCISCO • SEATTLE • IN CANADA: SPERRY GYROSCOPE COMPANY OF CANADA, LIMITED, MONTREAL, QUEBEC

Circle 40 on Inquiry Card, page 121



ELECTRONICS

SAN ANTONIO . . . IDEAL FOR ELECTRONICS

Labor Resources . . .

- Over 3000 now employed in electronics.
- Over 2000 now employed in research and development.
- Ready pool of trainable labor.
- Manufacturing employees wage rates 25% lower than national average. (Bureau of Labor statistics.)
- Work stoppage virtually unknown.

Living Conditions . . .

- Average mean temperature 50.6 degrees winter, 84.4 summer.
- Outdoor living year round.
- 2500 acres of parks.
- Hunting, fishing, motor boating, water skiing.
- 3 hours to gulf coast and Old Mexico.
- Old world atmosphere features the Alamo, 4 other Missions, La Villita and many other historic sites.

In addition to excelling in labor resources and living conditions, San Antonio offers all the other locational factors — good government, banks that support industry, abundant electricity, natural gas and water, excellent sites, good transportation and distribution facilities, equitable taxes, plenty of room for industrial expansion.

City in the Sun

SAN ANTONIO

For a detailed study of your specific needs
Write Greater San Antonio Development Committee
153 Navarro, P. O. Box 1628, San Antonio, Texas
All communications confidential

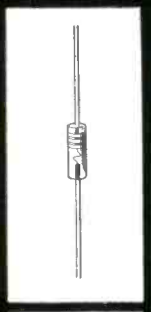
Your Design is better Your Product performs better

with this full line of

RAYTHEON

DEPENDABLE DIODES RELIABLE RECTIFIERS

Germanium GLASS DIODES



TYPE	Working Voltage (max.) v	Forward Current at +1 volt mA	Reverse Current μA at v
1N55B	150	5	500 at −150
1N66A	60	5	50 at −10
1N67A	80	4	50 at −50
1N68A	100	3	625 at −100
1N95	60	10	800 at −50
1N126	60	5	50 at −10
1N127	100	3	25 at −10

Type	Working Voltage (max.) v	Forward Current at +1 volt mA	Reverse Current μA at v
1N128	40	3	10 at −10
1N191	90	5	25 at −10
1N198	80	5†	75† at −10
1N294A	60	5	10 at −10
1N297A	80	3.5	100 at −50
1N298A	70	30*	250 at −40

*at +2 v †at 75°C

Germanium VIDEO DETECTOR Diodes

for TV video and portable radio application;
low capacity video detection; efficiency controlled at 50 Mc

Silicon DIFFUSED JUNCTION GLASS RECTIFIERS

TYPE	Peak Operating Voltage −65°C to +150°C Volts	Ave. Rectified Current 25°C mA	Ave. Rectified Current 150°C mA	Reverse Current (Max.) in μA at Specified Voltage Volts	25°C	100°C
1N645	225	400	150	225	0.2	15
1N646	300	400	150	300	0.2	15
1N647	400	400	150	400	0.2	20
1N648	500	400	150	500	0.2	20

Silicon DIFFUSED JUNCTION RECTIFIERS

WIRE IN TYPES

TYPE	Peak Operating Voltage −65°C to +165°C Volts	Ave. Rectified Current 25°C mA	Ave. Rectified Current 150°C mA	Reverse Current (Max.) at Specified PIV, 150°C mA
1N536	50	750	250	0.40
1N537	100	750	250	0.40
1N538	200	750	250	0.30
1N539	300	750	250	0.30
1N540	400	750	250	0.30
1N1095	500	750	250	0.30
1N547†	600	750	250	0.35

† Same as 1N1096 *to +135°C

STUD TYPES

TYPE	Peak Operating Voltage −65°C to +165°C Volts	Ave. Rectified Current 25°C Amps.	Ave. Rectified Current 150°C Amps.	Reverse Current (Max.) at Specified PIV. 25°C μA
1N253	95*	3.0	1.0*	10
1N254	190*	1.5	0.4*	10
1N255	380*	1.5	0.4*	10
1N256	570*	0.95	0.2*	20
CK846	100	3.5	1.0	2
CK847	200	3.5	1.0	2
CK848	300	3.5	1.0	2
CK849	400	3.5	1.0	2
CK850	500	3.5	1.0	2
CK851	600	3.5	1.0	2

All illustrations same size. Ratings at 25°C unless otherwise indicated. 1N253 through 1N256 available to MIL Specifications.

RAYTHEON SEMICONDUCTOR DIVISION

Silicon and Germanium Diodes and Transistors • Silicon Rectifiers

Newton, Mass......55 Chapel St., Bigelow 4-7500
New York:.....589 Fifth Ave., PLaza 9-3900
Chicago: 9501 Grand Ave., Franklin Park, NAtional 5-6130
Los Angeles: 5236 Santa Monica Blvd., NOrmandy 5-4221

Books

Introduction to Non-Linear Analysis

By W. J. Cunningham. Published 1958 by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36. 349 pages. Price $9.50.

This book provides both the scientist and the engineer with information concerning the methods for finding solutions for non-linear differential equations, having a single independent variable.

Methods considered here include those which can be applied with only modest facilities. Numerical, graphical, and analytical methods are described, and many examples of physical systems illustrate both techniques of solution and the unusual types of phenomena which may arise. A basic knowledge of electrical circuits, mechanical systems, and linear differential equations is presumed.

While much of the material contained between the pages of this book has been in existence for a long time, recently developed processes are also included. A set of exercise problems for each chapter and a selected list of references to the literature will be found at the end of the book.

Aircraft Communication Systems

By J. H. H. Grover. Published 1958 by Philosophical Library, Inc., 15 E. 40th St., New York 16. 127 pages, vii pages. Price $6.00.

This volume is a companion to the author's Radio Age to Air Navigation and the requirements of the Ministry of Transport Civil Aviation license have been the guide to both content and style. There are three parts to the work. Part 1 contains theoretical circuit descriptions of contemporary equipments; Part 2, setting up a practical operating instructions; and Part 3, brief details of VHF transmitter/receivers, contemporary American equipment and ancillaries.

Introduction to Electric Magnetic Engineering

By Robert F. Harrington. Published 1958 by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36. 312 pages. Price $8.00.

The author introduces a field theory as an extension of circuit theory, obtaining Maxwell's equations early in the text. These equations are then specialized to the static case, and considerable time is spent in static field theory. An introduction to the study of time varying field theory is given in the last chapter.

Physical Acoustics and the Properties of Solids

By Warren T. Mason. Published 1958 by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. 402 pages, xii pages. Price $9.00.

This introduction to the uses of wave transmission in solids provides both engineering applications and analytical uses under one cover.

Every attempt has been made to

(*Continued on page* 62)

YOU'VE GOT TO HAND IT TO ENGINEERING!

You've got to hand it to the engineering profession. The "slide-rule" boys know quality when they see it . . . and they won't be satisfied with anything less. Take solder, for example. Engineers depend on KESTER FLUX-CORE SOLDER in their work because they know Kester's reputation for quality and precision manufacturing . . . a reputation built up over more than 50 years. That's why Kester's the preferred choice of a great majority of electronic manufacturers. *Engineers know that a few pennies saved on a "second-line" solder product can waste dollars!*

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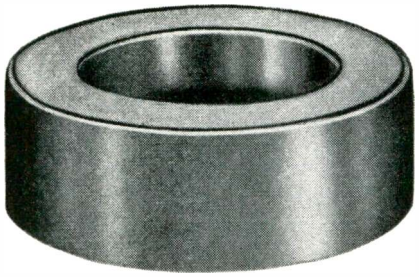
DESIGNews



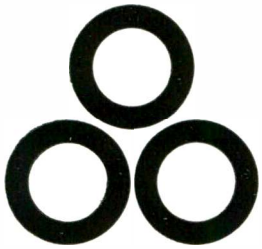
TAPE WOUND CENTRICORES
PROVIDE THERMAL STABILITY . . .

Cores which remain matched over a wide temperature range prove a real help to the designer of magnetic amplifiers who must contend with ever increasing variations in temperature environment.

▶ **BULLETIN D7**

Magnetic Metals Company produces both stamped and tape wound core parts for magnetic amplifier applications

STAMPED RING LAMINATIONS
IN PHENOLIC OR
ALUMINUM ENCASEMENTS . . .



Stamped ring laminations are processed from alloy strip .002″ or heavier; also available in etched magnetic parts less than .001″ in thickness.

▶ **BULLETIN C1**

With magnetic amplifiers serving a growing diversity of applications, the availability of components for various types of core construction is of great importance to the design engineer.

• **Where sub-miniaturization** and high sensitivity are required. Centricores offer the ultimate in both requirements.

• **Stamped ring laminations** provide the mechanical stability and resistance to shock demanded in industrial control systems.

• **Large units** for more powerful requirements are best served by DU laminations for reduction of production costs through the use of form wound coils.

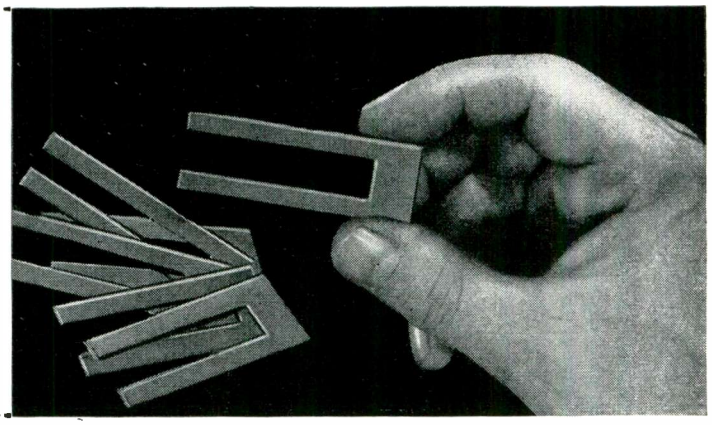
All three core types are available from Magnetic Metals Company—processed to individual specifications or from stock of standard sizes.

DU LAMINATIONS
MASS PRODUCED, PRECISION MADE . . .

- MORE IMPEDANCE PER TURN
- GREATER UNIFORMITY FROM CORE-TO-CORE
- LOWER MAGNETIC CORE RELUCTANCE

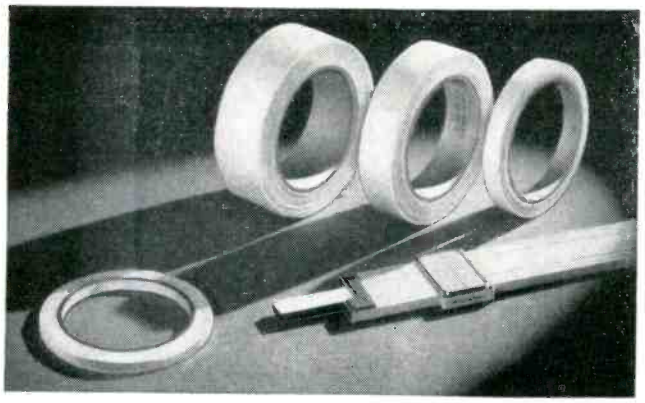
DU laminations are available in a variety of materials, including Squaremu, Orthonic and Squaresil. Stock of DU laminations is maintained in the new, improved Hymu "80".

▶ **BULLETIN D1**



MAGNETIC METALS COMPANY

ELECTROMAGNETIC CORE PARTS AND SHIELDS • HAYES AVENUE AT 21st ST. • CAMDEN 1, N. J.



TEMP-R-TAPE®

pressure-sensitive TEFLON* tapes for Class H & C insulation, non-stick or chemical resistant facing

Temp-R-Tapes, Teflon with a silicone polymer adhesive, provide dielectric strength up to 2750 v/m, low power factor, a temperature range of −100°F to 500°F (−75°C to 250°C) and a slippery, low friction or chemical resistant surface. Easy-to-apply, just press in place. Temp-R-Tapes are "called out" for many electrical and electronic insulating applications, aircraft and general industrial mechanical applications. 1/4" to 12" wide, .002" to .013" thick. From stock.

** du Pont T.M.*

FREE SAMPLE and data . . . *write, phone or use inquiry service.*

A PRODUCT OF CHR THE CONNECTICUT HARD RUBBER CO., NEW HAVEN 9, CONN

Circle 116 on Inquiry Card, page 121

Increased Insulation

BETTER CONNECTIONS

JONES BARRIER TERMINAL STRIPS

Leakage path is increased — direct shorts from frayed terminal wires prevented by bakelite barriers placed between terminals. Binder screws and terminals brass, nickel-plated. Insulation, BM 120 molded bakelite. Finest construction. Add much to equipment's effect.

Jones Means Proven Quality

No. 2-142 No. 2-142-¾ W No. 2-142-Y

Illustrated: Screw Terminals—Screw and Solder Terminals—Screw Terminal above Panel with Solder Terminal below. Every type of connection.

Six series meet every requirement. No. 140, 5-40 screws; No. 141, 6-32 screws; No. 142, T-32 screws; No. 150, 10-32 screws; No. 151, 12-32 screws; No. 152, 1/4-28 screws.

Catalog No. 22 lists complete line of Barrier strips, and other Jones Electrical Connecting Devices. Send for your copy.

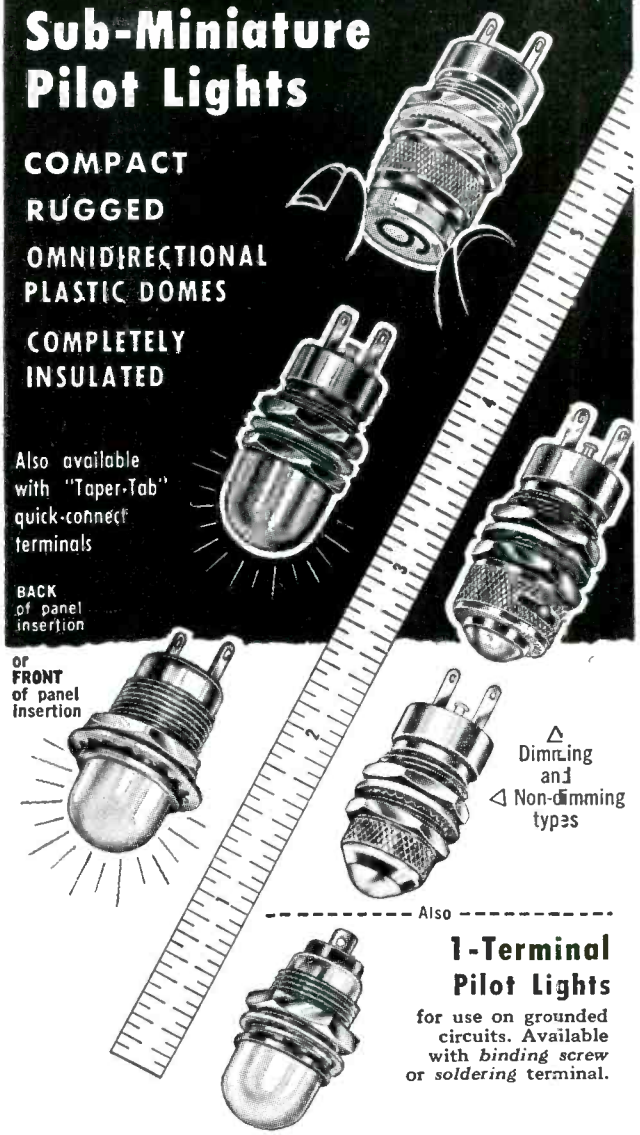
Jones HOWARD B. JONES DIVISION
CINCH MANUFACTURING CORPORATION
CHICAGO 24, ILLINOIS
SUBSIDIARY OF UNITED-CARR FASTENER CORP.

Circle 117 on Inquiry Card, page 121

PANEL SPACE LIMITED? SPECIFY

DIALCO® 2-Terminal Sub-Miniature Pilot Lights

COMPACT
RUGGED
OMNIDIRECTIONAL PLASTIC DOMES
COMPLETELY INSULATED



Also

1-Terminal Pilot Lights

for use on grounded circuits. Available with *binding screw* or *soldering* terminal.

DIALCO's expanded line of sub-miniature lights conform to all applicable Mil Specs. Use T-1¾ midget incandescent lamps—1.3 to 28 V. Spring mounted *Lens-with-Message* is readily positioned *after* installation . . . Mount from *back* of panel in 15/32" clearance hole; or from *front* of panel in 17/32" hole . . . 7 lens colors . . . Shown approx. actual size (top to bottom): No. 134-3830-375-6 . . . No. 101-3830-951 . . . No. 101-5030-951 . . . No. 109-3830-111 . . . No. 111-3830-111 . . . No. 107-1930-951.

Complete details in Brochures L-156 A and L-157.

SAMPLES ON REQUEST—AT ONCE—NO CHARGE

Foremost Manufacturer of Pilot Lights

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Name ..... Position .....

Company .....

Address .....

Circle 118 on Inquiry Card, page 121

Books

(*Continued from page* 58)

present underlying physics as simple as possible, and with a minimum of mathematics, in order that the diversity of possible applications be available to many scientists of varied professional backgrounds.

Part 1 thoroughly covers basic principles and engineering applications. It starts with the fundamentals of wave propagation in solids and continues with a discussion of transducers to generate such waves.

Part 2 deals in considerable detail with the analytical uses of sound wave propagation.

An appendix is devoted to a rigorous derivation of the mathematical laws governing stress-strain phenomena and the tensor relations between elastic variables and electric and magnetic fields from thermodynamics potentials.

Magnetic Recording Techniques

By W. Earl Stewart. Published 1958 by McGraw-Hill Co., Inc., 330 W. 42nd St., New York 36. 268 pages. Price $8.50.

This is a guide to the technology of magntic recording devices and techniques, written for engineers and technicians in the various fields utilizing magnetic recordings. Principles of the recording and root producing processes, recording materials, the theory of thorough magnetism, recording mechanisms, and established standards, are all covered at a realistic engineering level. Design techniques for the various elements of magnetic recording systems and ways to obtain better performance in many new fields of applications are shown.

Elementary Statistical Physics

By C. Kittel. Published 1958 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16. 228 pages, ix pages. Price $8.00.

This book is a fundamental and modern achievement of statistical mechanics, including stochastic processes and transport theory. Throughout the presentation, the Gibbs method of ensembles is used, with detailed discussion of its application.

Problems and examples are given which are applicable to many scientific fields—nuclear physics, electrical engineering, solid state physics, metallurgy, and chemistry—and are presented in a simple, clear, and in understandable manner.

Danger in the Air

By Oliver Stewart. Published 1958 by Philosophical Library, Inc., 15 E. 40th St., New York 16. 194 pages, xix pages. Price $6.00.

Air travel is becoming progressively safer, and statistics appear in frequent intervals which indicate the rapid improvements in aircraft themselves and in the methods of operat-

(*Continued on page* 66)

Teleprinted Communications . . . on the double!

The Kleinschmidt teletypewriter set sends teleprinted messages from tape at speeds up to 100 words per minute.
AT THE SAME TIME, on the same unit, the operator perforates and prints other messages for transmission.

Day after day, Kleinschmidt teletypewriters and related equipment at U. S. Army Communication Centers receive and transmit thousands of teleprinted messages. This tremendous communications traffic, accelerated by multiple-function Kleinschmidt equipment, developed in cooperation with the U. S. Army Signal Corps, flows smoothly and precisely. Both sender and recipient receive a teleprinted original, identical in every respect.

Since the century began, the Kleinschmidt name has been associated with every major development in teleprinted communications. Now a member of the Smith-Corona family, Kleinschmidt looks ahead to new attainments in broadening the field of electronic communications for business and industry.

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Pioneer in teleprinted communications equipment • A subsidiary of Smith-Corona Inc

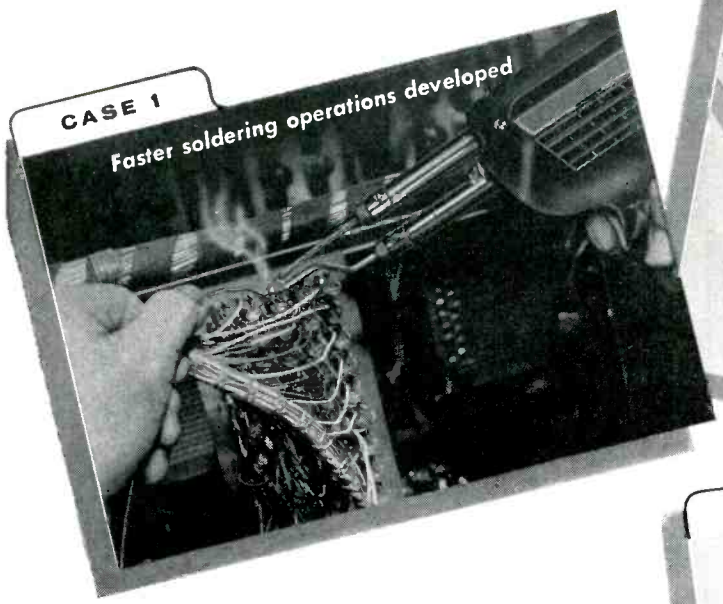
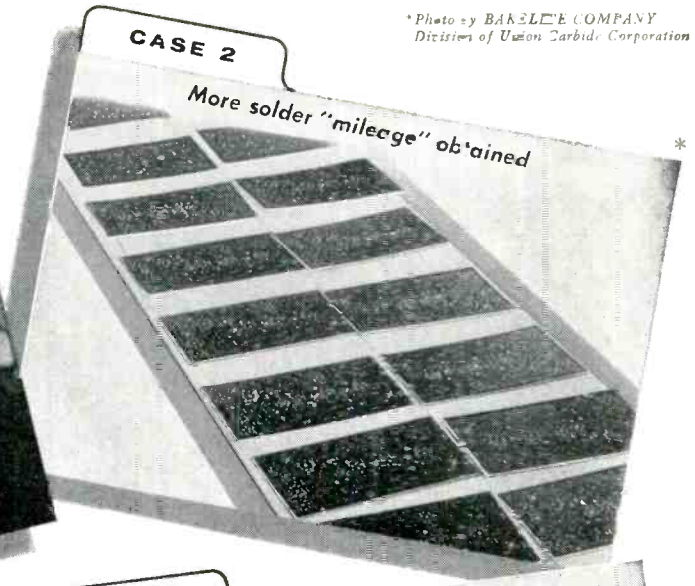
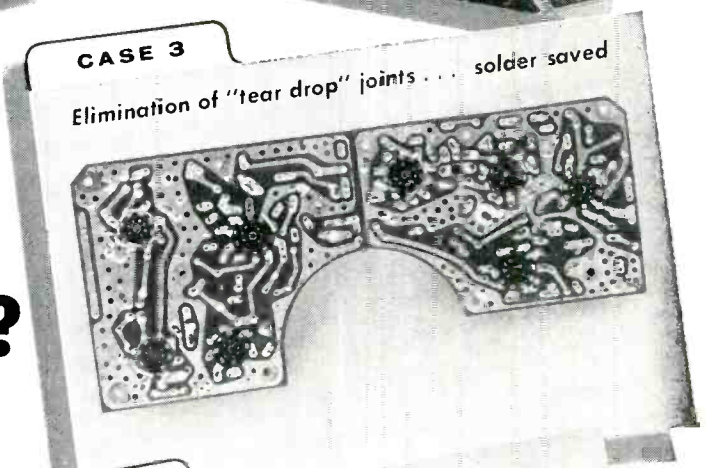
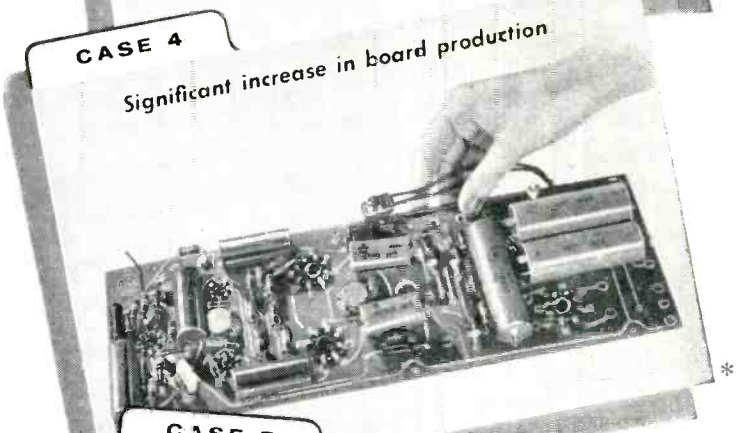
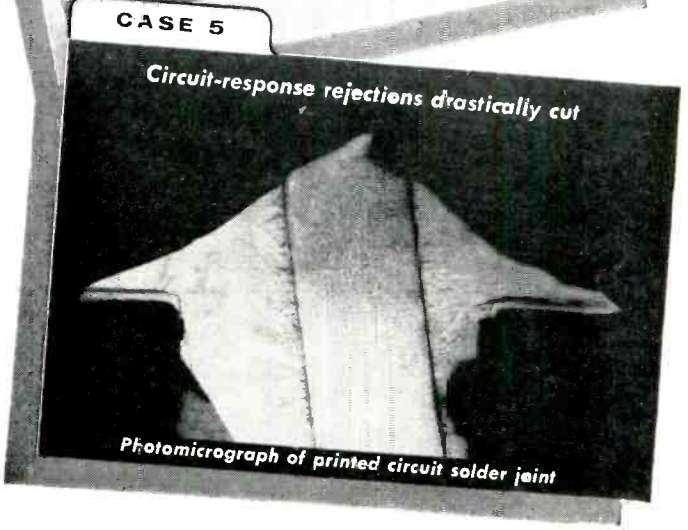


*Photo by BAKELITE COMPANY
Division of Union Carbide Corporation









How much is your "circuit printing" bill?

Maybe "Dutch Boy" Solder Specialists can help you reduce it

"Dutch Boy" Solder Specialists have helped a number of companies look into the soldering phase of their "circuit printing" costs . . . and have come up with substantial savings.

How have these savings been made?

Most of these savings have been made by very simple changes in flux or solder compositions or in operating conditions.

. . . A change in bath temperature. A switch to an activated non-conductive, non-corrosive flux . . .

In these and other ways "Dutch Boy" Solder Specialists cut "circuit printing" bills and boost production.

Maybe it would pay *you* to have a "Dutch Boy" Solder Specialist go over your soldering operations with an eye cocked for savings. Write NATIONAL LEAD COMPANY 111 Broadway, New York 6, New York.

Offices in Principal Cities

Dutch Boy®

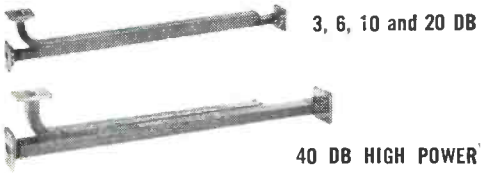
SOLDER AND FLUXES

DUAL HIGH DIRECTIVITY COUPLERS

Narda Dual High Directivity Directional Couplers are designed for reflectometer measurements in waveguide systems, and exhibit the same flat response (± 0.4) and high directivity (40 db min.) as Narda's single units. Primary line VSWR: 1.05 max. (1.10 for M1027); secondary line VSWR: 1.15 max.

Coupling structures are on opposite broad walls of the primary line; secondary output arms are on the same side. Detector mounts can be attached readily to facilitate connecting detector mounts.

BAND	FREQUENCY (kmc)	WAVEGUIDE O.D. (in.)	NARDA Model	PRICE
S	2.60-3.95	3 x 1½	1034	$650.
C	3.95-5.85	2 x 1	1033	400.
XN	5.40-8.20	1½ x ¾	1032	255.
XB	7.05-10.0	1¼ x ⅝	1031	220.
X	8.20-12.4	1 x ½	1030	175.
KU	12.4-18.0	.702 x .391	1029	180.
K	18.0-26.5	½ x ¼	1028	295.
V	26.5-40.0	.360 x .220	V1027	330.
M	50.0-75.0	.228 x .154	M1027	900.



3, 6, 10 and 20 DB

40 DB HIGH POWER

HIGH DIRECTIVITY COUPLERS

The 40 db High Power Coupler is another exclusive Narda product. Similar to standard types, except that coupling irises are in the narrow wall, it may be used at full rated power of the waveguide size. Nominal coupling value is 40 db; directivity 40 db. Directivity for 3, 6, 10 and 20 db couplers is also 40 db. Standard cover flanges on primary line; low VSWR termination and standard cover flange on secondary. All bands—2600 to 90,000 mc.

STANDARD REFLECTIONS

Narda offers five values of reflections for each of six different waveguide sizes . . the most complete choice we know of! Provides calibrated reflections or VSWR's for use in standardizing reflectometers or calibrating slotted line impedance meters.

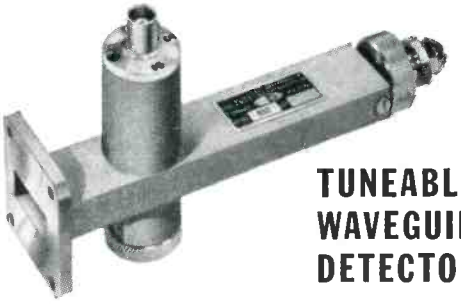
SPECIFICATIONS

Reflection Coefficient	0.00	0.05	0.10	0.15	0.20
Accuracy	0.002	0.0025	0.0035	0.0045	0.007
VSWR Equivalent	1.00	1.105	1.222	1.353	1.50

Models for 2.60 to 18.0 kmc, from $125 to $300

Microwave engineers—

Where can you use these exclusive features offered by NARDA?



TUNEABLE WAVEGUIDE DETECTORS

Narda's tuneable waveguide detectors are designed for broadband operation with small reflections and maximum versatility. Detected output is from a standard BNC female fitting, and the detectors may be used with a variety of crystal, bolometer, or thermistor elements, for absolute power measurements, as well as detection of relative power levels.

Although VSWR is low, impedance match can be improved by means of additional tuning such as E-H or slide-screw tuners. All models are designed for optimum VSWR with Narda model N610B bolometers, but good impedance matches can frequently be obtained with other bolometers and thermistors.

Data on VSWR with various elements is available from Narda, as well as a wide range of suitable detecting elements and crystals.

BAND	FREQUENCY (kmc)	WAVEGUIDE O.D. (in.)	NARDA MODEL	DETECTING ELEMENTS					MAX. VSWR WITH N610B	CRYSTALS	PRICE
				BOLOMETERS			THERMISTORS				
C	3.95-5.85	2 x 1	513	N610B	N821B	N605	N333D or N333	N334	1.25	IN21 or IN23	$95.
XN	5.30-8.20	1½ x ¾	512	N610B	N821B	N605	N333D or N333	N334	1.25	IN23	90.
XB	7.05-10.0	1¼ x ⅝	511	N610B	N821B	N605	N333D or N333	N334	1.25	IN23	85.
X	8.20-12.4	1 x ½	510	N610B	N821B	N605	N333D or N333	N334	1.25	IN23	75.
KU	12.4-18.0	.702 x .391	509	N610B		N605	N333D or N333		2.00	IN78 or IN23	110.

Tuneable Detectors for use with crystals only, available for millimeter bands 18,000 to 90,000 mc., from $125

Complete Coaxial and Waveguide Instrumentation for Microwave and UHF — including:
200 to 90,000 mc.

DIRECTIONAL COUPLERS
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FREQUENCY METERS
HORNS
VSWR AMPLIFIERS
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SLOTTED LINES
BENDS
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STANDARD REFLECTIONS
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the narda microwave corporation

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Circle 50 on Inquiry Card, page 121

Books

(*Continued from page 62*)

ing them. Some of this improvement, must be attributed to the detailed study of air accidents.

Arguing that the tendency to hush up air accidents or to treat them from a purely sensational angle is damaging to the development of safe line, the author describes and comments upon a set of air accidents, each one illustrating some particular kind of danger, and showing how it has been dealt with by engineers, designers, and research workers.

Electronics Industry Directory

Published 1958 by the Electronics Committee, Industrial Dept., Los Angeles Chamber of Commerce, 404 S. Bixel St., Los Angeles 54, Calif. Price $2.50.

Factual data concerning the firms engaged in electronics manufacture has been compiled.

The Chamber of Commerce Directory has been developed for use in dealing with the industry. Only those companies who have indicated that they conduct a manufacturing activity in the Los Angeles metropolitan area have been listed.

Books Received

Audio Design Handbook

By H. A. Hartley. Published 1958 by Gernsback Library, Inc., 154 W. 14th St., New York 11. 224 pages, paper bound. Price $2.90.

Conference on Extremely High Temperatures

Edited by Heinz Fischer and Lawrence Z. Mansur. Published 1958 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16. 269 pages. Price $9.75.

Based on the conference on extremely high temperatures held March 18th and 19th, 1958.

Guided Missiles: Operations, Design, and Theory.

Foreword by Lt. Gen. Charles T. Myers, USAF. Published 1958 by McGraw-Hill Book Co., 330 W. 42nd St., New York 36. 575 pages. Price $8.00.

Cook Technical Review, Volume IV, No. 3

Published 1957 by Cook Electric Co., 2700 Southport Ave., Chicago 14. 20 pages, paper bound. Price $1.00.

Industrial Control Circuits

By Sidney Platt. Published 1958 by John F. Ryder, Publisher, Inc., 116 W. 14 St., New York 11. 200 pages, paper bound. Price $3.90.

Sampled-Data Control Systems

By John R. Ragazzini and Gene F. Franklin. Published 1958 by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36. 331 pages, ix pages. Price $9.50.

Industrial Electronics Handbook

Edited by William D. Cockrell. Published 1958 by McGraw-Hill Book Co., 330 W. 42nd St., New York 36. 1408 pages. Price $22.50.

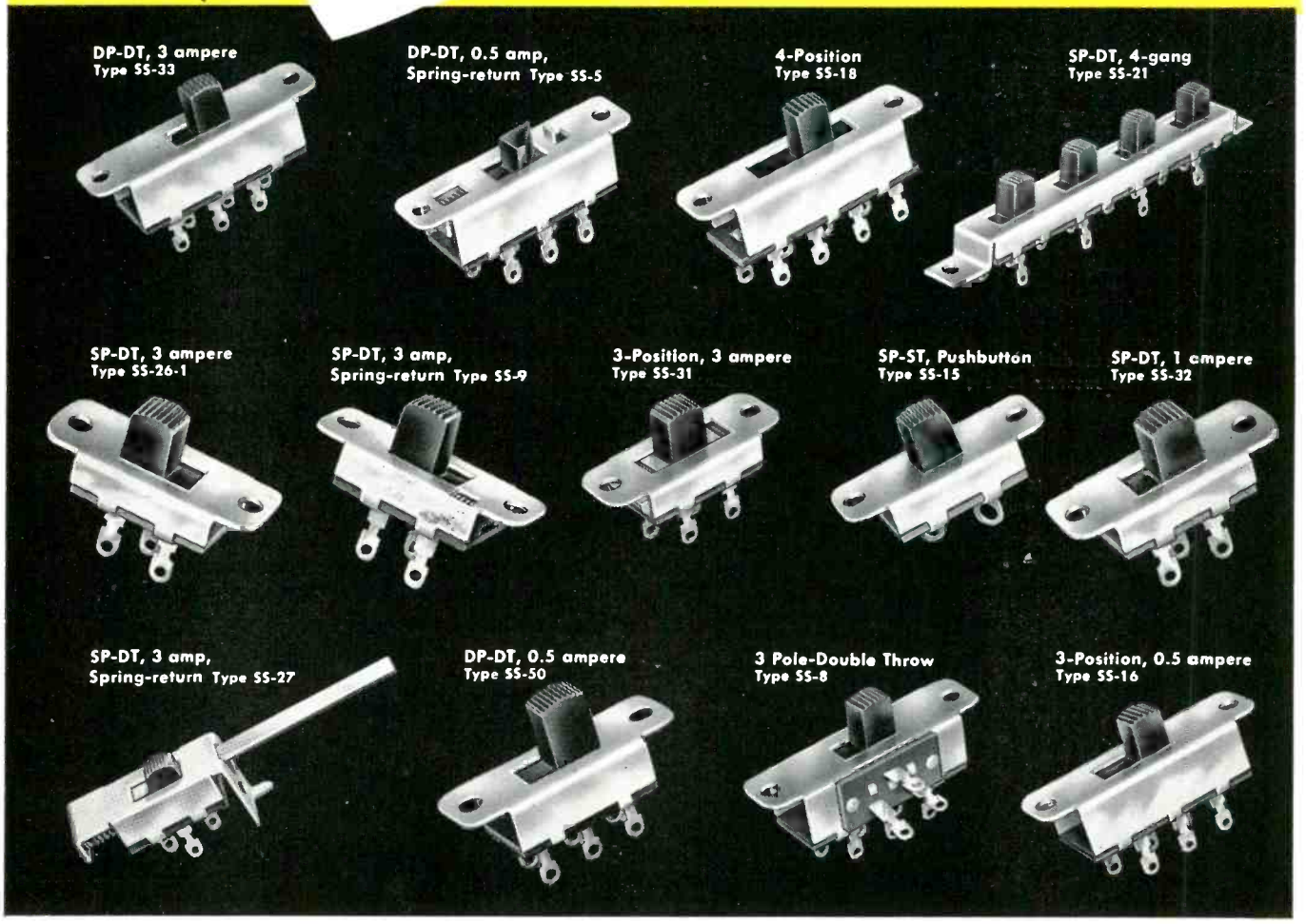
BOOST PRODUCT EFFICIENCY *and* SALES APPEAL...

Sturdy little Stackpole Slide Switches provide almost any desired switching arrangement at rock-bottom cost. Features include ½, 1 and 3 ampere 125 volt ratings in U.L. Inspected types; 1 to 3 pole types with up to 4 positions; momentary or maintained contact designs; lug, printed wiring or wire-wrap terminals; and many special types such as plunger-operated spring return, 4-gang SP-DT, and many more.

WRITE FOR SLIDE SWITCH BULLETIN RC-11D to:
Electronic Components Division, STACKPOLE CARBON CO., St. Marys, Pa.

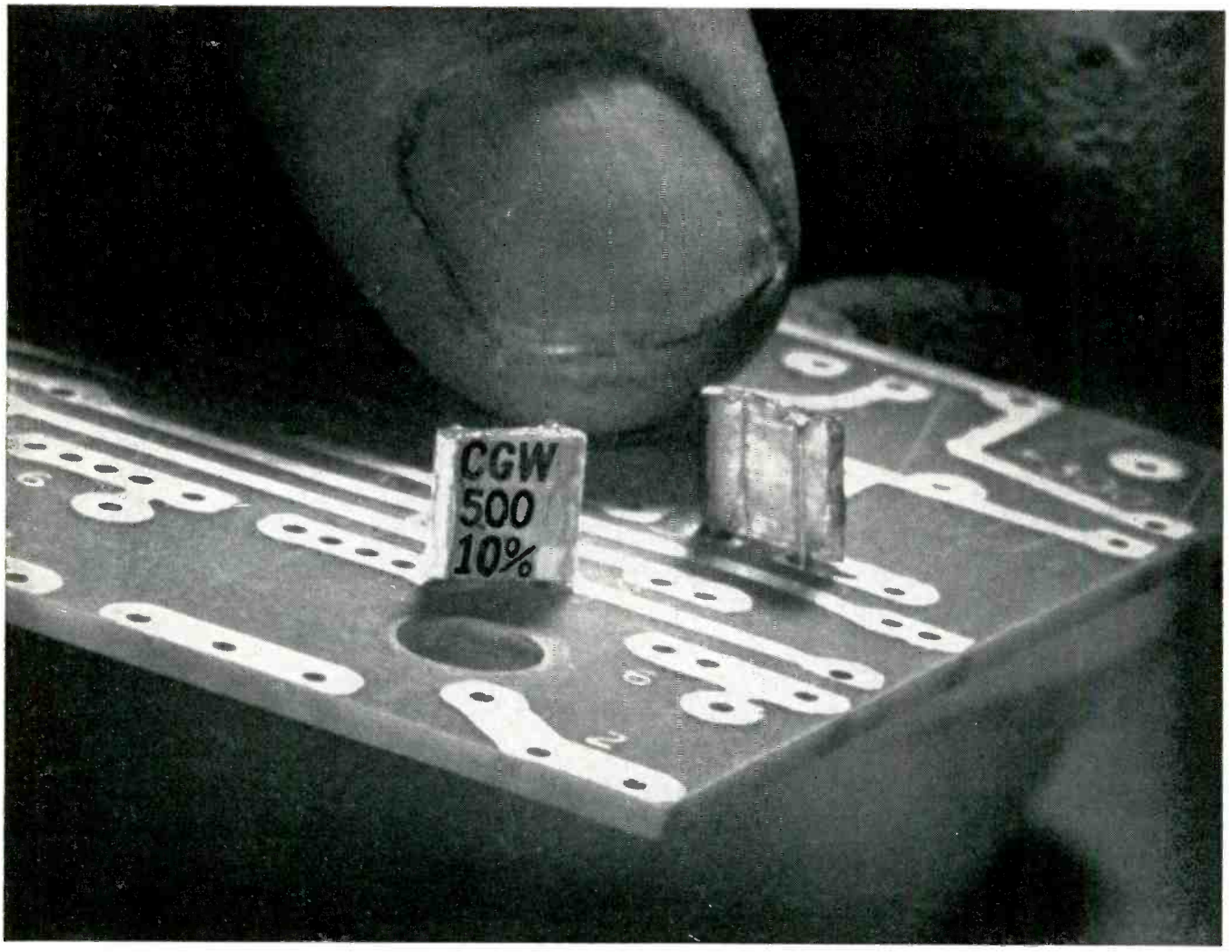
...WITH **13 Standard LOW COST TYPES** ...the most complete line

STACKPOLE SLIDE SWITCHES



Coldite 70+® fixed composition resistors • Snap and Slide Switches • Ceramag® ferromagnetic cores • Variable composition resistors • Ceramagnet® ceramic magnets • Fixed composition capacitors • Iron cores • Brushes for all rotating electrical equipment • Electrical contacts • Hundreds of related carbon, graphite and metal powder products.

Circle 52 on Inquiry Card, page 121



Truly sub-miniature, these capacitors were devised especially for printed circuits and automatic assembly. Since they retain all the properties of larger, pig-tail capacitors, they are well suited to general circuitry as well.

Now—Corning Fixed Glass Capacitors in new sub-miniature size

Packing up to 1,000 uuf at 300 V. and 125°C. into 0.010 cubic inches, these new capacitors are designed for use on printed circuit boards and all applications requiring high-quality components. Advantages include fixed temperature coefficient, high insulation resistance, low dielectric absorption, the ability to operate under high humidity and high temperature conditions, plus the added advantage of increased miniaturization.

You can now up-grade your specs for miniature capacitors used on printed circuits.

These new capacitors measure only $\frac{9}{32}$ x $\frac{19}{64}$ x .115, yet have capacitances up to 1000 uuf at a full 300 V. rating at 125°C. Such exceptional thinness makes these capacitors particularly well suited for vertical mounting in small, high-rated units.

The capacitors have high temperature soldered leads which allow direct connection to circuit boards. The leads are .100 inches long, fitting most circuit board thicknesses and eliminating any trimming.

Reliable · Since the new construction is extremely simple, reliability is correspondingly high.

Rugged · These capacitors, when mounted, successfully withstand a standard five-hour vibration cycling test at 10 to 55 cycles, 15G Max.

Known as WL-4 capacitors, these units are in mass production. Your inquiries concerning data and prices are welcome.

FEATURES

1. **to MIL C-11272A except smaller**
2. **1 to 1,000 uuf**
3. **300 volts**
4. **125°C. full rating**
5. **.010 cubic inches**

Corning means research in Glass

CORNING GLASS WORKS, Bradford, Pennsylvania

Electronic Components Department

Circle 53 on Inquiry Card, page 121

Circle 54 on Inquiry Card, page 121 →

Electron Tube News —from SYLVANIA

Anticipating the circuit designer's needs—everywhere in electronics

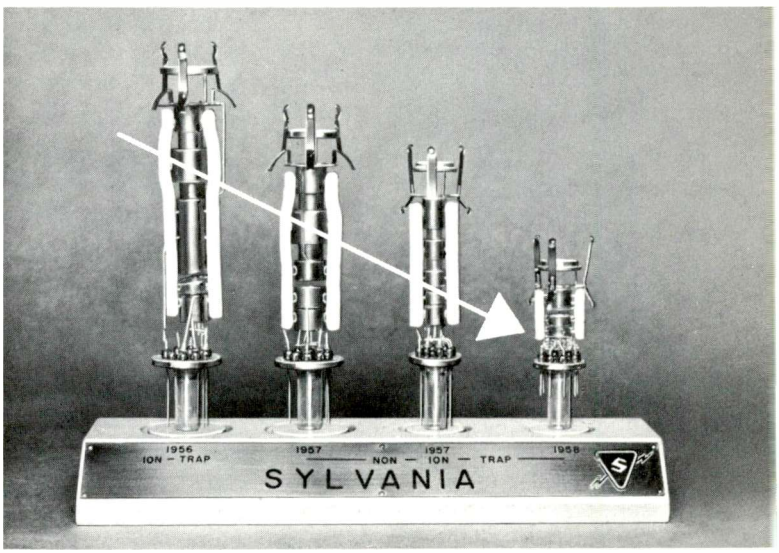
TELEVISION . . .

New Tripotential Electron gun takes another 2-inch slice off picture tube length

Sylvania, pioneer in 110° picture tube development, introduces another basic design innovation in cathode ray tubes—the short tripotential focus electron gun. It reduces picture tube length up to 2 1/8 inches, yet permits use of standard design centering magnets, yokes and other associated components.

Voltages required to operate tripotential focus picture tubes are available in ordinary TV receiver circuit designs.

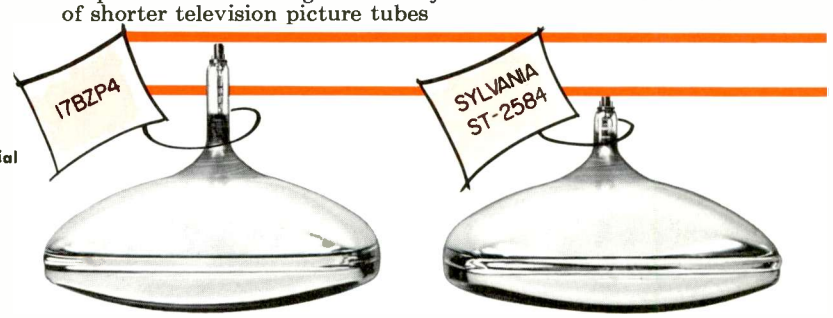
The new gun is much less complicated than conventional types. Its simplicity of design not only makes the gun inherently more rugged but allows for greater uniformity in manufacturing and assembling. This means less arcing, fewer shorts and better over-all performance throughout life.

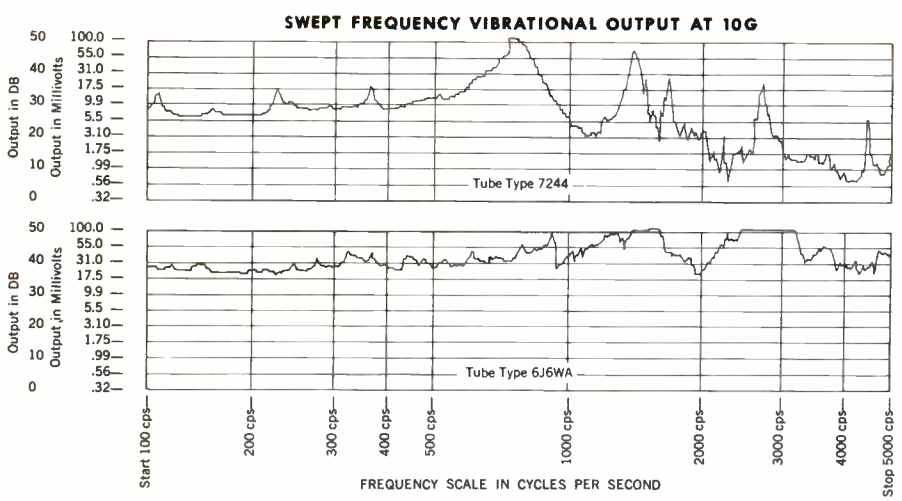


Tripotential Electron gun is a major advance in the evolution of shorter television picture tubes

Mechanical Dimensions Comparison Chart
Over-all Dimensions (Inches)

Screen 110° types, 1 1/8" neck dia.	Conventional Tubes	Sylvania Tripotential
17"	12 9/16	10 7/16
21"	14 11/16	12 9/16
24"	15 7/8	13 3/4





Over a frequency range of 100 to 5,000 cps at a 10 G level the type 7244 produced a vibrational output in the range of 6 millivolts average while the 6J6WA averaged 60 mv or higher

RELIABILITY . . .

Stacked tubes in glass set new standards for reliability in shock and vibration tests

Production of Sylvania's new stacked tubes in glass, types 7244 and 7245, is being stepped up to meet the increasing demands of military and industrial customers. Fast growing acceptance is based on the inherent reliability of the stacked mount structure:

Reliability

Actual vibrational test data of the stacked structure compared with a conventional tube indicates as much as 2 to 1 improvement in vibrational output at 6 times the G level.

AUDIO . . .

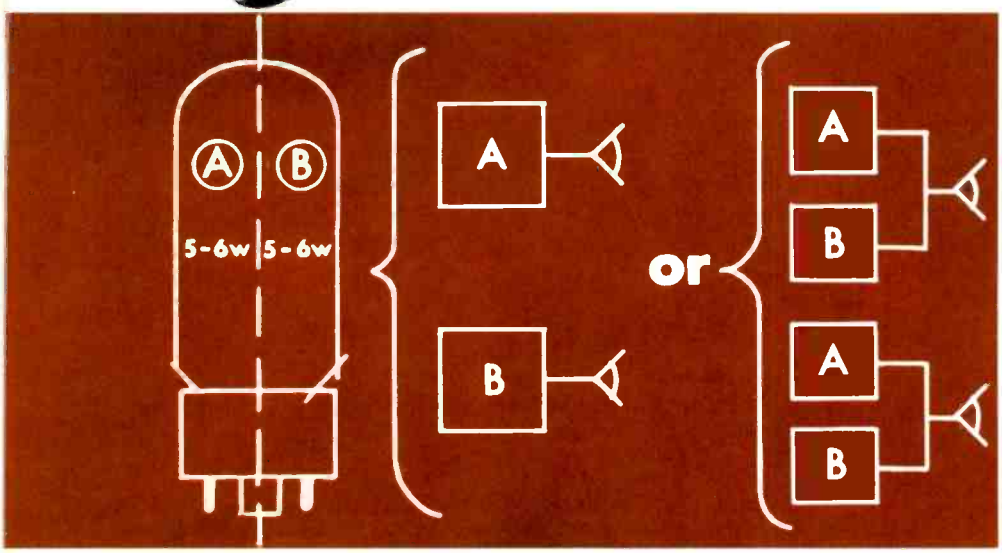
New dual-pentode for STEREO

Sylvania Framelok construction is adapted for greater circuit flexibility, better performance and new economy

A new tube design which takes advantage of the symmetry of the Sylvania Framelok tube construction is being developed specifically for application for the output stages of stereophonic sound circuits. Because it incorporates two identical pentodes in one envelope this new Framelok tube provides design flexibility and can introduce substantial circuit economies.

This new design concept now makes possible the use of a single Framelok tube—common cathode and screen grid—that will supply 5 to 6 watts usable audio output in each channel. Its unusual flexibility also permits application in push-pull in each stereo channel or two tubes push-pull, parallel in high power monaural systems.

In addition to its potential cost advantages there are the many benefits inherent only in the Framelok design: • Greater uniformity of electrical characteristics in tube after tube • Greater stability of electrical characteristics during tube life • Less change in electrical characteristics due to element temperatures at high dissipation levels • Better control of cutoff • Less chance for shorts, microphonism and noise • Better plate-to-screen current ratios • Less arcing.



New Framelok dual pentode type designed for stereo can supply 5 to 6 watts audio output single ended at the voice coil for each channel. High flexibility allows one tube to provide push-pull operation for each channel

RELIABILITY (Continued)

	Type 7244	Type 6J6WA
Frequency	40 cps	25 cps
G Level	15 G's	2.5 G's
Vibrational Output	15 MV	25 MV

Stability and Uniformity

The planar structure of the stacked tube in which all elements are arranged in parallel planes insures optimum stability of operation and uniformity of characteristics.

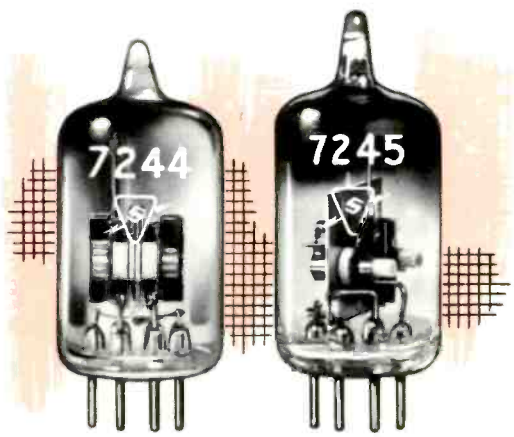
Fewer dimensions need to be controlled, providing a major simplification and reduction in the number of critical tolerances in parts fabrication.

Increased Mechanical Life

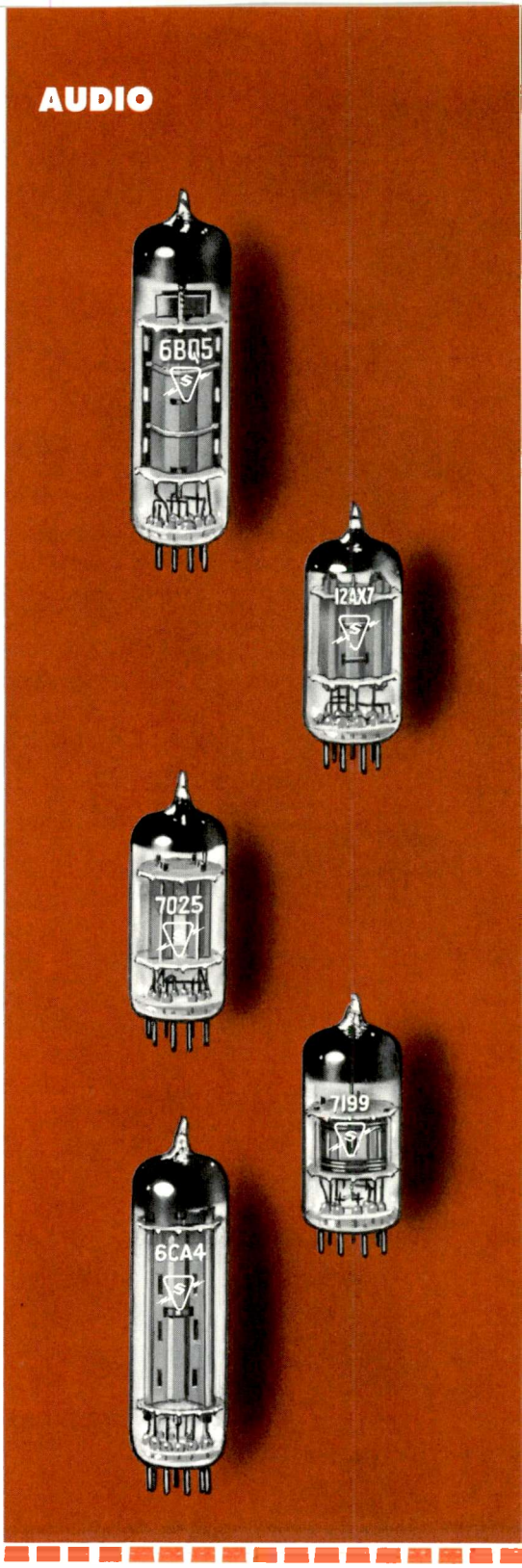
The ceramic mount structure is solidly integrated and relative motion between elements is negligible. The entire mount is displaced with shock and vibration as one solid entity, and parts or elements will not react independently. In fact, ceramic stacked mount tubes in glass have survived several hundreds of hours on 15 G, 40 cycle vibration fatigue with no significant change—a test which usually destroys conventional tube types in less than a hundred hours.

Lower Costs for Customers

The stacked tube in glass means less equipment maintenance. In-plant tube selection can be eliminated or reduced. Missile flights and other military operations have a higher probability of success with the rugged stacked tube. No major circuit redesign is necessary since the types are basically retrofits. The 7244 and 7245 can go in present equipment where 6J6WA and 6J4WA types are used with only slight compensations.



AUDIO



Beam power audio pentode for quality amplifiers

Better power output and less distortion than comparable types are the chief attributes of the new 6BQ5. It maintains initial peak performance standards throughout life. Throughout life tests the tube exhibits no "slumping" due to excessive screen dissipation. It delivers 5.6 watts at 9.2 percent distortion single ended under 4.30 v. signal input and 5.95 watts with a 4.70 v. signal. In push-pull at 250 v. plate & screen, the 6BQ5 delivers 10. 65 w. at 3.4 percent distortion; at 300 v. plate & screen, 16.5 w. at 4.16 percent distortion.

Improved high-mu twin triode serves as audio amplifier or phase inverter

As a result of Sylvania's continuing tube improvement program, a superior 12AX7 is now available with sharply reduced hum and noise. Through improved aging and processing schedules Sylvania engineers have been able to maintain the output advantages of the tube while at the same time minimizing the hum and noise characteristics.

Designed primarily for quality audio circuits, the improved 12AX7 has a center tapped heater for operation at 12.6 or 6.3 volts. It has separate cathodes and is packaged in a T-6½ envelope.

New double triode for extremely critical audio applications

Wherever extreme limits on hum and noise must be met, Sylvania's new 7025 will fill the requirements. Its special design incorporates a folded coil heater that improves over-all performance. The new high mu twin triode has an equivalent noise and hum voltage of 1.8 microvolts rms average and 7 microvolts rms maximum.

Low hum-low noise triode-pentode for hi-fi

Sylvania's new 7199 is a 9-pin miniature medium mu triode and sharp cutoff pentode designed particularly for high-quality audio applications. The triode is normally used as a phase inverter, although many other possibilities exist, while the pentode is used as a high-gain audio amplifier.

Folded coil heaters, separate cathodes and an internal shield to reduce electrical coupling combine to provide a pre-amplifier tube with low noise, low micro and high reliability, as required in high-performance audio systems.

New rectifier for hi-fi audio equipment

Double anode, indirectly heated, common cathode rectifier type 6CA4 is now available from Sylvania. The new tube can handle two 6BQ5 output tubes. It delivers 150 ma. maximum DC output current.

RATINGS (Design Center Values)

Peak inverse plate voltage	1000 volts max.
D. C. output current	150 ma. max.
Peak plate current per plate	450 ma. max.
Peak voltage between cathode and heater (cathode positive with respect to heater)	500 volts max.
Transformer voltage	2x250 2x300 2x350 volts, rms.
Total effective plate supply resistance per plate	150 200 240 ohms min.

SYLVANIA

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 2833 Sec. 34.9 P.L.&R., Buffalo 9, N.Y.

SYLVANIA ELECTRIC PRODUCTS INC.
1100 Main St.
Buffalo 9, N.Y.

MOBILE COMMUNICATIONS . . .

Sylvania introduces four new receiving tubes designed to meet the specialized requirement of mobile radio equipment

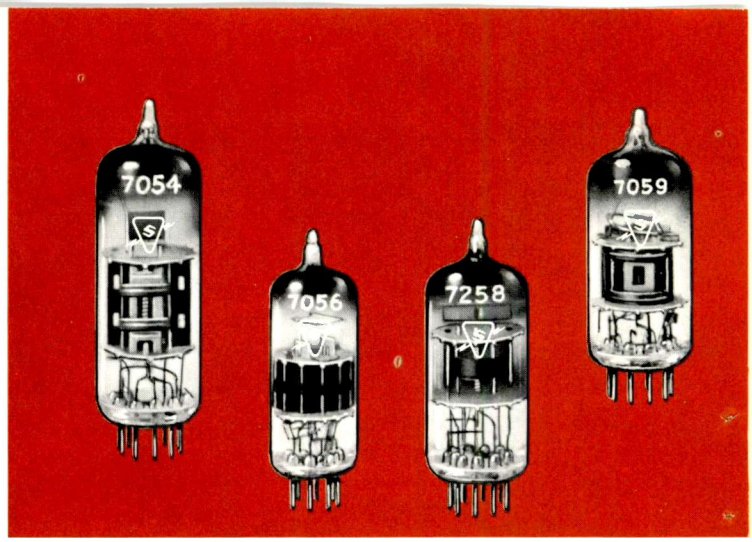
Now manufacturers of commercial and industrial mobile transceivers can select from a new line of rugged Sylvania receiving tubes designed with the special conditions of mobile radio in mind. The new tubes, types 7054, 7056, 7059 and Sylvania original type 7258, operate from B supply voltages ranging from 100 to 250 volts. The heater voltages of the line are centered at 13.5 volts—the midpoint of heater voltage range for vehicular equipments. This allows a full 3.52 volt safety margin for the tubes to take care of the fluctuating power supply that may occur in such mobile equipment.

In the Sylvania original type 7258, the pentode section may be used as an RF or IF tube. The triode section can serve as a low frequency oscillator or general purpose amplifier.

Type 7054—a 9 pin sharp cutoff pentode
Type 7056—a 7 pin sharp cutoff pentode
Type 7059—a 9 pin medium mu triode, sharp cutoff pentode
Type 7258—a 9 pin medium mu triode, sharp cutoff pentode

Characteristics and typical operation for Sylvania original type 7258

	Triode Section	Pentode Section
Plate Voltage	150	125 Volts
Grid No. 2 Voltage		125 Volts
Grid No. 1 Voltage	−3	0 Volts
Cathode Bias Resistor		56 Ohms
Plate Current	15	12 Ma
Grid No. 2 Current		3.8 Ma
Transconductance	4500	7800 umhos
Amplification Factor	21	
Plate Resistance (Approx.)	4700	170,000 Ohms
Grid No. 1 Voltage for Ib=20 ua (approx.)	−17	−6 Volts
Plate Current at Ec1 = −3 V Rk = 0		1.6 Ma



INDUSTRIAL & MILITARY C-R TUBES

Sylvania introduces a brand-new special purpose 12″ CRT designed particularly for radar and medical applications

Now, an economical 12″ 'scope tube, type SC2558, with fast response time, high impedance input and post deflection acceleration is available from Sylvania. The new tube, which will sell for approximately ½ as much as comparable types, incorporates both electrostatic deflection and focus. Its lower operating voltage eliminates the need for an elaborate power supply. With post deflection acceleration, greater deflection sensitivity is possible with increased brightness.

The large screen size of type SC2558 is especially convenient for group viewing of medical and radar displays. The new tube incorporates an aluminized screen, standard base and is available in any phosphor coating specified.

Typical Operating Conditions

Anode No. 3 Voltage	10,000 Volts D.C.
Anode No. 2 Voltage	5,000 Volts D.C.
Deflection factor	
Deflecting Plates 1-2	105 to 145 v/in.
Deflecting Plates 3-4	80 to 115 v/in.

SYLVANIA

Sylvania Electric Products Inc.
1740 Broadway, New York 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd.
P. O. Box 1190, Station "O," Montreal 9.

LIGHTING • TELEVISION • RADIO • ELECTRONICS • PHOTOGRAPHY • ATOMIC ENERGY • CHEMISTRY-METALLURGY

Please send additional information on the items checked below:

☐ New tripotential gun

Stacked tubes in glass:
☐ Type 7244
☐ Type 7245

Industrial & Military Cathode Ray Tubes:
☐ Type SC2558

Audio Tubes:
☐ New Framelok tube for stereo
☐ Type 6BQ5
☐ Type 12AX7
☐ Type 7025
☐ Type 6CA4
☐ Type 7199

Mobile Radio Tubes:
☐ Type 7054
☐ Type 7056
☐ Type 7059
☐ Type 7258

Name_____

Address_____

Company_____

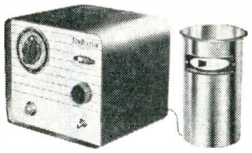
Use this handy business reply card to request additional information on these important new Sylvania developments

Narda SonBlasters offer the most complete line of lowest-cost mass-produced ultrasonic cleaners!

Narda's mass-production techniques assure you the most complete line of ultrasonic cleaners at the lowest prices in the industry! From the smallest 35-watt to the amazing 2500-watt unit with a tank capacity of 75 gallons, Narda's SonBlasters are available **now**—off-the-shelf—for immediate delivery. And with a full 2-year warranty besides!

What do **you** want to clean? Transistors, semi-conductors, other electronic, automotive, missile and avionic components, instruments, timing mechanisms—Narda's SonBlasters clean 'most any mechanical, electrical or horological part or assembly you can think of—and clean faster, better and cheaper.

No matter what you need in ultrasonic cleaning equipment, you'll find Narda's complete line of production-size units have the quality, power, performance, capacity and appearance of cleaners selling up to three times their price! Write for more details now and we'll include a free questionnaire to help determine the precise model you need. Address: Dept. EI-19.



Generator G-202 **Transducerized Tank NT-202**
35 watts **Capacity: ⅜ gallon**

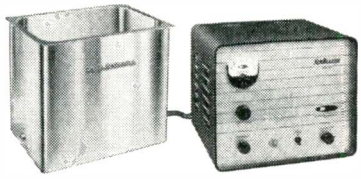
An amazingly efficient, yet inexpensive, ultrasonic cleaner. Duty cycle timer permits operator to turn the unit on, set it, and leave; the SonBlaster will turn off automatically at the end of the cycle. Four choices of timers—from 0-15 min. to 0-120 min. Also available without timer at slightly lower cost (G-201).

$220

Generator G-601 **Transducerized Tank NT-602**
60 watts **Capacity: 1 gallon**

A more powerful production-type unit, with a special circuit and selector switch permitting operator to alternate between two tanks, when items being cleaned require different solutions or a two-step process.

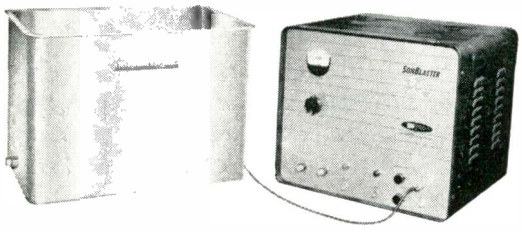
$350



Transducerized Tank NT-1505 **Generator G-1501**
Capacity: 5 gallons **200 watts**

The lowest price in the industry for a tank of this capacity and activity. Generator also will operate 2, 3 or 4 submersible transducers at one time, with just a turn of the load selector switch on the front panel.

$695



Transducerized Tank NT-5001 **Generator G-5001**
Capacity: 10 gallons **500 watts**

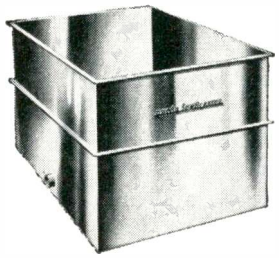
Generator features standby switch for longer life and load selector switch on the front panel to operate up to 8 submersible transducers or 8 NT-602 or 2 NT-1505 transducerized tanks at one time. Larger tanks available on special order.

$1325

Submersible Transducer NT-605

Heli arc welded stainless case, hermetically sealed for safe, leak-proof immersion. Radiating face: 27 sq. in. Effective plane of radiation: 40-50 sq. in. (approximately 10" x 5"). Effective cavitation of volumes up to 1200 cu. in. at 24 in. tank height (5 gal.) and 2400 cu. in. at 48 in. tank height (10 gal.). Bulkhead electrical fitting on back allows all wiring connections to be made on outside of tank. For use in any arrangement or location in any shape tank you desire to use. Also available—model NT-604, identical with NT-605, except for pipe thread instead of bulkhead fitting, permitting electrical connections inside of tank.

$130



Transducerized Tank
NT-25001
Capacity: 75 gallons

Powerful unit drives the largest mass-produced industrial-size transducerized ultrasonic cleaning tank made! Also energizes up to 40 Narda 60-watt submersible transducers (NT-604 or -605). Capable of energizing tanks measuring up to 150 square feet of area by 2' or 3' high.

$4360

Generator G-25001
2500 watts

Consult with Narda for all your ultrasonic requirements. The SonBlaster catalog line of ultrasonic cleaning equipment ranges from 35 watts to 2.5 KW, and includes transducerized tanks as well as immersible transducers which can be adapted to any size or shape tank you may now be using. If ultrasonics can be applied to help improve your process, Narda will recommend the finest, most dependable equipment available—and at the lowest price in the industry!

For custom-designed installation and unique electro-acoustic applications, including cleaning, soldering, welding, drilling and non-destructive testing, consult our subsidiary, Alcar Instruments Inc., at the address below.

the narda ultrasonics corporation
625 MAIN STREET, WESTBURY, L. I., N. Y.
Subsidiary of The Narda Microwave Corporation

← Circle 54 on Inquiry Card, page 121

Circle 55 on Inquiry Card, page 121

NEW!
HIGH-TEMPERATURE FABMIKA® CAPACITORS

. . . standard ratings for 260°C

. . . up to 310°C in special designs

Sprague's new FABMIKA Capacitors can really handle the HOT ones! . . . jet ignition, missile controls, atomic reactors . . . any high voltage d-c power supply where high temperature, small size, and light weight are important . . . especially where components are immersed in a dielectric fluid.

- Sprague's new FABMIKA Capacitors rely on a specially processed dielectric for their heat resistant properties. Developed through three years of research and manufacturing, this dielectric consists of silicone-bonded mica paper which can function effectively in temperatures up to 260°C and, in special designs, up to 310°C. There's a choice of four standard temperature ranges: from −55°C to +125°C, +165°C, +200°C, and +260°C.

TYPICAL INSULATION RESISTANCE	
Temp. °C	MΩ X μF
125	300 (min.)
165	100 (min.)
250	50 (min.)
260	10 (min.)

Maximum Dissipation Factor: .15% at 400 cy. 25°C.

- Radiation resistance is another outstanding characteristic of FABMIKA Capacitors. They have been application tested in reactors under high dosage rates without harmful loss of capacitance.
- Another important application is 400 cycle a-c power supplies where their low dissipation factor results in small capacitors with minimum rise in temperature under operating conditions.
- Miniature, high-reliability pulse forming networks are still another well tested application.
- FABMIKA Capacitors are available in four constructions: uncased (up to 200°C), uncased and clamped (up to 260°C), cast epoxy housing (up to 200°C), and drawn metal case (up to 260°C standard and 310°C special).
- For complete specifications, write for Engineering Bulletins to the Technical Literature Section, Sprague Electric Co., 233 Marshall St., North Adams, Mass.

SPRAGUE®
the mark of reliability

SPRAGUE COMPONENTS:

CAPACITORS • RESISTORS • MAGNETIC COMPONENTS • TRANSISTORS • INTERFERENCE FILTERS • PULSE NETWORKS • HIGH TEMPERATURE MAGNET WIRE • PRINTED CIRCUITS

Stockholm, scene of the 1958 IEC General Meetings, showing Royal Palace, center, Opera House, right and State House spire, right rear.

ELECTRONIC INDUSTRIES
October 1958

More than 900 of the world's leading engineers attend Stockholm event. What to expect as a delegate. The importance of international technical standardization for the electronic industries.

1958 IEC Conference Report

THIS year the general meetings of the IEC were held in Stockholm over the period June 30 to July 17. Most of the technical meetings were held in Stockholm but a few meetings had to be held in Ludvica and Vestaras, Sweden and in Copenhagen, Denmark, because of limited accommodations that the heavy tourist traffic that this time of year creates. At the Stockholm general meetings more than 900 delegates from 28 different countries (including USSR and iron curtain countries) participated. Along with the delegates came some 300 additional dependents so that in all some 1200 persons were at hand. Table 1 shows a list of the technical committees which met during this period and in Table 4 we have listed the names of the members of the U. S. delegation together with their company and technical committee affiliations.

In earlier issues of ELECTRONIC INDUSTRIES we have summarized the role of the IEC, how it functions,[1] and the need for expanded international technical representations.[2,3] Fig. 1 gives some idea as to the growth in the number of engineering documents being circulated among national committees over the period 1955-1958, and it also shows (in Swiss francs) how IEC expenditures have increased over an eight year period. During the first half of 1958 more than 1000 separate documents were circulated.

Fig. 1 (below): Growth of engineering documents being circulated among national committees and growth of IEC expenditures.

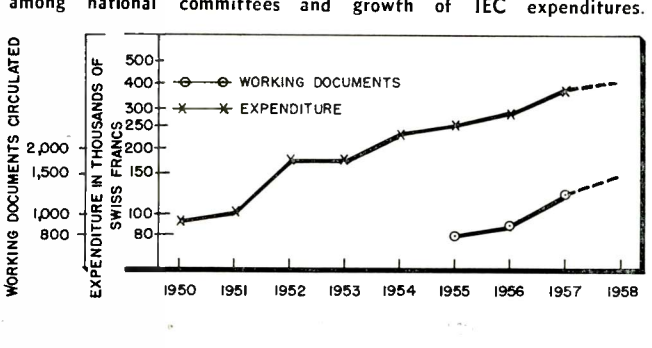


Fig. 2 is a diagram illustrating how the IEC is organized while Fig. 3 is a flow diagram that illustrates how IEC standardization recommendations are prepared.[4] During the Stockholm meetings this year some 45 draft recommendations were accepted for circulation to national committees for final vote. Table 2 lists these drafts by technical committee and by subject. Ten documents were accepted for final publication and these are listed in Table 3.[5]

As previously reported, the work of the IEC has been going forward for more than 50 years; the object being to prepare technical recommendations upon which national standards of member countries can be based. Aside from the better understanding between electrical engineers that this work creates, development of international trade is another most important aspect. In recent years more and more American firms have established manufacturing facilities or affiliations in overseas markets, and they are continuing to do so. The recent development of a European Common Market has also stirred considerable interest among U. S. suppliers. The rise of the "sputniks" and the cold war point to the necessity of international information interchange. Thus IEC, because of its long

Royal Institute of Technology, Stockholm, where technical meetings were held. Note IEC flag in foreground.

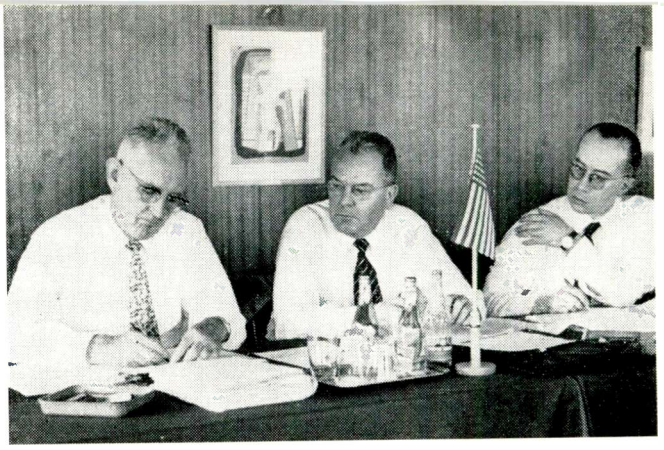
IEC Conference Report

(continued)

history and worldwide acceptance seems to be destined to be an increasingly important organization to the U. S. Its role among the electronic industries is even more important. In the period June 1957 to June 1958 there were 27 documents circulated for approval under the six months rule.[4] Of these, 20 are considered as being of direct interest and bearing to electronic manufacturers. (A price list of currently available IEC recommendations may be obtained from Mr. S. D. Hoffman, USNC Secretary, American Standards Association Inc., 70 East 45 St., N. Y. 17, N. Y.)

Table I: Number and description of technical committees meeting at 1958 Stockholm General Meetings

Com. No.	COMMITTEE
1	Nomenclature
2C	Classification of insulating materials (Informal Meeting)
2F	Dimensions of carbon brushes
3	Graphical symbols
3 Exp.	Graphical symbols—Experts Committee
7	Aluminium
7-1	Aluminium alloys
8	Standard voltages—Current ratings
13	Measuring instruments
13A	Integrating meters
13B	Indicating instruments
13C	Electronic measuring instruments
14	Power transformers
15	Insulating materials
15 Exp.	Insulating materials—Experts Committee
15WG/1	Dielectric strength
15WG/2	Volume and surface resistivity—insulation resistance
15WG/3	Tracking
15WG/4	Voltage endurance under the action of ionization discharges
15WG/5	Encyclopedia of insulating materials
15WG/6	Dielectric constant and losses
15WG/7	Temperature properties of insulating materials
17	Switchgear and controlgear
17A	High voltage switchgear and controlgear
17B	Low voltage switchgear and controlgear
22	Power converters
22-2	Semi-conductor rectifiers
23	Electrical accessories
24	Electric and magnetic magnitudes and units
25	Letter symbols and signs
28	Co-ordination of insulation
29	Electro-acoustics
29WG/1	Sound recording
29WG/3	Sound systems
29WG/5	Loudspeakers
29WG/6	Hearing aids
29WG/7	Ultrasonics
29WG/8	Sound level meters
37 Exp.	Lightning arresters—Experts Committee
38	Instrument transformers
39	Electronic tubes and valves and similar semi-cond. devices
39-1	Electronic tubes and valves
39-2	Semi-conductor devices
39/40	Sockets and accessories for electronic tubes and valves
40	Components for electronic equipment
40-1	Capacitors and resistors
40-2	R.F. Transmission lines and their accessories
40-4	Connectors and switches
40-5	Basic testing procedure
40-6	Parts made of ferro-magnetic oxides
42	High voltage testing techniques
	C.I.SP.R. Steering Committee
	Committee of Action
	Council
	ISO/TC 43—Acoustics

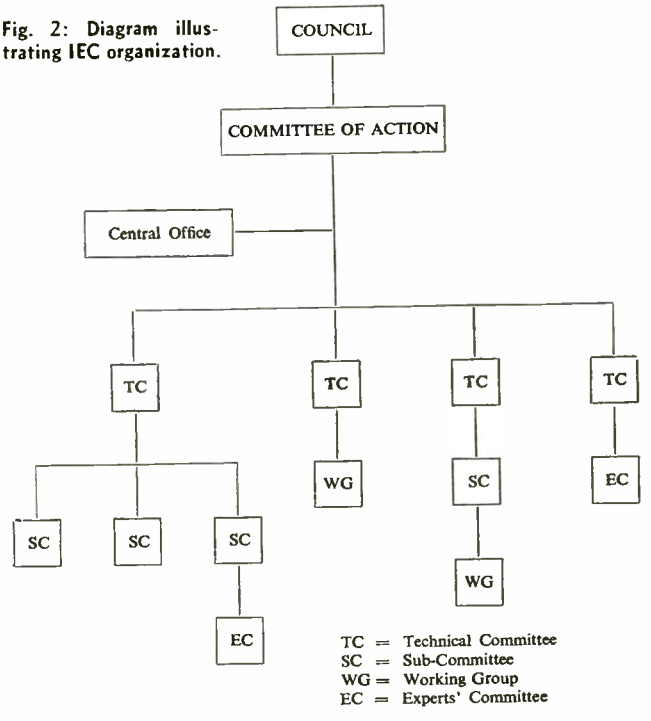


V. M. Graham (center), Electronic Industries Assn., presides over SC39-2 in Vestaras. He is flanked on his right by M. A. Acheson, Sylvania Electric Products Inc., and Dr. J. Mercier, Cie Francaise Thomson Houston, Paris.

This was our first actual experience working with IEC technical committees and a review of what you can expect as a delegate should be of interest. Upon acceptance and assignment to a committee, you begin to receive copies of documents of interest to that committee that collectively express the position of all of the countries involved. Considerable study is required in order to clearly understand all the issues since comments from one country will reference items and paragraphs in the documents of another. The appointed chairman, usually an individual who has had prior experience as an IEC delegate, arranges for a series of preliminary briefing meetings. At these meetings the U. S. position on the subject is developed and delegates become technically oriented. Any necessary liaison between technical committees of professional societies or organizations such as IRE, AIEE, JETEC etc for any additional information or recommendations on position is also carried out. In our case on three committees, TC-39 and SC 39-1, and 39-2, there were seven meetings extending over a six months period and the documents carried overseas weighed nearly nine pounds.

It is in going through the briefing sessions and attending the technical meetings overseas that one realizes the great value in having committees of continu-

Fig. 2: Diagram illustrating IEC organization.



ing representation, i.e., where the same delegates serve on the same committee year by year. For one thing a certain amount of aclimatizing is necessary on operational procedures. Next, being in a foreign country, language and customs have to be reckoned with. Finally, continued association with other foreign delegates on your committees helps develop a spirit of fellowship which reflects in getting the work at hand accomplished sooner and more easily.

Languages in IEC are English, French and Russian. In Europe, however, English appears to be more or less the international language. No difficulties with documents in foreign languages was experienced. Several of the documents were drawn in French, but translation copies were available on an overnight basis.

A different foreign country each year is host to the IEC, (U. S. was host in 1954 in Philadelphia) and all arrangements are made by that country's National Committee for accommodations, receptions, and for sightseeing and technical tours.

The 1958 general meetings of IEC get underway in Stockholm. Here are delegates attending opening session.

A word of praise is in order at this point for the well-planned and wonderfully executed program of the

(*Continued on page* 150)

Table 2: Draft Recommendations Accepted for Circulation To National Committees

TC 3: Graphical Symbols
Valves, tubes and rectifiers
Switches
Measuring instruments
Chapter C: Transmission lines and accessories
Magnetic transductors
Batteries and accumulators

TC 7: Aluminum
Aluminum alloys of the Al-Mg-Si type for busbars
Commercial, hard-drawn aluminum electrical conductor wire
Galvanized steel wires for the mechanical reinforcement of steel-cored aluminum conductors
Aluminum electrical conductor wire having tempers other than hard

TC 12: Radio Communication
Safety requirements for electric mains operated radio receiving apparatus

TC 13: Measuring Instruments
Watt-hour meters

TC 15: Insulating Materials
Methods of test for electrical strength of solid insulating materials at power frequencies
Methods of measurement of insulation resistance of solid insulating materials
Standard temperatures and humidities for the measurement of the insulation resistivity and resistance of insulating materials
Conditioning of insulating materials for all types of electrical tests
Test procedure for evaluation of the thermal stability of enamelled wire by loss of electrical strength
Guide for the preparation of test procedures for the thermal evaluation of electrical insulating materials
Method for determining the comparative tracking index of solid insulating materials

TC 17: Switchgear and Controlgear
Rules for isolators and earthing switches

TC 20: Electric Cables
Tests on oil-filled cables and accessories

TC 23: Electrical Accessories
Fuse links for miniature fuses
Fuses for domestic and similar general use

TC 29: Electroacoustics
Recommendations for magnetic tape recording and reproducing systems. Amendment to Publication 94
Recommendations for stereophonic disk records
Tolerances on the thickness of 45 rpm disks. Amendment to Publication 94
Recommendations for loudspeakers
Description of the IEC-reference coupler for the calibration of hearing aids employing earphones of the insert type
Specification for sound-level meters

TC 35: Primary Cells and Batteries
Capacities of radio HT batteries

TC 39: Electronic Tubes and Valves
Definitions of rating, rating systems, and 3 electrical rating systems for electron devices
Dimensions of electronic tubes and valves. Amendment to Publication 67, Part II
Specification for sockets for electronic tubes and valves
Dimensioning of wiring jigs and pin straighteners

TC 40: Components for Electronic Equipment
An extension of the specification for general-purpose aluminum electrolytic capacitors
Recommendations for radio-frequency cables. Appendix to Part I of IEC Publication 96
Standard impedances and diameters of R.F. cables. Revision of IEC Publication 78
General specification for rotary wafer switches
General specification for toggle switches
Specification sheets for toggle switches
Draft revision of IEC Publication 68: Part I, tests D, H, M, and tests T and U partly
Test F: Vibration
General classification of ferromagnetic oxides materials
Recommendations of terms and measuring methods for cores of ferromagnetic oxides for data-processing devices

TC 42: High-Voltage Testing Techniques
Voltage measuring with sphere-gaps (one sphere earthed)

Nomographs for . . .

Designing Transistor Narrow Band Amplifiers

Nomographs are given which permit quick determination of the realizable performance of a transistor as a narrow band amplifier in terms of its available or measurable operating parameters and a desired skew factor.

By L. M. KRUGMAN,
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RCA Victor Radio & "Victrola" Div.
RCA, Camden 2, N. J.

THE factors which cause instability in transistor narrow band amplifiers have been covered in detail.[1, 2, 3, 4, 5] In general, stable operation requires that the energy transfer from the output to input circuit is balanced out or more exactly *unilateralized*. This requirement may be expressed mathematically in terms of the nodal intrinsic and extrinsic feedback parameters as:[6]

$$y_{12} - y_f = 0$$

The unilateralized operating characteristics for a transistor at a given dc bias and frequency may be determined by measurement[7, 8] or from manufacturers' specification sheets. Figs. 4 through 7 illustrate the variation of the major performance characteristics of a typical i-f transistor with dc bias at 455KC.

The maximum available gain, MAG, of a transistor is identical to its R-C unilateralized, conjugate-matched power gain. The MAG is not realizable in a practical design where interchangeability is a factor, due to variations in transistor and component characteristics. A procedure has been derived[9] by which i-f amplifier stages may be designed on a basis of maximum usable gain, MUG. The nomographs shown in Figs. 1 through 3 which are based on the MUG concept, permit the rapid and accurate determination of transistor i-f design factors.

Table 1

SYMBOL DEFINITIONS

C_f = Effective operating feedback capacitance variation.
C'_f = Minimum change in external feedback capacitance required to produce instability in a unilateralized, conjugate-matched amplifier.
C_N = Extrinsic neutralization capacitance.
ΔC_N = Effective intrinsic neutralization capacitance variation.
C_K = Nomograph factor = $C_N + 0.1\ C_N$.
IL = Insertion loss.
MAG = Maximum available gain.
MUG = Maximum usable gain.
K_r = Nomograph factor = $5 \log R_i R_o - 30$.
R_i = Input resistance.
R_o = Output resistance.
S = Stability factor.
SF = Skew factor.
ω = Operation frequency in radians/second.

Design Equations

Definitions of symbols are summarized in Table I.

1. The minimum capacitance[10] which will cause oscillation when connected between the input and output terminals of a unilateralized, conjugately-matched transistor amplifier is:

$$C_f' = \frac{4}{\omega\,[MAG\ (R_i\ R_o)]^{\frac{1}{2}}}$$

2. The effective feedback capacitance under given operating conditions for a 10% tolerance in the neutralizing capacitor, C_N, and an allowable skew factor, SF[11] is:

$$C_f = \frac{C_N + 0.10\ C_N}{SF}$$

3. The stability factor of an amplifier is the ratio of the effective feedback capacitance under the given operating conditions (C_f) to the minimum capacity required to produce oscillation under conjugate-matched conditions (C_f'). It is equal to the insertion loss required for stability.

$$S = \frac{C_f}{C_f'} = IL$$

4. The maximum useful gain, MUG, is the difference between the maximum available gain and the required insertion loss.

$$MUG = MAG - 10 \log IL$$

Examples

1. *Determination of Maximum Usable Gain:* Determine the 455 KC MUG of the typical transistor whose characteristics shown in Figs. 4 through 7 for (a) E_c = 6.0 volts, I_e = 0.4 ma, and (b) E_c = 6.0 volts, I_e = 1.2 ma. Assume C_N = ±3.5 μμf and that a skew factor of 0.2 can be tolerated.

From the Characteristics:

E_c = 6.0 v., I_e = 0.4 ma.

C_N = 10.8 μμf
ΔC_N = ± 3.5 μμf
R_i = 1600 ohms
R_o = 43 K ohms
MAG = 36.9 db

E_c = 6.0 v., I_e = 1.2 ma.

C_N = 10.0 μμf
ΔC_N = ± 3.5 μμf
R_i = 540 ohms
R_o = 18 K ohms
MAG = 36.9 db

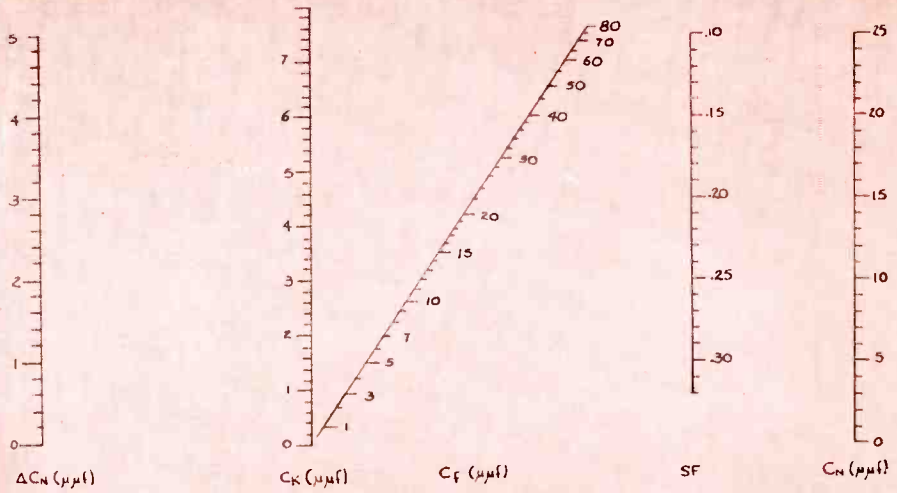


Fig. 1: Determination of minimum capacitance for instability with specified operating conditions.

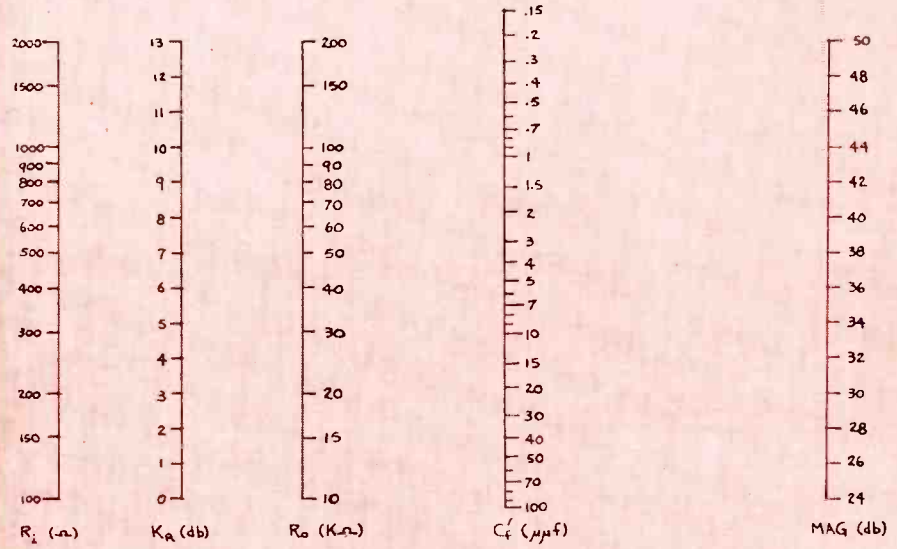
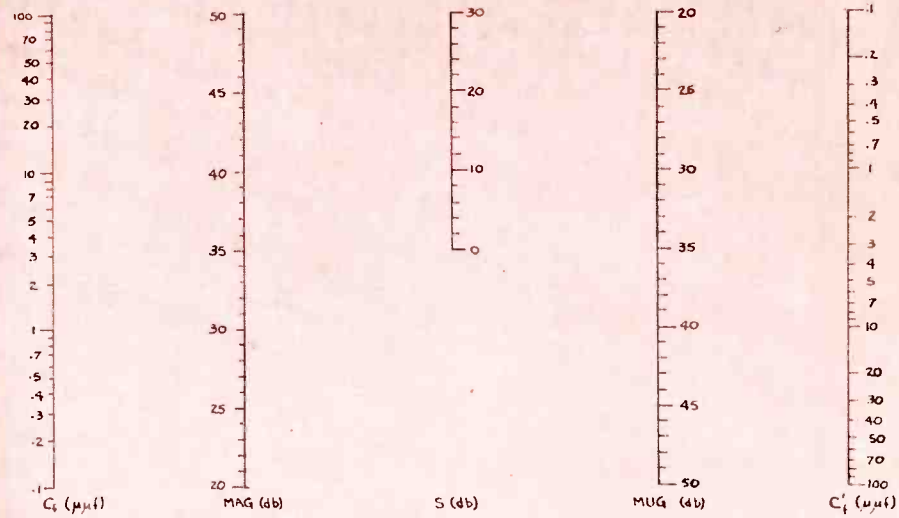


Fig. 2: Determination of minimum capacitance for stability with conjugate matching.

Fig. 3: Nomograph for finding stability factor and maximum usable gain.



Amplifier Nomographs

(Continued)

Procedure: $E_c = 6.0$ v., $I_c = 0.4$ ma.
(a) Connect $\Delta C_N = 3.5$ to $C_N = 10.8$.
Read $C_K = 4.6$ at intersection on the C_K axis.

(b) Connect $C_K = 4.6$ to SF = 0.2.
Read $C_f = 23$ at intersection on the C_f axis.

(c) On Fig. 2, connect $R_i = 1600$ to $R_o = 43$.
Read $K_r = 9.2$ at the intersection.

(d) Connect $K_r = 9.2$ to MAG = 36.9 db.
Read $C_f' = 2.4$ at intersection.

(e) On Fig. 3, connect $C_f = 23$ to $C_f' = 2.4$
Read insertion loss, S = 9.7.

(f) Connect S = 9.7 and MAG = 36.9.
Read MUG = 27.2 db.

For $E_c = 6.0$ v. and $I_c = 1.2$ ma,

Repeat steps (a) through (f).
Read $C_K = 4.5$, $C_f = 22$, $K_r = 4.9$, $C_f' = 6.5$, S = 5.3, and MUG = 31.6 db.

Note that although the MAG is the same at each of the specified operating conditions, the usable gain at $I_c = 1.2$ ma is 4.4 db greater than the MUG at $I_c = 0.4$ ma.

2. *Determination of Insertion Loss at Operating Frequencies Other Than 455* KC: Determine the insertion loss necessary for stability using the following transistor as a 2 MC i-f amplifier.

Given or measured values at 2.0 MC.

$I_c = 1.0$ ma, $E_c = 12$ v.
$C_N = 10\ \mu\mu f$, $\Delta C_N = 0.5\ \mu\mu f$
$R_i = 700$ ohms, $R_o = 30$ K ohms
MAG = 30 db, SF = 0.15

Procedure:
(a) On Fig. 1, connect $\Delta C_N = 0.5$ to $C_N = 10$.
Read $C_K = 1.5$ at intersection on the C_K axis.

(b) Connect $C_K = 1.5$ to SF = 0.15.
Read $C_f = 10$ at intersection on the C_f axis.

(c) On Fig. 2, connect $R_i = 700$ to $R_o = 30$.
Read $K_r = 6.6$ at intersection on the K_r axis.

(d) Connect $K_r = 6.6$ to MAG = 30.
Read $C_f' = 9.8$ at intersection on the C_f' axis.

Since this nomograph is normalized for an operating frequency of 455 KC, C_f' must be multiplied by an appropriate correction factor, i.e.

$$C_f' @ f_o = C_f' @ 455 \text{ KC} \left(\frac{455 \text{ KC}}{f_o \text{ KC}}\right)$$

$$\text{Then } C_f' @ 2.0 \text{ MC} = 9.8 \left(\frac{455}{2000}\right) = 2.2$$

(e) On Fig. 3, connect $C_f = 10$ to $C_f' = 2.2$.
Read S = 6.5 at intersection on the S axis.
The insertion loss required for stability is 6.5 db.

Fig. 4: Unilateralized input resistance vs. collector bias.

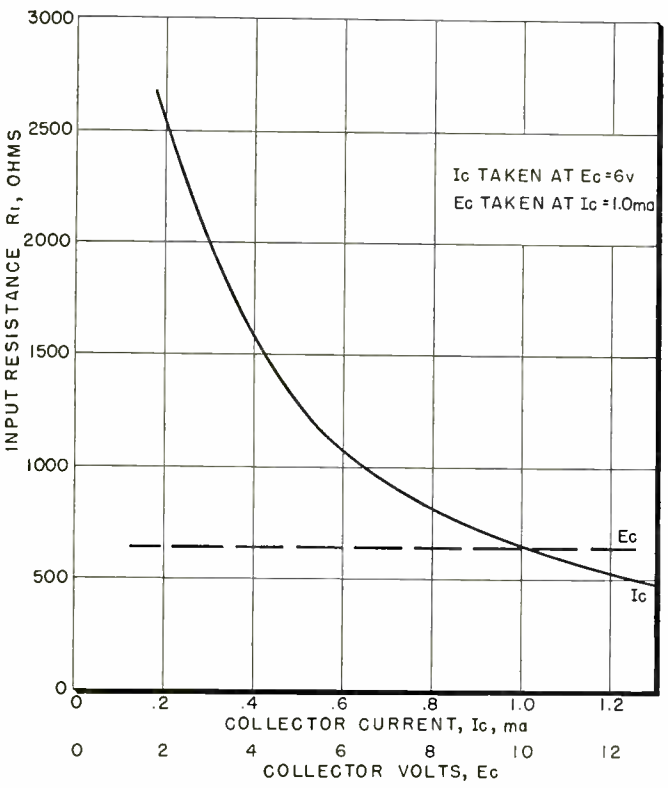
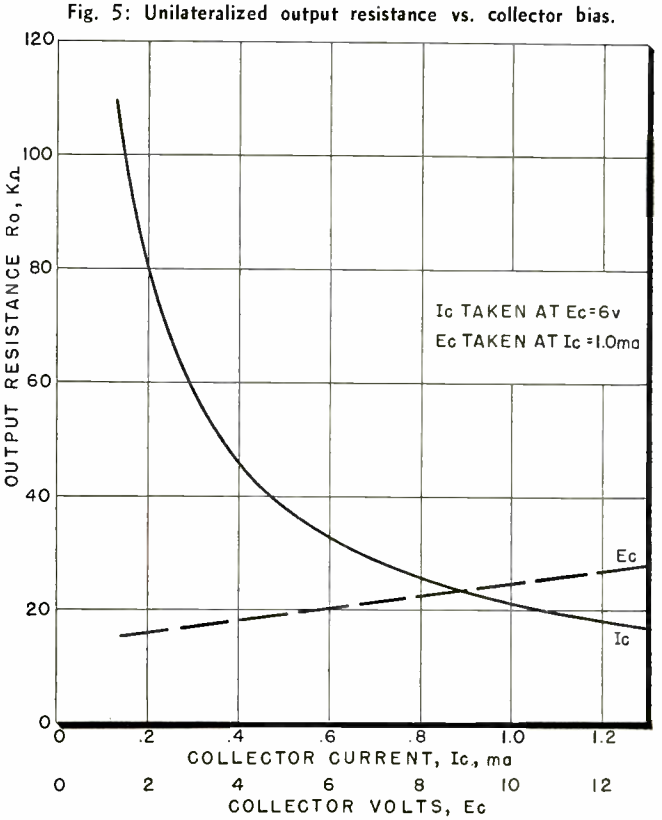


Fig. 5: Unilateralized output resistance vs. collector bias.



3. *Determination of Maximum Skew Factor:* Determine what skew factor must be tolerated if a MUG of 32.5 is desired, using a transistor having the following characteristics:

C_N = 10.2 $\mu\mu$f. ΔC_N = ± 3.5 $\mu\mu$f
R_i = 650 ohms, R_o = 22 K
MAG = 37.2

Procedure:
(a) On Fig. 2, connect R_i = 650 to R_o = 22.
Read K_r = 5.8 at intersection on the K_r axis.

(b) Connect K_r = 5.8 to MAG = 37.2.
Read C_f' = 5.1 at intersection on the C_f' axis.

(c) On Fig. 3, connect MAG = 37.2 to MUG = 32.5.
Read S = 4.7 at intersection on the S axis.

(d) Connect C_f' = 5.1 to S = 4.7.
Read C_f = 15 at intersection on the C_f axis.

(e) On Fig. 1, connect ΔC_N = 3.5 to C_N = 10.2.
Read C_K = 4.5 at intersection on the C_K axis.

(f) Connect C_K = 4.5 to C_f = 15.
Read SF = 0.3 at intersection on the SF axis.

Then the maximum skew factor which must be tolerated for the required usable gain is 0.3.

4. *Determination of Neutralizing Capacitance Tolerance:* Under the same conditions as example 3, determine what tolerance must be specified for C_N if a skew factor of 0.25 may not be exceeded.

Procedure:
Steps (a) through (d) same as example 3.
(e) On Fig. 1, connect C_f = 15 to SF = 0.25.
Read C_K = 3.8 at intersection on the SF axis.
(f) Connect ΔC_N = 3.5 to C_K = 3.8.
Read C_N = 3.0 at the intersection on the C_N axis.

Since this nomograph is normalized for a 10% tolerance. The maximum allowable tolerance is:

$$\frac{3}{10.2}(10\%) = 2.9\pm$$

Acknowledgment

The comments and assistance of Messrs. J. W. England, L. A. Freedman, and W. Hasenberg are gratefully acknowledged.

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9. Holmes, D. D., and T. O. Stanley, "Stability Considerations in Transistor IF Amplifiers," *TRANSISTORS I*, RCA Laboratories, Princeton, N. J., 1956, pp. 403-421.
10. See reference 9 for derivation.
11. Reference 9, page 406, Fig. 2. This factor is based on the allowable selectivity skew resulting from misneutralization. A value of SF = 0.2 is normally adequate.

Fig. 6: Unilateralized collector base neutralization cap. vs. bias.

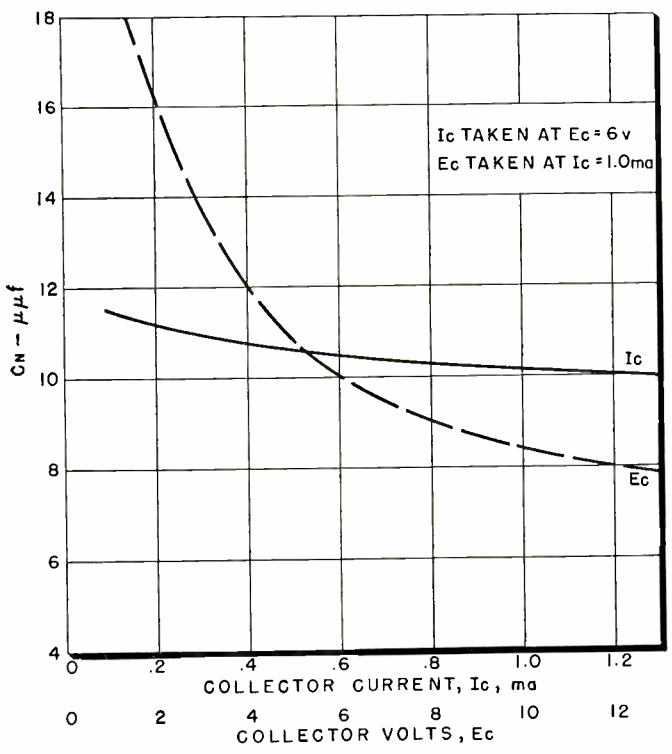
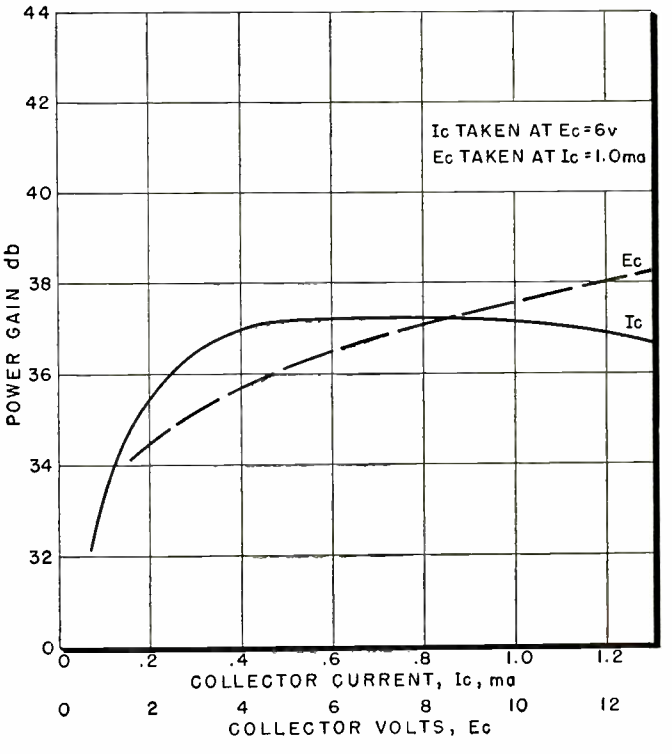


Fig. 7: Unilateralized power gain versus collector bias.



Direct writing pen instruments present undesirable curvilinear recordings. The theory and method of transforming these simple laboratory devices to give more readily usable data is described.

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Avionics & Electronics Division
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Converting Recorders

THE simplicity featured by the meter-movement type penmotor makes direct writing recorders using this kind of pendrive a very convenient instrument for ordinary laboratory work. The fact that the ordinates of the obtained recordings are arcs of a circle instead of straight line segments is the penalty paid for this convenience.

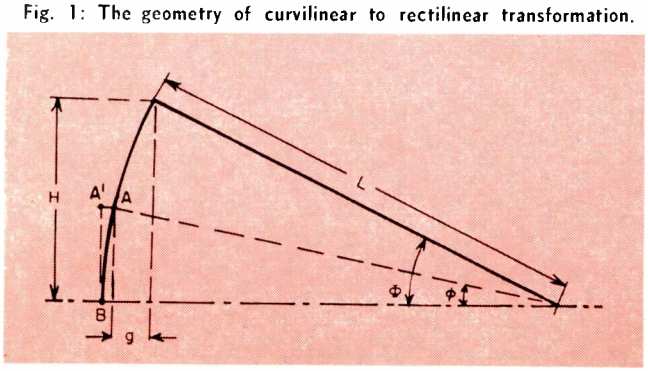
In most cases this distortion is not objectionable. There are instances, however, where the linearity of the graph along both reference axes is desirable, especially when readings and measurements have to be made on the recording for further analytical work.

In laboratories where analog computing equipment is already available, a curvilinear direct writing recorder can be used to produce rectilinear recordings by means of the technique described below.

Theory

As Fig. 1 shows, a recorder pen of a length L mm and maximum travel $\pm H$ mm will plot a given voltage e as a point A, which should have been plotted at A^1 if the recording process was rectilinear. This would have required advancing the graph by an amount AA^1 mm for the voltage level e. The advance, expressed in the time domain, will be $\tau = AA^1/u$ sec, where u mm/sec is the paper speed.

Fig. 1: The geometry of curvilinear to rectilinear transformation.



While advancing the graph is not feasible, the inverse is quite possible; that is, we can delay each ordinate by an interval progressively larger as its magnitude decreases. Thus, the point A corresponding to a pen rotation ϕ will have to be delayed by an amount

$$\tau = \frac{g}{u} = \frac{L}{u}(\cos\phi - \cos\Phi) \cdot$$

The well-known series expansion of the cosine may be used at this point to derive the approximation

$$\cos\phi \cong 1 - \frac{\phi^2}{2} \cdot$$

Ordinarily, the error introduced by such an approximation is negligible. For instance, for a recorder featuring a pen length $L = 3$ in. and maximum pen-tip excursion $H = \pm 1$ in. we have:

$$\Phi = \sin^{-1}\frac{1}{3} = \sin^{-1} 0.33333 = 0.33973 \text{ rad.} \qquad (1)$$

The cos ϕ value as determined from the above approximation is 0.94229 against the true value of 0.94284, i.e., an error of only 0.06%.

On the other hand, the substitution of the arc BA by the line segment BA^1 causes an error in the ordinate length, which is equivalent to the difference between the value of the corresponding angle ϕ, measured in radians, and its sine. Obviously, the maxi-

mum error will occur for $\phi = \Phi$, and using Eq. (1) we find it to be about 1.9%.

The expression for the pure time delay becomes now

$$\tau = \frac{L}{2u}\left[2\,(1 - \cos\Phi) - \phi^2\right] = \frac{L}{2u}\left[0.1102 - \phi^2\right] = \frac{L}{2u}\left[0.1102 - k^2e^2\right], \quad (2)$$

where k is the recorder sensitivity in radians/volt. The two extreme values of τ, occurring at $\phi = \Phi$ and $\phi = 0$, are, of course,

$$\tau_{min} = 0,$$
$$\tau_{max} = 0.0551\,\frac{L}{u} \quad (3)$$

by means of a velocity servo control of the paper drive. When such a variable speed machine is available, it offers the additional advantage of a precise duplication of the time-shifted signal practically without phase shift over the frequency range of the recorder. There is a limit, however, to the response speed of the tape drive which degrades the performance increasingly with the signal frequency.

On the other hand, electronic simulators offer a very convenient way of simulating transport time delay and do not require any handling of mechanical components. Their function is based on the fact that operational amplifier circuits provide transfer functions of the form $A_n(\omega)/B_m(\omega)$, where A_n and B_m are algebraic polynomials of the n and m order respec-

to Rectilinear Outputs

Method of Transforming

Pure time delay generators are well-known devices in simulation work. The most common ones are either of the magnetic tape write-read type, or of the operational amplifier electronic type.

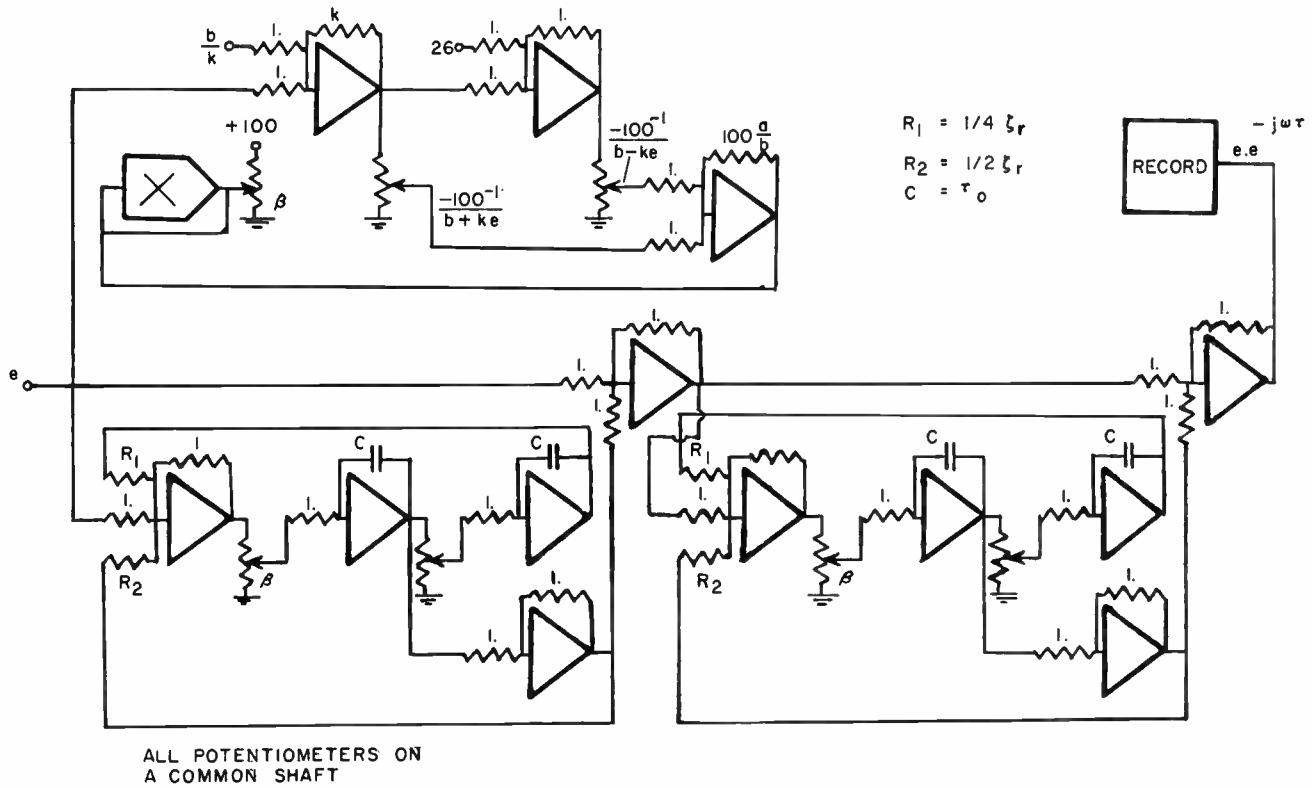
In the case of the magnetic tape pure time delay simulator, the variable time delay can be obtained by varying the tape speed (for a constant head spacing)

tively, and they naturally suggest themselves for the approximation of the pure delay which in its complex expression is

$$\frac{E_{out}}{E_{in}} = G(j\omega) = e^{-j\omega\tau}. \quad (4)$$

Thus, one can easily construct a computer circuit responding as

Fig. 2: Computer circuitry for the generation of variable transport time delay.



Rectilinear Outputs *(Continued)*

$$G(j\omega) = \prod_{n}^{n}\left(\frac{A_n(j\omega)}{B_n(j\omega)}\right) \cong e^{-j\omega\tau}. \qquad (5)$$

Second order polynomials, A_n, B_n are easily simulated and a number of good approximations of Eq. (5) have been developed more or less based on the expression

$$e^{-j\omega\tau} \cong \prod_{r=1}^{n}\left[\frac{1 - 2\,j\omega\zeta_r\tau_r - \omega^2\tau_r^2}{1 + 2\,j\omega\zeta_r\tau_r - \omega^2\tau_r^2}\right] \qquad (6)$$

where

$$\tau = \sum_{r=1}^{n} 4\,\zeta_r\tau_r. \qquad (7)$$

The degree of approximation is directly proportional to the value of n and depends on the judicious choice of ζ_r and τ_r.

Phase Shift

Since the ideal phase shift required for the expression (3) is $\tau\omega$ it follows that

$$\tau\omega = \sum_{r=1}^{n} 4\,\zeta_r\tau_r\omega$$

while the phase shift given by the approximation (6) is

$$\sum_{r=1}^{n} 2\tan^{-1}\frac{2\,\zeta_r\tau_r\omega}{1 - \tau_r^2\,\omega^2}.$$

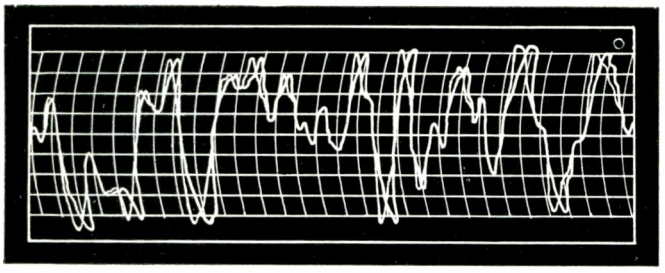


Fig. 3: Comparison of the original versus the linearized recording.

In practice, of course, $\tau\omega$ is extended to the maximum required delay and the highest frequency encountered in the particular problem. Fig. 2 shows a very efficient computer circuit, developed in ref. 4 and consisting of two similar cells, thus making $n = 2$. The chief merit of this design is the fact that variation of τ is achieved by varying potentiometer settings without causing stray transients.

The delay obtained through each cell is

$$\tau_r = \frac{\tau_o}{\beta} \qquad (8)$$

where $0<\beta<1$ the potentiometer setting. For any term in Eq. (7), it is found that the phase error is positive if $\zeta_r < \sqrt{3}/2$ and negative if $\zeta_r > \sqrt{3}/2$.

Therefore, one can select succeeding terms properly in order to cancel errors caused by previous terms. This can be done easily since the damping ratio ζ_r when translated in circuit parameters is

$$\zeta_r = \frac{1}{4\,R_1} = \frac{1}{2\,R_2}$$

The overall transport time obtained by the cascade of two cells is

$$\tau = \frac{4\,\tau_o}{\beta}(\zeta_1 + \zeta_2). \qquad (9)$$

When $\beta = 1$, $\tau = \tau_{min}$ which according to Eq. (2) will mean $\tau_o = 0$, a value obviously impractical circuit-wise. To avoid this, a biasing pure time delay τ_c has to be introduced causing simply a shift of the whole graph by an amount $(u\tau_c)$ mm.

Taking into account τ_c, Eqs. (2) and (9) give the required potentiometer setting

$$\beta = \frac{8\,\tau_o\,(\zeta_1 + \zeta_2)\,u}{(0.1102\,L + \tau_c) - k^2c^2},$$

or

$$\beta = \frac{a}{b^2 - k^2c^2}, \qquad (10)$$

where the values of the constants a and b are obvious.

Since β is a potentiometer arm displacement, it can be accomplished by means of a servomultiplier as shown at the upper part of the circuit schematic in Fig. 2. Furthermore, since all potentiometers pictured in this schematic are ganged together, the setting of the servo feedback pot is duplicated at all times in the rest of them.

This completes the computer setup necessary for the solution of the problem. The $n = 2$ approximation of the time delay expression allows for the recording of a maximum frequency signal component $\omega_{max} = 6.5/t_{max}$ rad/sec. with a phase error of about 1° as shown in Ref. 6.

Fig. 3 shows the recordings of the same signal before and after linearization of the ordinate-axis. The rectified graph was copied on the curvilinear one disregarding the time scale offset τ_c between the two.

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5. J. D. Kennedy, "Summary of Dead Time Simulation Techniques and General Applications," Electronics Associates, Inc., Report presented at the N & L Simulation Council, Washington, D. C., December 1957.
6. N. P. Tomlinson, "Fundamental Circuits and Techniques Used with Electronic Analog Computers," Goodyear Aircraft Corporation Report AP-77079, pp. 52-59, May 1956.

Increasing selectivity of quartz crystal oscillator circuits prompts detection of spurious response. Described here is a complete development program—tester design, reference selection, and test requirement determination.

Quartz Crystals Require . . .

Testing for Spurious Response

By ALFRED N. SILVERSTEIN
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Brooklyn 1, N. Y.

FOR some time there has been a need for a comparatively simple and dependable method for determining the presence of spurious responses in the frequency spectrum of quartz crystal units and deciding which responses are objectionable. This problem is becoming more severe with the increasing selectivity of quarts crystal oscillator circuits, particularly those employing high frequency overtone crystals. Taking cognizance of this situation the Bureau of Ships authorized a development project at the Material Laboratory with a threefold objective:

(1) To design and develop a basic test instrument for field use.
(2) To choose a highly selective quartz crystal oscillator circuit using overtone crystals which would serve as a "critical" reference oscillator.
(3) To determine test requirements to be used in conjunction with the Spurious Response Tester which will serve to reject crystal units possessing interfering spurious responses.

Basic Test Instrument

The basic test instrument is a modified version of the low frequency Spectrum Analyzer previously reported.[1] The block diagram of the Spurious Response Tester. which now covers the frequency range of 20 to 60 MC and the schematic diagrams are shown in Figs. 1, 2 and 3.[1]

A dual triode tube (2C51) is used in the oscillator-modulator-mixer section of the instrument. The first triode, VIA, serves as a 115 MC fixed frequency oscillator of the Colpitts type with a variable reactance element (VARI-L Type PF-82) in the tank

Main tuning dial of the Spurious Response Tester being aligned with the aid of a screwdriver.

Spurious Response

(Continued)

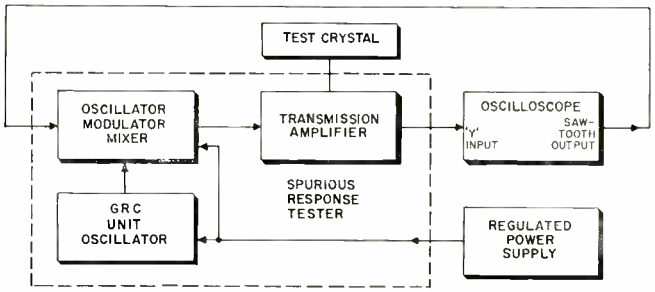


Fig. 1: Diagram of the tester and associated equipment.

circuit. Modulation is achieved by applying a sawtooth voltage obtained from the associated oscilloscope across the control winding of the VARI-L, thus effectively providing sweep frequency modulation of the fixed frequency oscillator in synchronization with the oscilloscope trace. The sweep width can be controlled up to 6 MC by proper choice of current limiting resistors in the input to the VARI-L control winding. A General Radio Unit Oscillator, type 1215B, is used as the variable frequency oscillator. This oscillator has a stability and accuracy of 1% over the frequency range of 125 MC to 200 MC. Mixing of the frequency modulated signal with the output of the variable oscillator takes place in the second section of the V1B (2C51). Two shielded plug-in units house the low Q tank circuits which cover the frequency range of the instrument and are tuned for optimum response by variable capacitor C306. The difference frequency is then coupled through capacitor C307 to cathode follower stage V2 (6AN5).

From this point the frequency modulated signal is fed to a transmission amplifier where the quartz crystal unit under test will pass only those frequencies matching its response characteristics. These signals are then amplified and rectified by the action of voltage doubler CR401, CR402, C401, C402. This detector circuit had adequate frequency response up to 20KC which makes it compatible with the upper response limit imposed by the maximum sweep rate (100 cps) used in displaying the quartz crystal spectrum. The rectified signal is then applied to the vertical amplifier of the oscilloscope where the frequencies and relative amplitudes of the main crystal response and the spurious responses can be determined.

Reference Oscillator

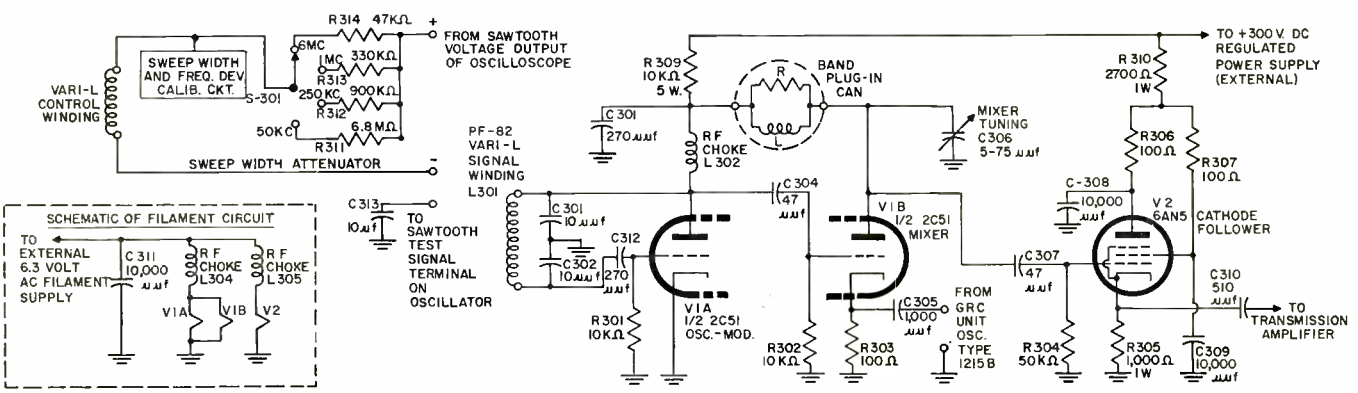
A literature search and analysis of several high frequency oscillator circuits used in military equipment indicated that an optimum critical oscillator should utilize a highly selective circuit which is crystal controlled in the series mode. A modified Butler cathode coupled oscillator was chosen because it meets these criteria and is representative of several circuits used in military equipment with respect to sensitivity and selectivity.

Fifty representative samples of overtone crystal units were investigated. Each of these crystals was oscillated in the TS-683/TSM Crystal Impedance Meter as presently required by military crystal specifications. This tuned-plate, tuned-grid (modified Colpitts) oscillator was adjusted to cover a range of ±20% around the nominal frequency of the crystal in a search for spurious responses. All of the crystals were then tested in the critical oscillator over the same frequency range. Finally, the spectrum of each crystal was displayed on an oscilloscope using the Spurious Response Tester.

The Tester developed at the Material Laboratory was able to detect a total of 182 spurious responses giving an average of more than 3 responses per crystal unit. Thirty-six of these had amplitudes greater than 30% of the main crystal response and were classified as major responses. Interestingly enough, no spurious responses were detected using the Crystal Impedance Meter. Eleven of the crystal units caused spurious oscillations in the critical oscillator and were classified as interfering responses.

A graphical representation, Fig. 4, was used to correlate the spurious responses displayed on the

Fig. 2: Shielded plug-in units house the low Q tank circuits which cover the range of the instrument.



Spurious Response Tester with the interfering modes detected in the critical reference oscillator.

Classification Criteria

Two criteria were used in establishing requirments for classifying responses seen with the Tester; one was the ratio (in percent) of amplitudes of the spurious response to the main response and the other was the frequency difference between the spurious and main response. The distribution of major spurious responses shows that those having amplitudes greater than 70% of the main response and frequencies more than 0.05 MC away from the main response cause unwanted oscillations in the critical circuit and should be rejected.

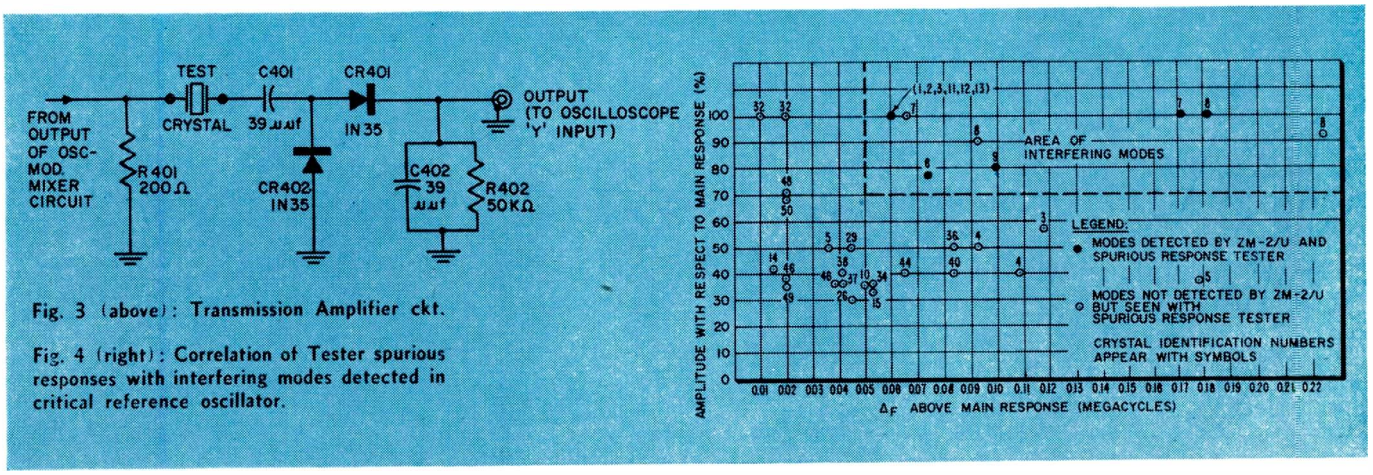


Fig. 3 (above): Transmission Amplifier ckt.

Fig. 4 (right): Correlation of Tester spurious responses with interfering modes detected in critical reference oscillator.

The oscilloscope photographs, Fig. 5, show typical crystal responses displayed with the Spurious Response Tester. An acceptable 47.916670 MC crystal is shown in (a) and a 28.700000 MC crystal with an interfering response is displayed in (b).

It was observed that all spurious responses had higher frequencies than the main response. Also, the critical oscillator could respond to spurious modes only by tuning from the high frequency end of the search band toward the nominal crystal frequency. Although the sensitivity of the reference oscillator is somewhat arbitrary, the level at which spurious responses are picked up can be adjusted as the need arises.

Results obtained show conclusively that all 50 overtone crystal units would be acceptable under presently specified test methods. The newly developed Spurious Response Tester, however, rejected 20% of these crystals because of undesirable spurious responses.

Test Requirements

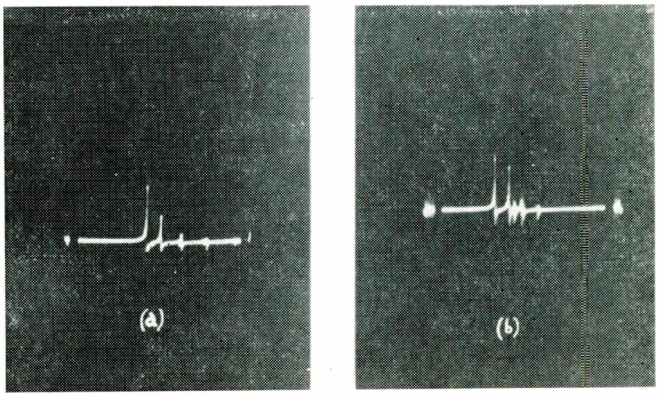
The experimentation described above indicates that the following test procedures and requirements should be used in determining which crystal units have interfering spurious responses. The response characteristics of the quartz crystal unit being tested should be displayed on the oscilloscope using the 6 MC sweep width setting. If it is desired to examine the crystal frequency response over a greater band width, the main tuning dial can be varied to cover frequencies beyond the ±20% search range now required in quartz crystal specifications. When the area of interest is determined, any particular portion of the scope display can be expanded by means of the sweep width control. In this way the frequency distribution and relative amplitudes of the various crystal responses can be readily determined.

To be acceptable, the amplitude of any crystal unit spurious response must be less than 70% of the main response with the following exception: quartz crystal units are also acceptable if those spurious responses having amplitudes greater than 70% of the main response are less than 0.05 MC away from the main response.

This 0.05 MC separation can be determined by applying a biasing current to the VARI-L control winding which will produce a calibrated frequency shift in the scope display or by using suitable crystal controlled frequency markers in addition to the test crystal.

The new instrument together with the procedures developed for classifying interfering spurious responses in overtone quartz crystal units will prove extremely useful in many ways. Specification development work and production line testing can be accelerated. The instrument will aid in studies of basic causes of spurious responses and will permit rapid evaluation of crystal fabrication techniques. Also, the effects of both rapidly varying and steady

Fig. 5: Typical critical responses displayed by tester; (a) acceptable 47.916670 MC, (b) 28.700000 MC crystal with interfering response.



Spurious Response
(Concluded)

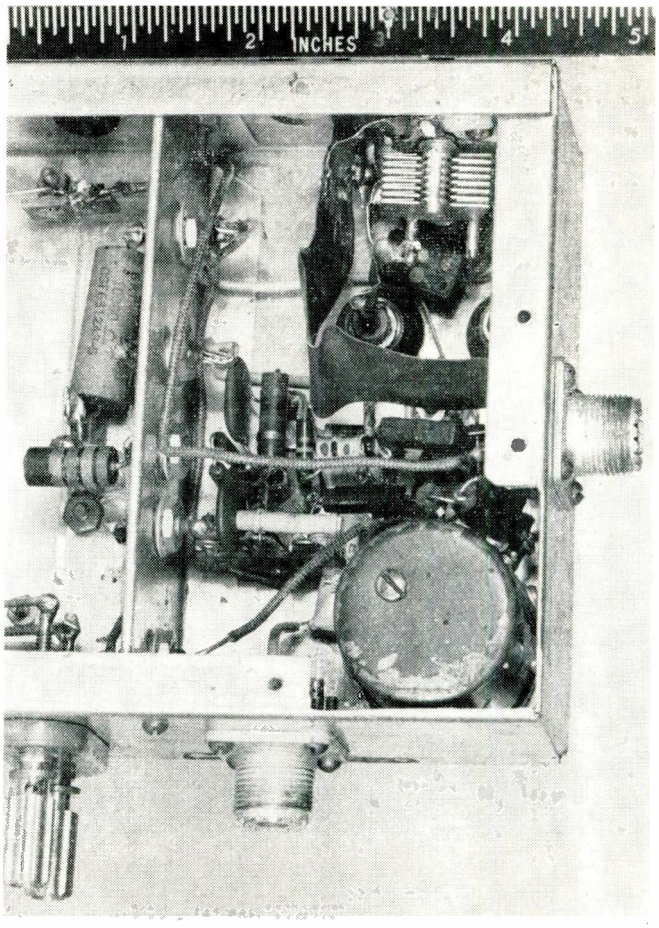


Fig. 6: An internal view of the high frequency section of the oscillator-modulator-mixer circuit.

state temperatures on spurious response content can be readily observed. The frequency range of the Spurious Response Tester can be extended to keep pace with the state of the art.

Acknowledgment

The author wishes to thank (Mrs.) Consuelo Milner, Vincent Iacono and Anthony Palatinus for their contributions to this development. Acknowledgment is also due Robert W. Fairweather, Section Head, and George C. Neuschaefer, Branch Head, for their encouragement and helpful suggestions.

Reference

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The Editor
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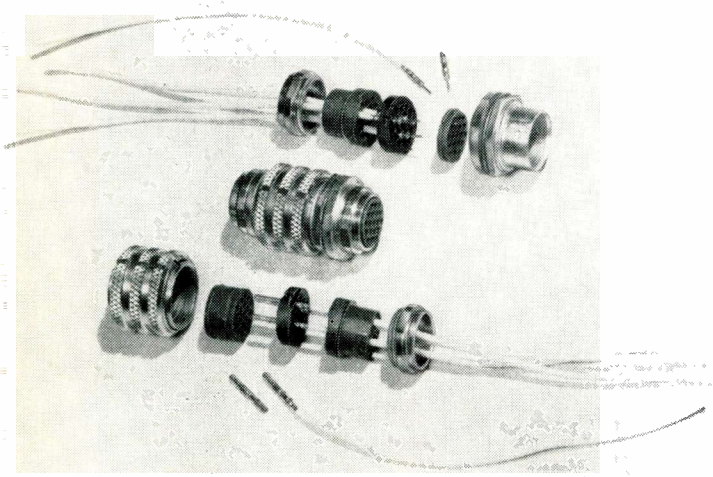
Snap-In Connector

MINIATURE electrical connectors with insertable pins and sockets and crimp-type terminations answer the twin problems of electrical failures and complex installation. It's the new DS series "snap-in" connector, designed and manufactured by The Deutsch Company, 7000 Avalon Blvd., Los Angeles, for use in advanced electronic and electrical systems.

These laboratory-tested environmental units are designed with silicone inserts for high-temperature operation and are available in a variety of shell sizes. Included are a single hole, square-flange mounting receptacle; single hole, bulkhead mounting receptacle; and push-pull type quick-disconnect plug.



Insertable pins and sockets, with crimp-type terminations, simply snap-in. No time lost in soldering.

Plugs feature an exclusive ball-lock coupling ring, which reduces installation to a simple "push in to connect—pull back to disconnect" operation. The operation of DS plugs is always in the direction of plug travel.

Time-consuming soldering of contacts is eliminated by the use of crimp-type terminations.

Only four tools are needed for fast, simple insertion and removal of contacts in the DS connectors. A sure-grip insertion tool speeds assembly time. A positive-action crimping tool completely crimps the pin or socket, and a spring-loaded, non-jamming removal tool steps up removal time. An aligning bushing assures alignment when snap-in contacts are removed.

The DS series provides these features: visual inspection for correct assembly; crimp-type contacts with inspection hole; continuous

(*Continued on page* 177)

An Inexpensive Ultra-Linear Output Stage

By I. F. BARDITCH
Air Arm Division
Westinghouse Electric Corporation
Baltimore, Maryland

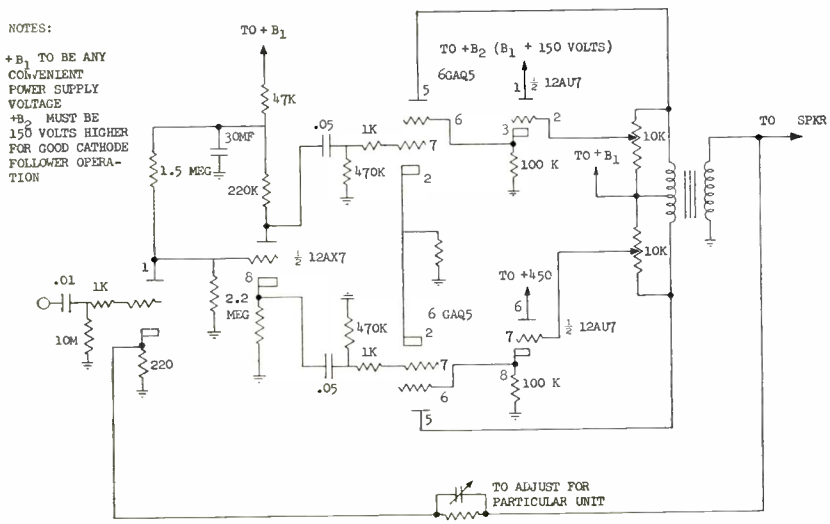
ANY audio amplifier with a pentode output stage can be converted to the equivalent of an ultra-linear output unit without the use of a transformer. The conversion can be carried out very simply and easily by using a dual pot, a twin triode and two resistors. In addition, the flexibility of the method allows the stage performance to be optimized by a simple adjustment. Advantages not present in the conventional U.L. output stage are also presented. The outstanding advantage is that no screen current need be drawn through the output transformer. This makes possible a relaxing of some difficult requirements on the transformer.

Examination of the diagram (Fig. 1) shows that for tubes V_1 and V_2 the two cathode follower grids are fed from the variable arms of the two 10,000 ohm pots which each shunt the plate windings of the output transformer. By setting the pot arms at the end furtherest from the plate either full pentode operation with an extremely low impedance screen feed is obtained or by going to the other extremity of the pots full triode-type operation is obtained; at some mid-point a position of best ultra-linear type performance occurs. This will vary with the tube type. A circuit using this drive circuit is shown in Fig. 1. However, the basic modification can be used in any output stage if proper adjustment of other feedback loops present are made for the altered characteristics of the new output stage. The circuit shown was adapted from an available unit at hand and was to determine the feasibility of the method.

Basically, this circuit introduces a local feedback in the output stage thereby altering its characteristics. Performance-wise it allows setting the screen feedback signal to the point of optimum performance. Used as a full pentode output stage, the cathode follower makes an ideal screen voltage source.

This modification is much cheaper than buying a new special transformer.

Fig. 1: The addition of a twin triode, dual pot and 2 resistors will convert any audio amplifier using pentode output into an ultra-linear output stage.



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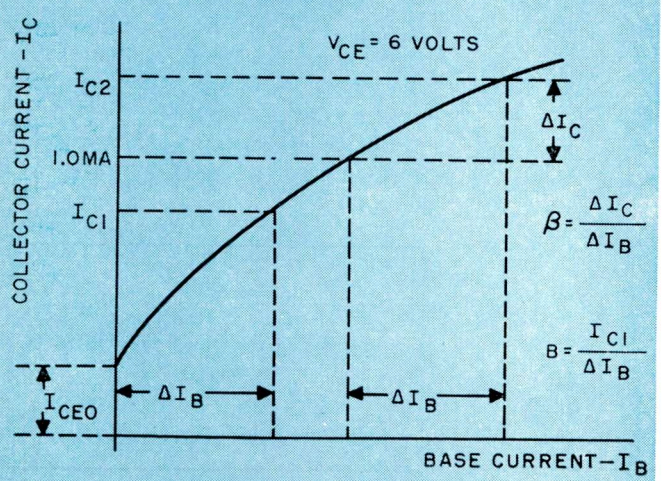
Unique equipment measures both the d-c and a-c common emitter current gain as well as collector to emitter leakage current. Features include good accuracy, small size and convenient operation.

A Transistor DC-AC Beta Tester

By T. P. SYLVAN
Application Engineer,
General Electric Co.,
Semiconductor Product Dept.
Syracuse, N. Y.

THE common-emitter current gain of a transistor is one of the more important parameters affecting circuit performance in many types of applications. For low to medium power transistors this parameter is also one of the most variable, covering a range greater than 10 to 300. There are a number of possible definitions of the common-emitter current gain which correspond to various measurement conditions and which in turn are related to specific applications. However, there are two main classes covering all definitions of current gain. The more common of these classes is the ac or small-signal, open-circuit output, common-emitter current gain designated by h_{fe} or β. This type of current gain is of most importance in determining performance in ac amplifier circuits. The second class is the dc current gain designated by h_{FE} or β and is of most importance in determining the biasing requirements of amplifier stages or performance in switching circuits.

Fig. 1: Diagram of measurements on transistor beta tester.



The transistor beta tester described here can be used to measure both the dc and ac common emitter current gain of a transistor as well as the collector to emitter leakage current, I_{CEO}. This tester features good accuracy (±5%), small size, and convenient operation. Zener diodes are used to stabilize currents and voltages so that battery aging will have no effect on the performance of the circuit and no calibrating adjustments will be necessary. Convenient operation is achieved with a single balance control and four push-button switches which also serve to prevent accidental battery discharge. The entire tester including the battery may be easily packaged in a regular 3 in. meter case.

Theory of Measurement

The effective ac current gain is measured by a dc incremental method. This is done by applying an emitter bias current of 1 ma to the test transistor and zeroing the meter by balancing out this current at the meter. An incremental base current of 1 or 10 μa is then applied to the test transistor and the effective β is indicated on the meter in terms of the ratio—

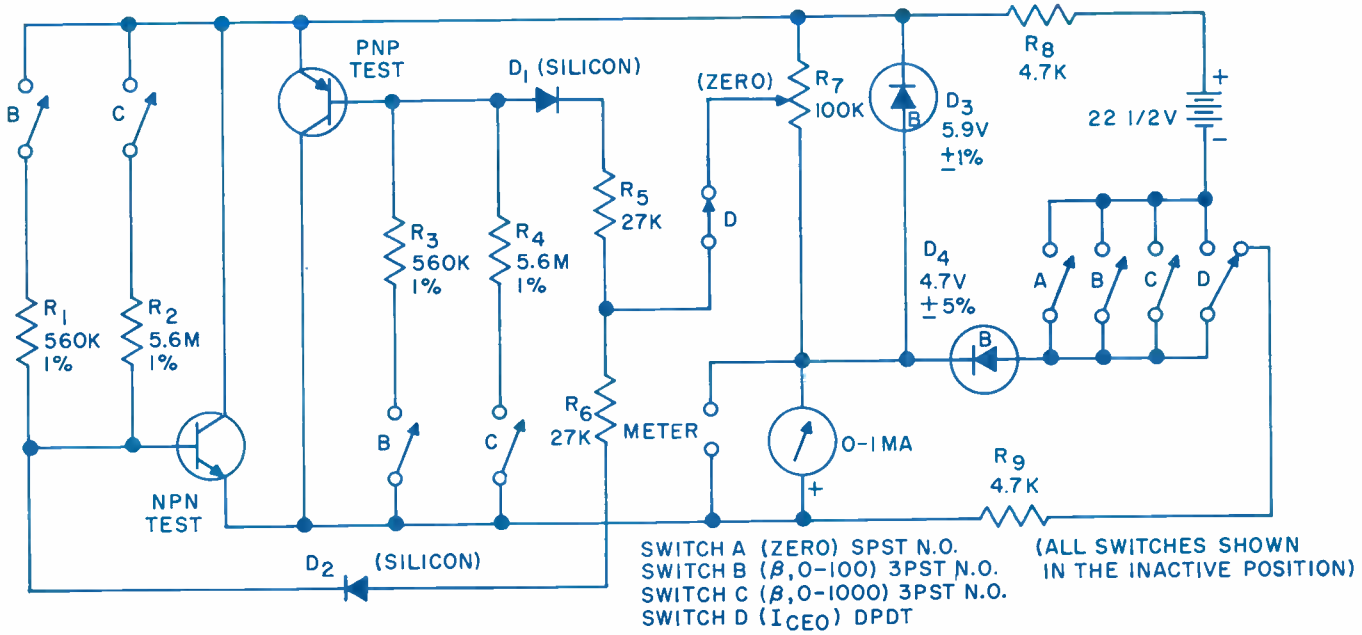


Fig. 2: Schematic of the transistor beta tester. Zener diode D_3 furnishes a constant collector voltage of 5.9 v.

$$\left(\frac{\delta I_C}{\delta I_B}\right) V_{CE} \text{ constant}$$

On the one ma meter an incremental base current of 10μa corresponds to a β of 100 full scale and an incremental base current of 1 μa corresponds to a β of 1000 full scale. The essential features of this measurement are indicated in Fig. 1.

The collector to emitter leakage current, I_{CEO}, is measured by applying collector voltage to the transistor with the base open circuited. I_{CEO} is approximately equal to the product of the common-base collector leakage current, I_{CO}, and the common-emitter current gain, β, measured at low values of dc base current. Thus an estimate of I_{CO} may be obtained from the measured values of β and I_{CEO} by the use of the equation—

$$I_{CO} \cong \frac{I_{CEO}}{\beta} \qquad (1)$$

The dc current gain of the transistor, B or h_{FE}, is measured by applying a total base current of 1 or 10 μa and measuring the total collector current, I_{C1}. The effective dc current gain is then read directly on the meter as either 100 or 1000 full scale in terms of the ratio—

$$\left(\frac{I_{C1}}{\delta I_B}\right) V_{CE} \text{ const.}$$

As can be seen from Fig. 1 the current I_{C1} includes the leakage current I_{CEO} so that the measured value of B can be expected to be somewhat larger than the measured value of β. This is generally true for most types of germanium transistors which have high values of I_{CO} and high values of β at low values of collector current, but is not generally true for silicon transistors which have low values of I_{CO} and low current gains at low values of collector current.

For most transistors the base bias current, I_B, required for a collector bias current, I_C, may be calculated from the equation—

$$I_B \cong \frac{I_C - I_{CEO}}{\beta}$$

TABLE I

SUMMARY OF MEASUREMENTS ON BETA TESTER

BUTTONS	PARAMETER MEASURED	RANGE	CONDITIONS
Zero	Set zero for measurements.	-	V_{CE} = 6V, I_E = 1 MA
β (100)	A-C Current Gain (β)	0-100	V_{CE} = 6V, I_E = 1 MA., ΔI_B = 10 μa
β (1000)	A-C Current Gain (β)	0-1000	V_{CE} = 6V, I_E = 1 MA., ΔI_B = 1 μa
I_{CEO}	Collector to Emitter Leakage Current	0-1.0 MA.	V_{CE} = 6V, I_B = 0
β (100) & I_{CEO}	D-C Current Gain (B)	0-100	V_{CE} = 6V, I_B = 10 μa
	Emitter Bias Current with I_B = 10 μa	0-1.0 MA.	
β (1000) & I_{CEO}	D-C Current Gain (B)	0-1000	V_{CE} = 6V, I_B = 1 μa
	Emitter Bias Current with I_B = 1 μa	0-1.0 MA.	

Beta Tester *(Continued)*

Because of the temperature dependence of I_{CEO} this equation is valid only at the temperature at which I_{CEO} was measured.

Circuit Operation

The complete circuit schematic of the beta tester is shown in Fig. 2. The Zener diode D_3 is used to furnish a constant collector voltage of 5.9 v. Calibrated base currents of 1 or 10 μa are provided by precision resistors between the collector and base terminals. An emitter to base voltage of 0.3 v. is assumed for the purpose of testing germanium transistors. The Zener diode D_4 and resistor R_9 provide the constant reverse bias current of 1 ma for the meter. This current is balanced by the emitter current of the test transistor which is adjusted by varying the base current with the potentiometer R_7. The use of two Zener diodes in this circuit permits a single battery to be used without affecting the isolation between the collector voltage supply and the meter bias supply. Also this circuit prevents damage to either the meter or the test transistor since the meter current is limited to 3 ma, the transistor current is limited to 4 ma, and the maximum collector power dissipation is 12 mw. For economy, external meter terminals can be provided as indicated in Fig. 2 so that the meter can be used as a conventional milliammeter when it is not being used to test transistors.

Measurement Procedure

The measurement procedure is relatively simple

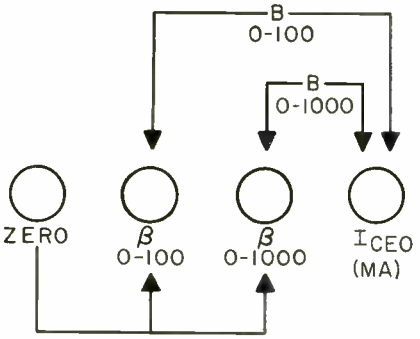


Fig. 3: Labels on the selector switches indicate measurement procedure.

and is indicated by the labels on the selector switches as shown in Fig. 3. The collector to emitter leakage current is measured by pushing the I_{CEO} button and reading the meter. The β measurements are made by first pushing the ZERO button and setting the meter to zero with the potentiometer R_7, then pushing either the β (0-100) of the β (0-1000) button and reading the meter. The dc current gain measurements require no zero adjustment, the two buttons β and I_{CEO} are pushed simultaneously and the value of B, either 0-100 or 0-1000, is read on the meter. The complete series of measurements and the measuring conditions are summarized in Table 1.

Flushing Etched Panels

This typical lay up shows the etched circuit in place; steel plate with kraft paper about to be applied.

FLUSHING etched panel—pressing in the copper conductor to make it flush with the base laminate — minimizes arc draw and edge wear if the circuit is part of a sliding electrical contact. Because of this protection the area of electrical contact remains constant.

Taylor Fibre Co., Norristown, Pa., manufacturers of copper clad laminate, uses rolled copper foils of better than 99.5% purity. Because of its close grain structure and surface smoothness, rolled copper foil is ideally suited for hard surfacing, like rhodium plating, to increase resistance to sliding wear such as encountered in flushed switch sectors and commutators.

Although an oscilloscope is the best determinant and is recommended to check the degree of flushing, a fast check is to run a fingernail across the circuit. It should not catch on the copper. A good flushed circuit should have no voids around the edges of the copper and no appreciable reduction in the thickness of the laminate.

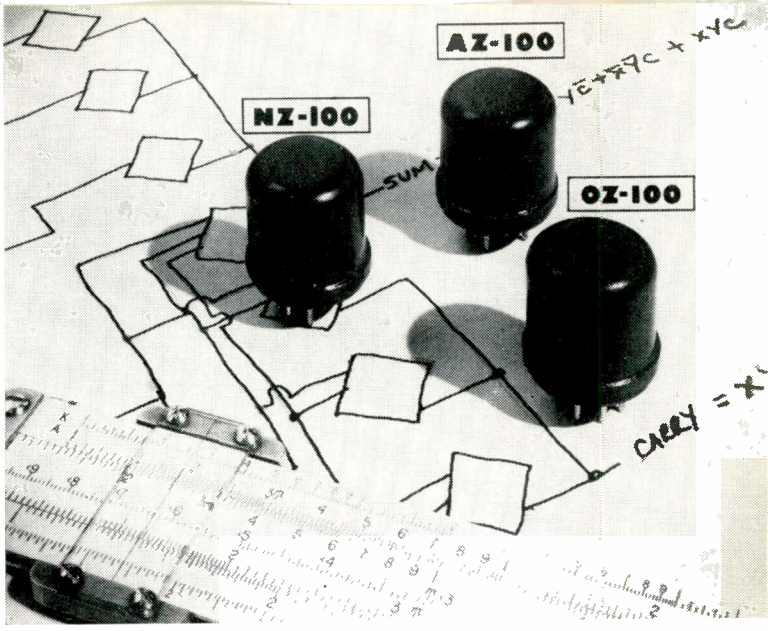
Selection of Base Laminate

The ability to flush an etched circuit successfully depends to a great extent on the base laminate. Etched circuits can be readily flushed when using Taylor's grade XXXP-242—a phenolic resin, paper-base laminate that can be punched cold up to 1/16-in. thick —and grade GEC-500—an epoxy resin, glass-fabric laminate supplied with the copper bonded to the base with adhesive (Grade GEC-500 Cu Clad A) or without adhesive (Grade GEC-500 Cu Clad NA).

(*Continued on page* 172)

What's New . . .

Plug-In Logic



The three modules that form the "Magnalog" system: "NOT" (NZ-100); "AND" (AZ-100); and, "OR" (OZ-100).

A NEW, simple and unique approach to the design of digital logic has been developed. Called the "MAGNALOG" System, it frees the designer from circuitry involvement and enables him to concentrate his attention on logic programming. The Semiconductor Division of Hoffman Electronics Corp., 930 Pitner Ave., Evanston, Ill., developed and manufactures this logic system.

Consisting of three basic 7-pin miniature plug-in modules, the units are interchangeable with each other. They are energized by a 100 KC R-F power supply.

The first of the three modules, which is designated as Type NZ100, is a "NOT" plug-in. It is comprised of a series-type pulse magnetic amplifier.

The second module in the system is designated as Type OZ100, an "OR" unit. It consists of three silicon double anode, zener diodes with appropriate zener breakdown voltages.

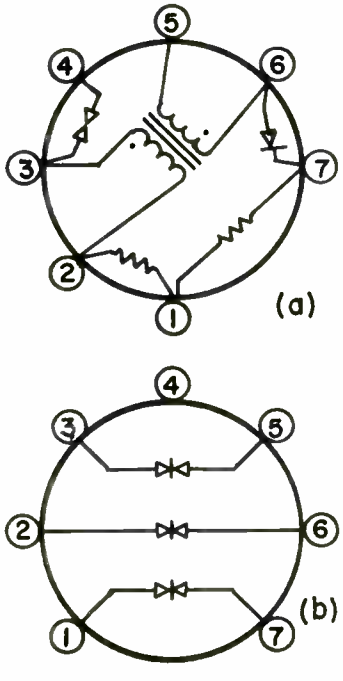
The third module, "AND," is designated as Type AZ100. It also contains three zener diodes, of different breakdown voltage values from the OZ100.

The circuit schematics with the pin connections of these three modules are shown in Fig. 1.

The basic logic configuration of the "Magnalog" System is shown in Fig. 3. The correlation between NZ100 pin connections and the logic symbol is shown in the drawing. The power connection from the 100 KC oscillator is made to pin 5 and the ground connection is pin 1. The "B" input is a diode from an OZ100 module. Any number of "B" inputs from OZ100

(*Continued on page* 126)

Fig. 1: Wiring diagrams for (a) NZ-100, a series-type pulse magnetic amplifier and (b) AZ-100 and OZ-100, double anode, zener diodes.



Electronic Refrigerator

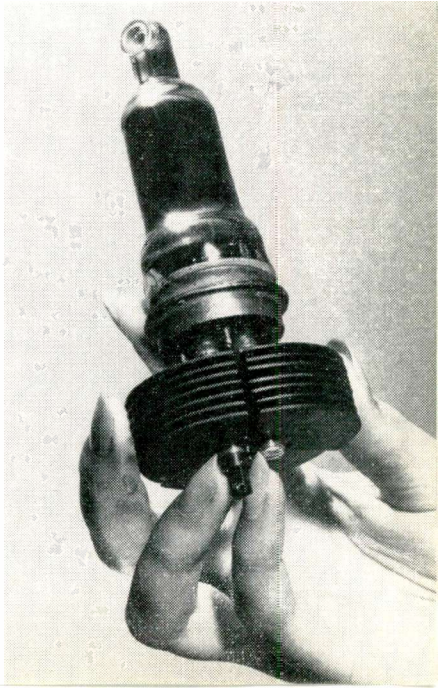
A TINY electronic refrigerator capable of inducing a 50° temperature drop in sensitive electronic components promises much. Engineers at Nortronics Advanced Development department have delivered two units to the Navy for evaluation. Nortronics, located in Hawthorne, Calif., is a division of Northrop Aircraft, Inc.

The micro-refrigerator, which represents one of the first successful applications of the Peltier effect in physics, contains no moving parts. Refrigeration is induced by passing a current across the junction of two dissimilar metals. One junction then becomes hot and the other junction becomes cold. The cold junction is then used to draw heat from sensitive electronic components which operate best at low temperatures.

Pointing to the broad advantages of Peltier refrigeration over conventional methods of cooling electronic components, M. B. Grier, engineer in charge of the development program, said that the device will permit great size and weight

(*Continued on page* 128)

This unit, now used to cool components, may some day be used for home refrigeration.



Radio phase-difference methods are being used to provide continuous airborne vehicle directions. A geometric method is one of the more common methods employed. A description of this method and overcoming the problems encountered, are discussed.

By MALCOLM W. MILES

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Radio Interferometers Track

RADIO phase-difference schemes have been recently employed to provide a continuous direction indication to mobile sources of radio signals such as earth-launched satellites, missiles and other airborne vehicles. The most frequently encountered measurement geometry i.e., arrangement of the signal source and the receiving antennas, is shown in Fig. 1. This elementary system consists of the tracked signal source, A, and receiving antennas B and C. The separation between B and C is fixed and known. Radio signal energy from A travels paths R_1 and R_2, arriving at B and C with a phase difference proportional to $R_2 - R_1$. For an appropriate minimum operating range, R,

$$\frac{R_2 - R_1}{2L} \approx \text{Cos } \theta \qquad (1)$$

This parameter (Cos θ) may be electronically observed in the manner of Fig. 2.

The Virtual Source

The direction indication (Cos θ) must be solely a function of the total airborne vehicle progress in an orbit, trajectory or other flight path. Unfortunately, the location of a fixed virtual source of radio energy on airborne vehicles is precluded due to the complex geometry of the ground plane or counterpoise provided by the airframe.

Examine Fig. 3. The signal vector resultant in any direction is a composite of energy contributions from the tail, wings, and other appurtenances. When the total vehicle dimension is only a few or several wavelengths, the desired signal (from the antenna element itself) is easily obscured by con-

Fig. 1: The basic geometric measurements.

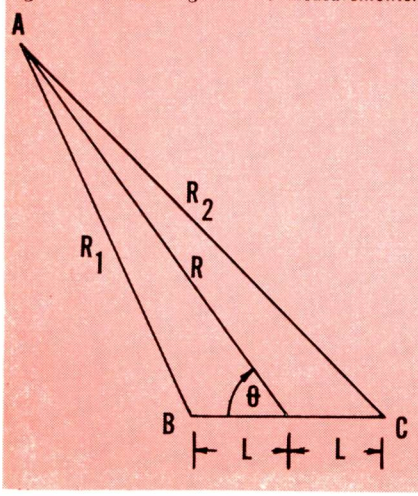


Fig. 2: Elementary measuring equipment.

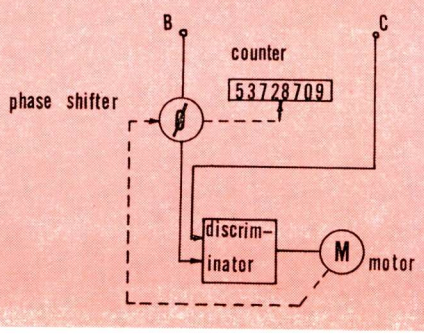
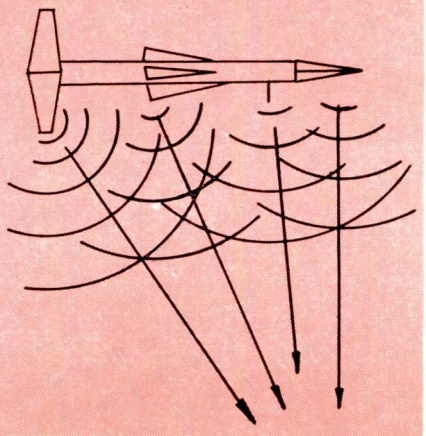


Fig. 3: A complex source provided by an airborne vehicle that is in motion.



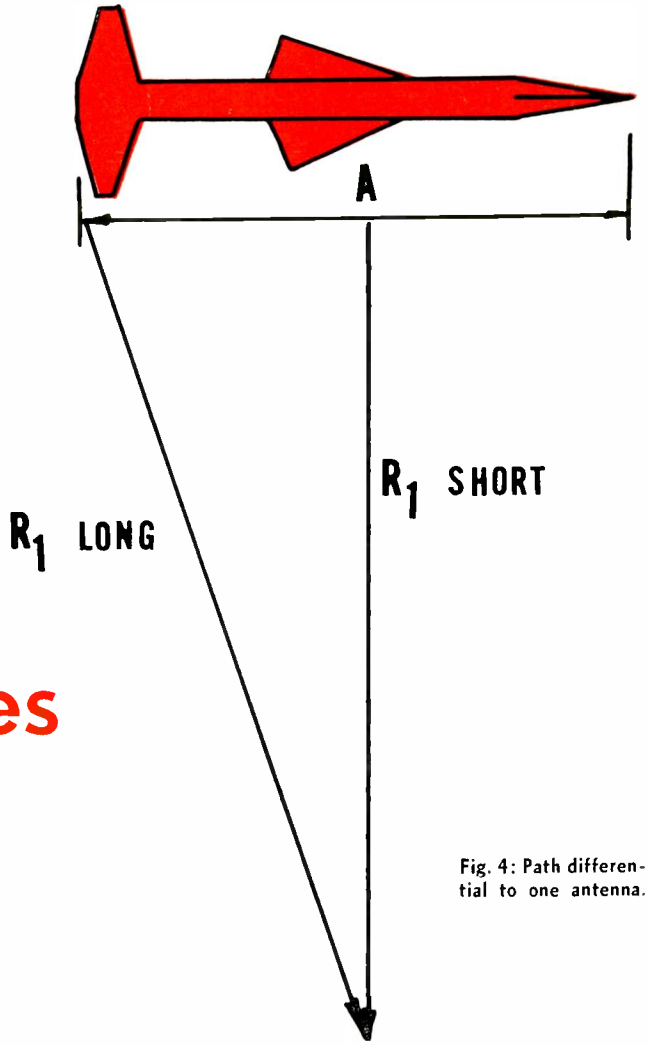


Fig. 4: Path differential to one antenna.

Airborne Vehicles

tributions from various other portions of the structure. Depending on the vehicle attitude with respect to B or C, the vector resultant will apparently emanate from areas on the structure other than the antenna element. This apparent signal origin is mobile; changing location with changes in vehicle attitude (bank, climb or glide). The direct consequence of this anomaly is easily recognized by considering the situation where vehicle progress is in one direction, while the virtual source (due to attitude changes) is traveling opposite.

The general case is seen to be the constant shifting of this source within the extremes of the total vehicle anatomy such that radio path R_1 (or R_2) may be instantaneously the longest or the shortest distance from the airframe to receiving antennas B or C (see Fig. 4). Suppose the vehicle were to travel from $\theta = 0°$ to $\theta = 90°$. The total phase difference change should be exactly equal to 2L in degrees at the carrier wavelength. Where antennas B and C are unfocused (omnidirectional) in the plane of measurement, and R is a finite distance, the indicated phase difference change might possibly include an amount due to a re-location of the virtual source. The location of the virtual source of signal energy at $\theta = 0°$ is not necessarily identical to the location of this apparent source at $\theta = 90°$. In order that direction determination is not compromised by this phenomena, a preliminary definition of minimum R must include the tolerable accuracy of Cos θ such that the entire vehicle is geometrically reduced to a specified angular width. Fig. 5 demonstrates the effective angular width of radius vector R for a vehicle dimension, A. A graph of minimum R versus cosine error magnitude is shown in Fig. 6.

Source Differential

An even more intolerant feature of complex airborne radiating systems is realized by noting that the virtual source is apparently originating at different locations when viewed from different aspects such as B and C. Thus the starting phases, in directions R_1 and R_2 from the vehicle, are not necessarily identical. The path difference measurement will include an error due to the vector resultant or composite signal being different in these separate directions as shown in Fig. 7.

In the vicinity of airborne antenna pattern nulls especially, the instantaneous starting phase in separate directions will be significantly different. Vehicle spin or roll will create a 'scanning' of the receiving antennas by adjacent pattern maximums and minimums, thereby allowing phase difference changes to be continually observed and recorded even when no relative change in angle θ occurs. (Adjacent pattern lobes have an in-

(*Continued on page* 151)

H-F Wide Band Electronic Integrator Design

When integration is performed in the video range, the output tube capacity of the associated amplifiers introduces considerable distortion in the integrated output. This article presents a compensating scheme for two types of integrators that completely eliminates the distortion caused by the output tube capacity.

By HENRI HODARA
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AN electronic integrator comprises essentially an R-C or integrating network and an amplifying device. Most types of electronic integrators may be represented in Fig. 1. If the output of the amplifier is purely resistive, the circuit of Fig. 1b is equivalent to Fig. 1a if

$$C_f = \frac{C_1}{1 - A_0}$$

as shown in Fig. 2. Under such conditions, both circuits have identical time constants and gains and thus give identical performance as integrators. The circuit of Fig. 1b is sometimes preferred because the output is but slightly dependent on gain A_0, thus on the tube parameters as can be seen from the well known equation for the integrator output waveform e_2:

$$e_2 \approx \frac{1}{R_1 C_f} \frac{A_0}{1 - A_0} \int e_1 \, dt^a$$

When electronic integrators are used at frequencies of the order of 1 MC/sec, the shunting effect of the tube output capacity introduces frequency and phase distortion and the response is no longer the integral of the input.

This fact is illustrated by scope traces sketched in Fig. 3 for the circuit of Fig. 4. Note how phase and amplitude distortion round off the peaks of the triangular output at 1 MC/sec (Fig. 3b).

One remedy that suggests itself is to use inductive compensation in the output as it is commonly done in video amplifiers. However, because of the transient nature of the waveforms and their high harmonic content usually encountered in integrating operation, the necessary bandwidth to be covered by inductive compensation may make the circuit unduly complex. For example, if the input is the asymmetrical square wave shown in Fig. 3b, significant harmonics up to 7 MC/sec are found in the output.

A more effective approach is to distort the input in order to compensate for the phase lag and the attenuation caused by the output capacity C_2, thus reducing the attenuation at the input of the tube at higher frequencies so as to counterbalance exactly the phase lag and the attenuation in the output. It was found that the distortion caused by the output tube capacity C_2 could be entirely eliminated in the circuit of Fig. 1a if a capacity C_a was shunted across R_1 so as to satisfy the following relationship:

$$R_1 C_a = R_2 C_2 \qquad (1)$$

where the various parameters are defined in Fig. 4. The derivation of (1) follows. The tubes are pentodes, thus

$$R_2 << r_p, R_g C_1 >> R_1 C_1.$$

This latter assumption implies that R_g can be omitted in the subsequent derivation. Both assumptions are easily met in practice. Later on, a relationship similar to (1) will be derived for the circuit of Fig. 1b.

Before proceeding with the derivation, it is worth determining under what conditions the circuits of Fig. 1 can be expected to perform satisfactory integration. Take for example the circuit of Fig. 4 and neglect C_2. Using Laplace Transform notation, the transfer function for this integrator is:

$$\frac{E_2(s)}{E_1(s)} = \frac{A_0}{1 + R_1 C_1 s} \qquad (2)$$

where $A_0 = -g_m R_2$

Good integration will result if $R_1 C_1 s >> 1$ and consequently:

[a] Thomas L. Martin, Jr., *Electronic Circuits*, Prentice-Hall, Inc., p. 620, 1955. (The derivation of this equation is similar to the derivation of Eq. 5 in the text.)

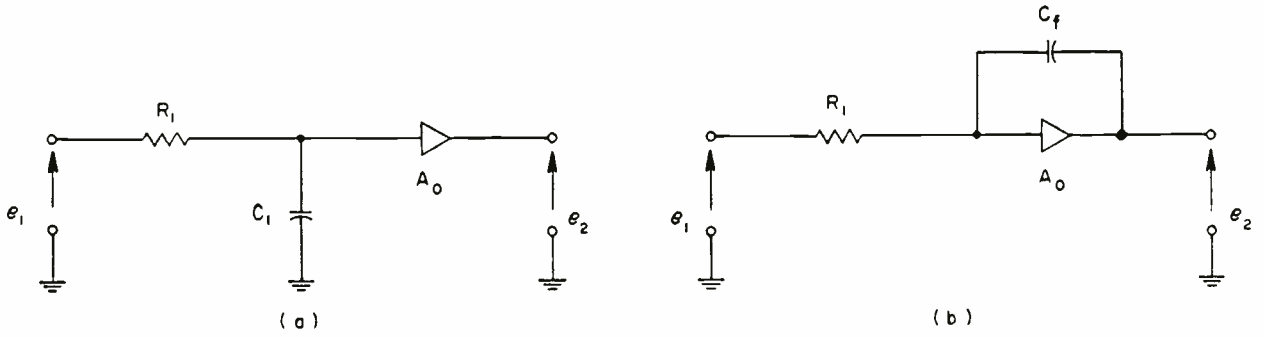


Fig. 1: Electronic integrators are essentially an RC network and an amplifying device. Most common types are shown above.

$$\frac{E_2(s)}{E_1(s)} \approx \frac{A_0}{R_1 C_1 s} \tag{3a}$$

or

$$E_2(s) \approx \frac{A_0}{R_1 C_1 s} E_1(s) \tag{3b}$$

Since the Laplace Transform of the integral of a function equals 1/s times the transform of the original function, e.g.

$$L\left[\int e_1\, dt\right] = \frac{L\left[e_1(t)\right]}{s} = \frac{E_1(s)}{s} \tag{4}$$

The inverse transform of (3) becomes

$$e_2(t) = \frac{A_0}{R_1 C_1} \int e_1\, dt \tag{5}$$

Thus $e_2(t)$ is the integral of the input $e_1(t)$. A pause is necessary here to clarify the meaning of the basic assumption for good integration, namely:

$$sR_1 C_1 >> 1 \tag{6}$$

R_1 and C_1 are meaningful physical quantities but s is only an operator and it may seem difficult to choose the proper values of R_1 and C_1 that will satisfy (6) not knowing what values s takes on.

A physical interpretation of how s varies can be obtained by making use of the "Initial Value Theorem" for the Laplace Transformation, namely:

$$\lim_{t \to 0} e(t) = \lim_{s \to \infty} s E_2(s) \tag{7}$$

Substitution of (3b) into (7) yields:

$$\lim_{t \to 0} e_2(t) = \lim_{s \to \infty} \frac{s E_1(s)}{1 + R_1 C_1 s} \tag{8}$$

As s approaches infinity, it is equivalent to consider the response near the starting time, e.g., t close to zero. Thus for a given R_1 and C_1 the assumption $R_1 C_1 s >> 1$ for good integration implies that integration will only be satisfactory for small values of t. As t increases, the response will depart further and further from true integration.

It is well known that if a step function is applied to the circuit of Fig. 4 (still assuming $C_2 = 0$) the output will rise linearly with time (integral of the input) only for a short time during which C_1 charges rapidly. As time goes on, and the rate of charging of C_1 decreases, the output approaches a constant value exponentially. In terms of the Laplace Transform, the input step function is:

$$E_1(s) = L\left[e_{in}(t)\right] = \frac{1}{s}$$

and the transform of the output

$$E_2(s) = \frac{1}{s} \frac{A_0}{1 + R_1 C_1 s}$$

after multiplying both numerator and denominator by $R_1 C_1$ can be rewritten as

$$E_2(s) = \frac{A_0 R_1 C_1}{(R_1 C_1 s)(1 + R_1 C_1 s)} = a E_2'(as) \tag{9}$$

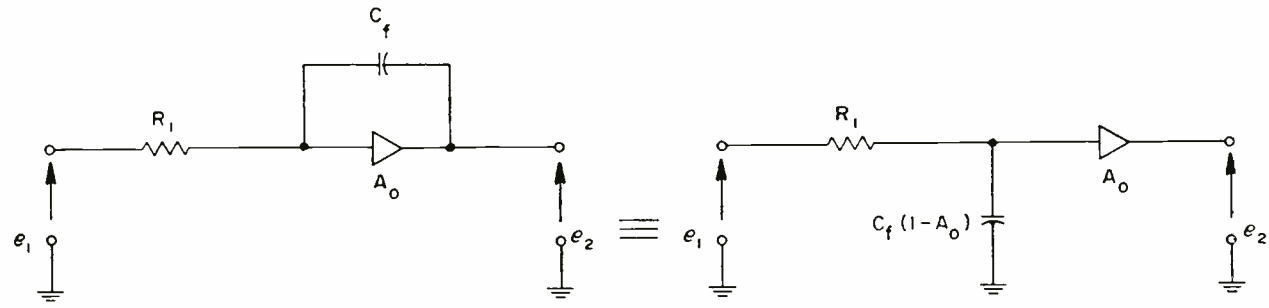
where

$$E_2'(s) = \frac{A_0}{s(1 + s)}$$

Observe that the variable s is now multiplied by $a = R_1 C_1$. Making use of the well-known theorem for change of variable for Laplace Transforms, i.e.

$$L\left[e_2\left(\frac{t}{a}\right)\right] = a E_2'(as) \tag{10}$$

Fig. 2: If the output of the amplifier is purely resistive, then the circuits are equal if Cf = C1/1 — Ao. Both will then give identical performance.



Integrator Design *(Continued)*

and applying the initial value theorem to (10), we get:

$$\underset{s\to\infty}{\text{Lim}}\ s\,E_2(s) = \underset{as\to\infty}{\text{Lim}}\ as\,E_2'(s) = \underset{t/a\to 0}{\text{Lim}}\left\{e_2'\left(\frac{t}{a}\right)\right\} \qquad (11)$$

Thus for a given $a = R_1C_1$ good integration will be insured whenever $t/a = t/R_1C_1$ is close to zero; e.g., when the elapsed time is much smaller than the R-C time constant of the circuit. *Therefore, a prerequisite for good integration is to have a transfer function of the same form as Eq. (2) with the term in $s >> 1$.* After this brief explanation on the meaning of (6), let us return to the circuit of Fig. 4, taking now the output capacity C_2 into account and derive the transfer function.

Using standard transform notation:

$$\frac{E_2(s)}{E_1(s)} = \frac{\dfrac{1}{C_1 s}}{R_1 + \dfrac{1}{C_1 s}} \times \frac{-g_m R_2}{1 + R_2 C_2 s} = \frac{A_0}{(1 + R_1 C_1 s)(1 + R_2 C_2 s)} \qquad (12)$$

Observe that the criterion $R_1C_1 >> 1$ is not sufficient to give good integration because of the factor $(1 + R_2C_2 s)$. If a capacity C_a as discussed earlier is shunted across R_1 (Fig. 5) the resulting transfer function G(s) becomes:

$$G(s) = \frac{\dfrac{1}{C_1 s}}{\dfrac{R_1}{1 + R_1 C_a s} + \dfrac{1}{C_1 s}} \times \frac{A_0}{1 + R_2 C_2 s} \qquad (13a)$$

Further simplication yields:

$$G(s) = \frac{A_0}{1 + R_1 (C_1 + C_a) s} \times \frac{1 + R_1 C_a s}{1 + R_2 C_2 s} \qquad (13b)$$

If:

$$R_1 C_a = R_2 C_2 \qquad (14)$$

the transfer function reduces to

$$G(s) = \frac{A_0}{1 + R_1 (C_1 + C_a) s} \qquad (15)$$

similar to (2) with the added advantage that the time constant is slightly increased, thus improving the quality of the integration without decreasing the gain.

Experimental results with the circuit of Fig. 6 are shown in Fig. 7 for an asymmetrical square wave input of 1 MC/sec. Observe the distortion introduced

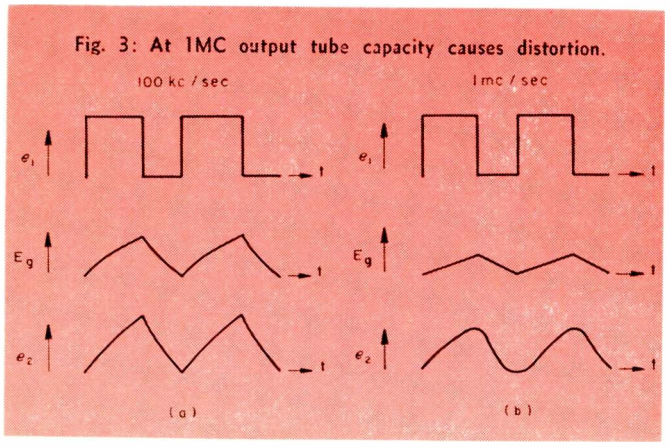


Fig. 3: At 1MC output tube capacity causes distortion.

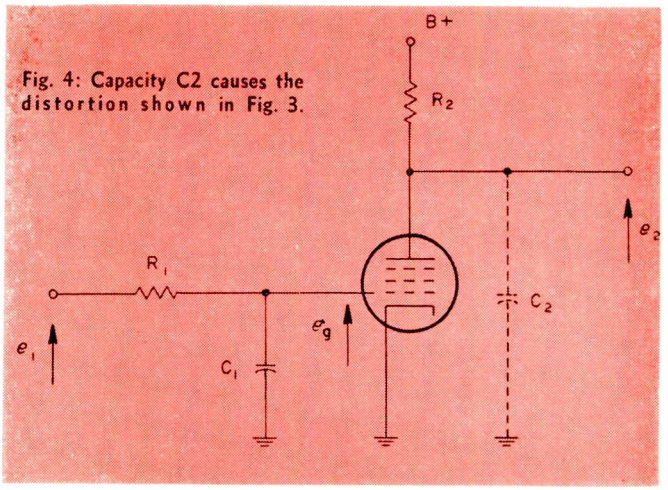


Fig. 4: Capacity C2 causes the distortion shown in Fig. 3.

at the grid of the tube in order to compensate for the output capacity.

Let us now analyze the transfer function of the circuit of Fig. 1b, namely, the Miller integrator which is redrawn in Fig. 8 with the various parasitic capacitances added on. The tube input capacity C_g now shown separately (although in Fig. 1a it is implicity lumped with C_1) adds to the reflected capacity C_f at the input of the tube according to the well-known formula for input admittance:

$$Y_{in} = s\,[C_f (1 - A) + C_g] \qquad (16)$$

where as before

$$A = \frac{-g_m R_2}{1 + R_2 C_2 s} = \frac{A_0}{1 + R_2 C_2 s} \text{ as long as } R_2 C_f s << (1)$$

The overall transfer function G(s) is obtained by substituting Y_{in} as given in (16) for sC_1 in (12). After a few algebraic manipulations, the following expression results:

$$G(s) = \frac{A_0}{1 + s\,[R_1 C_f (1 - A_0) + R_2 C_2 + R_1 C_g] + s^2 R_1 R_2 C_2 (C_f + C_g)} \qquad (17)$$

The denominator of the above expression is a quadratic function of s. For good integration, the term in s should be large with respect to unity and the term in s^2 should be zero. If some compensation can be devised which will introduce a zero in the transfer function that will cancel out one of the poles, the transfer function will be of the same form as (2)

$$\text{constant} \times \frac{A_0}{1 + (\quad) s} \qquad (18)$$

a prerequisite for good integration.

Let us introduce the same type of compensation as shown in Fig. 5 for the circuit of Fig. 1a, namely, an additional capacitor C_a across R_1. The resulting transfer function is obtained by substituting

$$\frac{R_1}{1 + R_1 C_a s}$$

for R_1 in (17) which yields after algebraic manipulations:

$$G(s) = \frac{(1 + R_1 C_a s) A_0}{1 + s\left\{R_1\left[C_f (1 - A_0) + C_a + C_g\right] + R_2 C_2\right\} + s^2 R_1 R_2 C_2 (C_a + C_f + C_g)} \qquad (19)$$

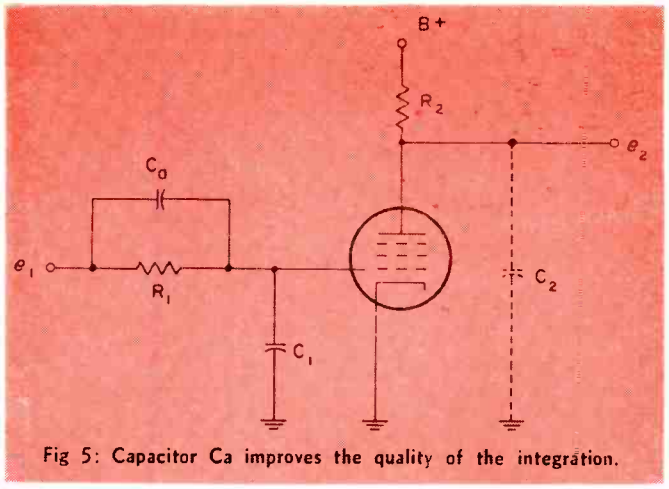


Fig 5: Capacitor Ca improves the quality of the integration.

If the following changes of variables are introduced:

$$C_T = C_a + C_g + C_f (1 - A_0) \quad (20a)$$

$$C_p^2 = C_2 (C_a + C_g + C_f) \quad (20b)$$

G(s) Equation (19) becomes:

$$G(s) = \frac{(1 + R_1 C_a s) A_0}{1 + s (R_1 C_T + R_2 C_2) + s^2 R_1 R_2 C_p^2} \quad (21)$$

Further change of variable:

$$a = R_1 R_2 C_p^2 \quad (22a)$$

$$b = R_1 C_T + R_2 C_2 \quad (22b)$$

reduces the transfer function of (19) to:

$$G(s) = \frac{(1 + R_1 C_a s) A_0}{1 + bs + as^2} \quad (23)$$

If Equation (23) is factored out in terms of its poles and zero:

$$G(s) = \frac{R_1 C_a A_0}{a} \times \left[\frac{s - \left(- \frac{1}{R_1 C_a} \right)}{(s - \alpha)(s - \beta)} \right] \quad (24)$$

where α and β are given by

$$\alpha = \frac{-b + \sqrt{b^2 - 4a}}{2a} \quad (25a)$$

$$\beta = \frac{-b - \sqrt{b^2 - 4a}}{2a} \quad (25b)$$

In order to get an expression similar to (18), prerequisite for good integration, one of the poles, say α must equal the zero

$$\left(- \frac{1}{R_1 C_a} \right)$$

Thus let

$$\alpha = - \frac{1}{R_1 C_a} \quad (26)$$

Making use of (25a), (26) becomes

$$- \frac{1}{R_1 C_a} = - \frac{b}{2a} + \frac{\sqrt{b^2 - 4a}}{2a} \quad (27)$$

Rewriting (27)

$$\frac{b}{2a} - \frac{1}{R_1 C_a} = \frac{\sqrt{b^2 - 4a}}{2a} \quad (28)$$

and squaring both terms:

$$\frac{1}{R_1 C_a} = \frac{b - R_1 C_a}{a} \quad (29)$$

which is rewritten as

$$\frac{a}{R_1 C_a} = b - R_1 C_a \quad (29a)$$

Substituting (22a) for a, and (22b) for b in (29a) gives after simplification

$$\frac{R_2 C_p^2}{C_a} = R_1 (C_T - C_a) + R_2 C_2 \quad (30)$$

after transfer of R_2C_2 to the left side of (30) and multiplication of both sides by C_a

$$R_2 (C_p^2 - C_a C_2) = R_1 C_a (C_T - C_a) \quad (30a)$$

Rewriting (30a) as

$$R_1 C_a = R_2 \frac{C_p^2 - C_a C_2}{C_T - C_a} \quad (31)$$

and making use of (20a) and (20b) we finally obtain:

$$R_1 C_a = R_2 C_2 \frac{C_g + C_f}{C_g + C_f (1 - A_0)} \quad (32)$$

This is the required relationship between the compensating capacitance C_a and the other parameters of the Miller integrator in order to obtain an integrated output free of distortions caused by tube and stray output capacities. Note similarity with Equation (14) except for the factor

$$\frac{C_g + C_f}{C_g + C_f (1 - A_0)}$$

brought about by the Miller effect. Also observe that if the parasitic input capacity C_g can be neglected, (32) reduces to

$$R_1 C_a (1 - A_0) = R_2 C_2 \quad (33)$$

Another useful form for Equation (32) is obtained by introducing a new variable

$$\gamma = \frac{C_g + C_f}{C_g + C_f (1 - A_0)} \quad \text{(Note } \gamma < 1) \quad (34)$$

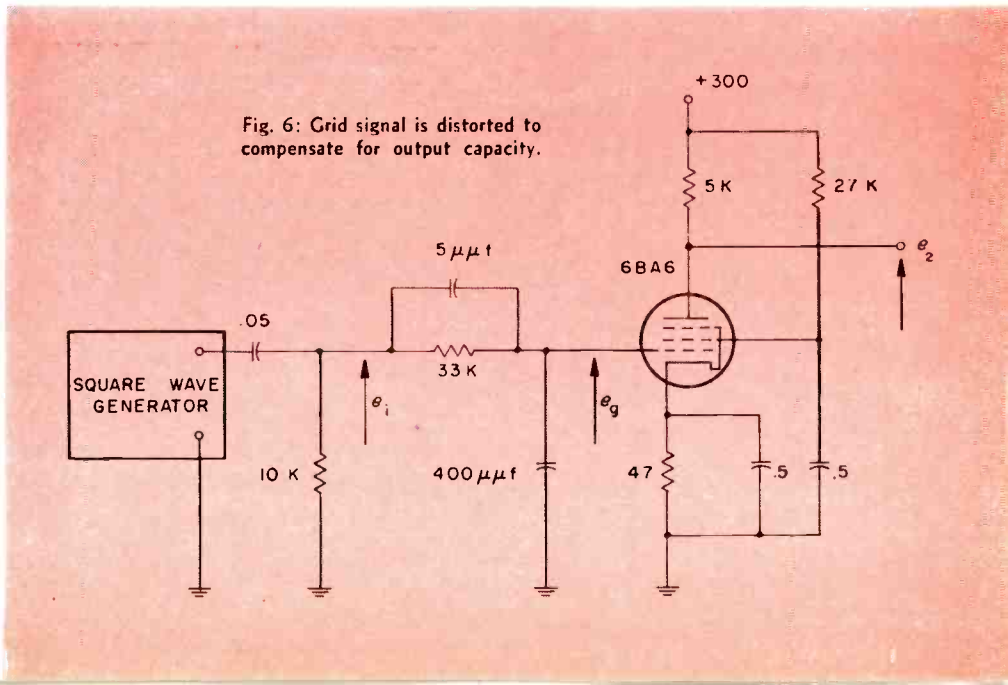


Fig. 6: Grid signal is distorted to compensate for output capacity.

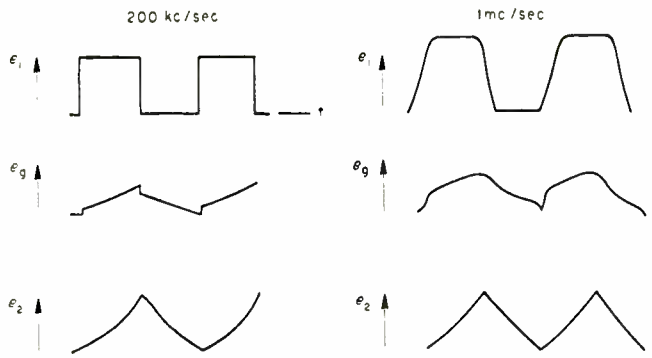


Fig. 7. The wave shapes shown refer to circuit in Fig. 6.

Integrator Design

(Concluded)

and (32) becomes

$$R_1 C_a = \gamma R_2 C_2 \tag{35}$$

It now remains to express the transfer function G(s) for the Miller integrator when the compensation indicated by (35) is used. The algebraic manipulations required, although simple, are tedious and have been relegated to the appendix. The resultant transfer function is

$$G(s) = \frac{A_0}{1 + \dfrac{R_1 (C_a + C_g + C_f)\, s}{\gamma}} \tag{36}$$

The same advantage as with circuit of Fig. 1a is noted; namely, slight increase of time constant without deterioration of gain. If $C_g = 0$, G(s) becomes

$$G(s) = \frac{A_0}{1 + R_1 (C_a + C_f)(1 - A_0)\, s} \tag{37}$$

Note similarity with (15) except for the fact that C's are multiplied by $(1 - A_0)$ as it is expected with the Miller effect.

Conclusion

If wide band integration is desired at frequencies at which tube output capacities cannot be neglected, frequency and phase distortion will affect the quality of the integration. Compensation can be introduced that will eliminate this distortion entirely by adding a capacitor C_a across the resistance R_1 (Fig. 1) in the integrating network provided the following relationship is satisfied:

$$R_1 C_a = \gamma R_2 C_2$$

where:

R_2 = output resistor

C_2 = tube output capacity

γ = 1 for integrator followed by a buffer amplifier

$\gamma = \dfrac{C_g + C_f}{C_g + C_f (1 - A_0)}$ for Miller's Integrator

C_g = tube input capacity

C_f = feedback capacity

A_0 = amplifier gain with tube capacities neglected

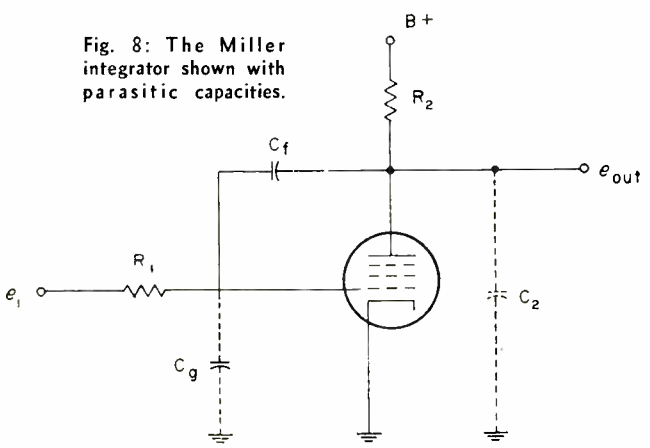


Fig. 8: The Miller integrator shown with parasitic capacities.

APPENDIX

DERIVATION OF COMPENSATED MILLER INTEGRATOR TRANSFER FUNCTION WHEN COMPENSATION IS MADE ACCORDING TO THE RELATIONSHIP $R_1 C_a = \gamma R_2 C_2$

Since $\alpha = -\dfrac{1}{R_1 C_a}$ and the transfer function before compensation is Eq. (24) or

$$G(s) = \frac{R_1 C_a A_0}{a}\left[\frac{s - \left(\dfrac{1}{R_1 C_a}\right)}{(s - \alpha)(s - \beta)}\right]$$

the resulting transfer function after compensation becomes

$$G(s) = \frac{R_1 C_a A_0}{a}\,\frac{1}{s - \beta}$$

Now, as shown in Eq. (25b)

$$\beta = -\frac{b}{2a} - \frac{\sqrt{b_2 - 4a}}{2a}$$

and from Eq. (28)

$$\frac{\sqrt{b^2 - 4a}}{2a} = \frac{b}{2a} - \frac{1}{R_1 C_a}$$

Substitution of Eq. (28) into Eq. (25b) gives

$$\beta = \frac{1}{R_1 C_a} - \frac{b}{a} \tag{I}$$

Substitution of Eq. (22a) for a, and Eq. (22b) for b in (I) gives, after a few manipulations

$$\beta = -\frac{R_1 C_T C_a - R_2 (C_p^2 - C_2 C_a)}{R_1 R_2 C_a C_p^2} \tag{II}$$

Substituting Eqs. (35), (20b), (34), (20a) in (II) yields, after simplification

$$-\beta = \frac{\gamma}{R_1 (C_a + C_g + C_f)}$$

Substitution of (III) into (24) gives

$$G(s) = \frac{R_1 C_a A_0}{a}\,\frac{1}{s + \dfrac{\gamma}{R_1 (C_a + C_g + C_f)}}$$

Substituting (22a), (20b) and (35) into (IV) gives, after simplification

$$G(s) = \frac{A_0}{1 + \dfrac{R_1 (C_a + C_g + C_f)}{\gamma}\, s}$$

Preview of the

NATIONAL ELECTRONICS CONFERENCE—1958

Three-day conference of technical sessions and product exhibits is expected to attract more than 10,000 engineers and scientists to the Hotel Sherman in Chicago. Conference opens Oct. 13th and runs to the 15th.

THE top electronic show of the Midwest, the 14th Annual National Electronics Conference, will open at the Hotel Sherman in Chicago on October 13. The three-day conference will feature technical sessions and exhibits by leading electronic manufacturers.

The conference is being sponsored by the AIEE, Illinois Inst. of Technology, the Inst. of Radio Engineers, and Illinois and Northwestern Universities. Participants are: Michigan, Michigan State, Notre Dame, Purdue, Wayne State and Wisconsin Universities, Electronic Industries Association and the Society of Motion Picture and Television Engineers.

An up-to-the-minute report on satellites and space stations and a discussion of automatic navigation will be featured. In addition, there will be a panel discussion on "The Role of the Laboratory Program in Engineering Education" and a session with five journalists covering "Engineering Writing and Speech."

Three distinguished leaders—one from the military, one from government and one from private industry—will speak at luncheons during the conference. They are:

Gen. John B. Medaris, commanding general, U. S. Army Ordnance Missile Command, Redstone Arsenal. General Medaris, chosen as the first commander of this new Army organization, will speak on Monday, Oct. 13.

Donald B. Quarles, Deputy Secretary of Defense for the United States. Quarles will address an NEC luncheon on Tuesday.

Dr. Simon Ramo, vice president of Ramo-Wooldridge Corporation in California. Dr. Ramo, known for his far-reaching capabilities in electronics and missile-space technology, speaks Wednesday.

NEC's three-day program includes over 100 technical papers as well as panel and tutorial discussions, according to Conference President Joseph H. Enenbach, supervising engineer for Illinois Bell

(*Continued on page* 176)

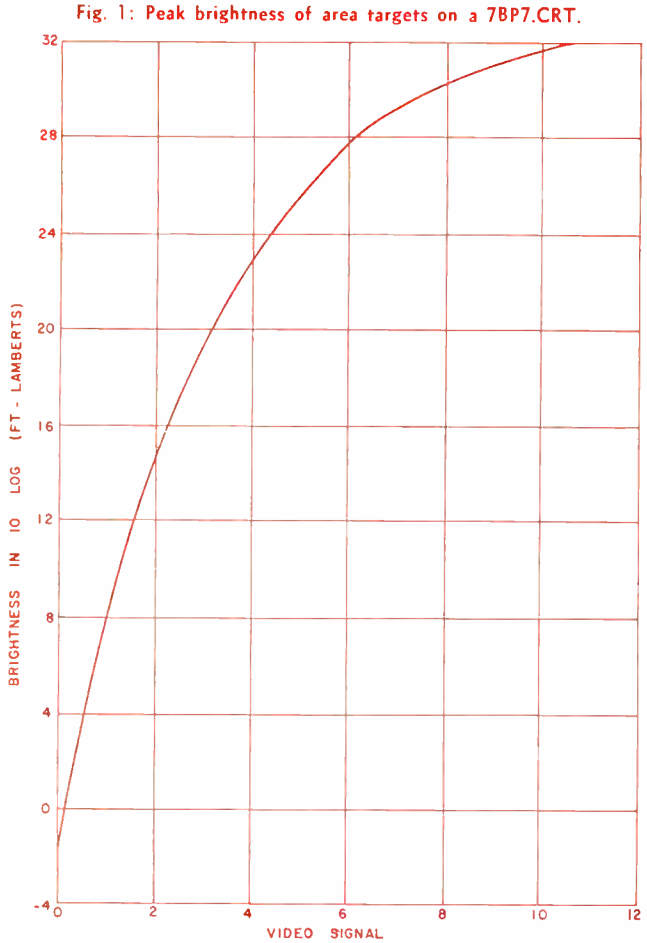
Group of past and present NEC chairmen and presidents are shown. Left to right, standing: J. M. Cage, R. M. Soria, H. H. Brauer, G. H. Fett, Kipling Adams, W. O. Swinyard, E. O. Neubauer, J. D. Ryder and J. A. M. Lyon. Left to right, seated: C. E. Barthel, Jr., O. I. Thompson, E. H. Schulz, J. E. Hobson, J. H. Enenbach, Nathan Cohn and W. G. Dow. Mr. Enenbach is 1958 president and Mr. Brauer is board chairman.

By DR. DANIEL LEVINE
Consulting Engineer
3826 North 55th Drive
Glendale, Arizona

Selection of the dynamic compression curve for a radar receiver is a system problem influenced by several factors. A discussion of some of these factors is included with a graphical analysis of the different types of receivers.

Dynamic Compression for Radar Receivers

Fig. 1: Peak brightness of area targets on a 7BP7.CRT.



Part One of Two Parts

COMPRESSION and expansion of signal levels in an airborne radar receiver can be designed to obtain optimum use of the range of light output of the cathode-ray tube. To accomplish the necessary analysis of this dynamic compression, use is made of graphical procedures.

Selection of the dynamic compression curve is based on the following factors: (1) dynamic range of the input signals, defined as the ratio of the power in the strongest signal to the receiver noise power; (2) range of the output voltage as limited by the characteristics of the cathode-ray tube and by the recording and play-back equipment; (3) amplitude distribution of significant input signals; (4) changes in the amplitude distribution of significant signals over different types of terrain.

The first two topics form the subject matter of this article; the last two must be left for other investigators.

Cathode-Ray Tube

The dynamic range of the CRT in radar displays is usually expressed in terms of distinguishable steps on a gray scale. Because of their subjective nature, evaluations of this type are of limited utility. However, several investigators have obtained photometric measurements that may be used as a basis for receiver design.

This material was prepared under U. S. Air Force contract AF33(600)-28553, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio.

H. B. Ranken[2] has found that the range of central luminance of a 5FP4A CRT trace extends approximately from 0.1 to 180 millilamberts, which is the equivalent of 10 log 1800 = 32.6 db. Additional measurements were obtained by Sweet and Bartlett,[3] who found the range of 10 log peak brightness for the 7BP7 CRT to be from −3 to +33 (36 db). (Fig. 1.)[a]

The above results apply to area contrast where the brightness of the strongest target area is compared with that of the barely visible sweep line. Other figures that may be cited are those on detail contrast[b] given by Haines,[4] who found a range of from 10 to 20 db, depending upon the transmissivity of the CRT face plate. This result implies an area contrast in excess of 20 db.

Radar Receivers

The objective numerical results cited indicate that the CRT has a rather large range of light output. Although this report deals with compression and expansion of different signal levels to make the best use of this range, it has not been possible, because of the limited applicability of the data used, to draw any immediate conclusions concerning the optimum receiver. However, graphical procedures for studying dynamic compression are presented for the following cases:

1. The CRT is to be viewed by a human observer (giving rise to the linear brightness receiver).
2. The CRT is to be photographed for direct analysis of the negative image (giving rise to the linear density receiver).

The method of analysis is outlined in the following paragraphs.

Visual Presentation

a. Linear Receiver—The response of a linear receiver is:[c]

$$v_o = G_L v_i \tag{1}$$

where

$$G_L = \frac{V_{oM}}{V_{iM}} \tag{2}$$

Thus,

$$v_o = \frac{V_{oM}}{V_{iM}} v_i = v_{oM} \frac{\frac{V_i}{V_{iN}}}{\frac{V_{iM}}{V_{iN}}} \tag{3}$$

The following information is needed to specify the linear receiver:

1. The maximum signal voltage, v_{oM}, to be applied to the grid of the CRT.
2. The dynamic range of the input signal, D, to determine v_{iM}/v_{iN}.
3. The bias setting of the CRT.

For example, the curves of Fig. 6 were drawn for

[a] In Fig. 1 the ordinate is labeled "brightness" because the visual response to a change in light intensity is taken to be a linear function of log luminance. Although the assumption of a linear relation is not valid, it is questionable whether further refinement of the brightness scale would be particularly advantageous, because of the complexity introduced.

[b] Detail contrast is the brightness ratio of an infinitely large, uniformly excited field with a small, unexcited spot centered in this field.

[c] The symbols are defined in the List of Symbols .....

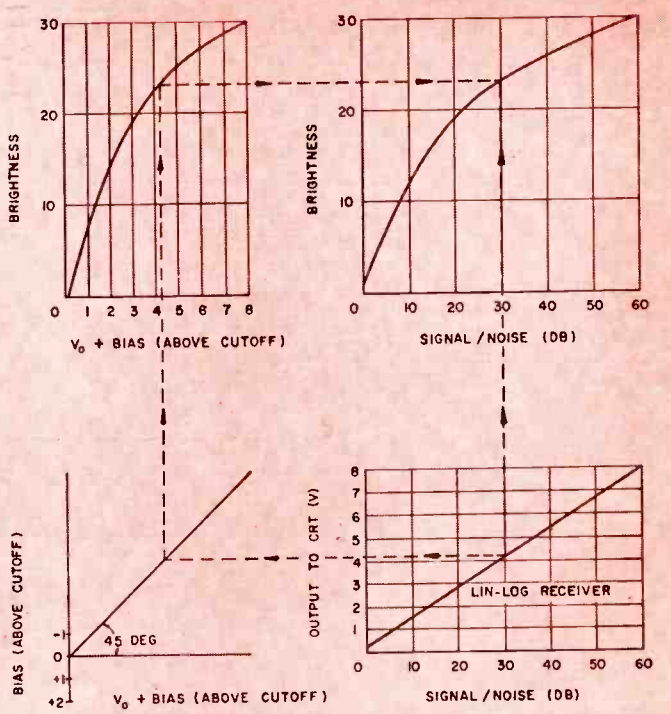


Fig. 2: Graphical procedure for specifying a receiver.

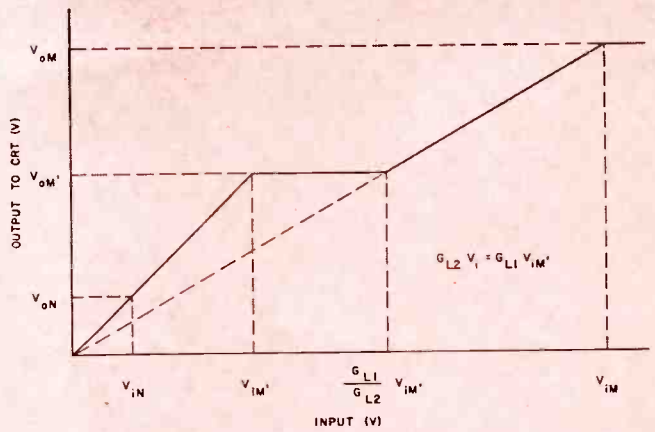
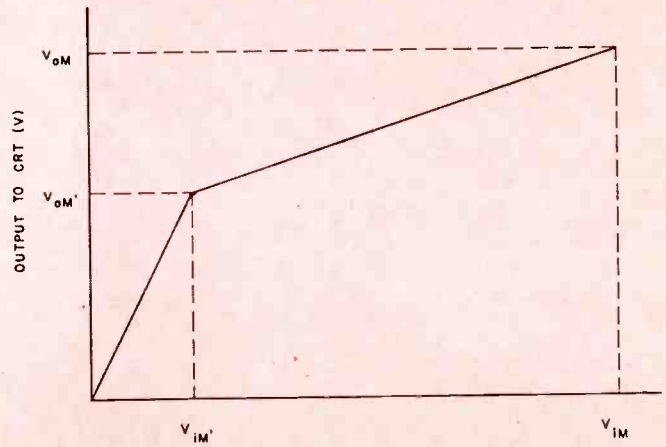


Fig. 3: The output of a contrast receiver illustrated.

Fig. 4: The linear regions of a bilinear receiver shown.



Dynamic Compression *(Continued)*

$v_{oM} = 8$ v. and D = 30 and 60 db. From these curves, the output voltage for any input signal-to-noise ratio may be obtained. Then the corresponding light output may be found by means of a curve such as that in Fig. 1, and the input signal may be correlated with its response on the CRT. The complete graphical procedure is illustrated in Fig. 2, starting with a receiver represented by a straight line in the lower right quadrant. Correlation of the curves requires determination of the bias setting on the CRT, since the value of the bias setting determines the axial intercept of the curve in the lower left quadrant of Fig. 2. (The bias setting here is shown as being at cutoff.)

The brightness curves of the linear receiver, based on Fig. 1 and 6 with the CRT biased to cutoff, are given in Fig. 7. The peak video signal was set at 8 v. because of the flattening of the brightness curve in Fig. 1 for larger signals. Thus, the output for a 12 v. signal is only two units of brightness greater than for an 8 v. signal. Even with the limit at 8 v., the rounding off of the CRT brightness curve appears as a point of inflection in the receiver brightness curves.

b. Contrast Receiver—The output of a contrast receiver (Fig. 3) is:

$$v_o = \begin{cases} G_{L1}v_i, & (0 \leqq v_i \leqq v_{iM}') \\ G_{L1}v_{iM} \equiv v_{oM}', & \left(v_{iM}' \leqq v_i \leqq \dfrac{G_{L1}}{G_{L2}} v_{iM}'\right) \\ G_{L2}v_i, & \left(\dfrac{G_{L1}}{G_{L2}} v_{iM}' \leqq v_i \leqq v_{iM}\right) \end{cases}, \quad (4)$$

where

$$\text{and} \qquad \left.\begin{aligned} G_{L1} &= \frac{v_{oM}'}{v_{iM}'} = \frac{v_{oN}}{v_{iN}} \\ G_{L2} &= \frac{v_{oM}}{v_{iM}} \end{aligned}\right\}. \quad (5)$$

To fix the slope of the lower gain curve, an output noise level of 0.25 v. is selected, so that for a maximum output v_{oM} of 8 v.

$$v_o = \begin{cases} 0.25\,\dfrac{v_i}{v_{iN}}, & (0 \leqq v_i \leqq v_{iM}') \\ 0.25\dfrac{v_{iM}'}{v_{iN}}, & \left(v_{iM}' \leqq v_i \leqq \dfrac{v_{oM}}{v_{oM}} v_{iM}\right) \\ 8\,\dfrac{\dfrac{v_i}{v_{iN}}}{\dfrac{v_{iM}}{v_{iN}}}, & \left(\dfrac{v_{oM}'}{v_{oM}} v_{iM} \leqq v_i \leqq v_{iM}\right) \end{cases}. \quad (6)$$

If a receiver designed for a 60-db dynamic range is used over a target area having a range of only 30 db, an adjustment of the video gain control can be made to provide an 8-v. output for the 30-db signal. Due to noise level the contrast type of receiver holds little promise for simple automatic operation over greatly varied terrain.

c. Bilinear Receiver—The bilinear receiver has two linear regions as shown in Fig. 4. Its gain equation is:

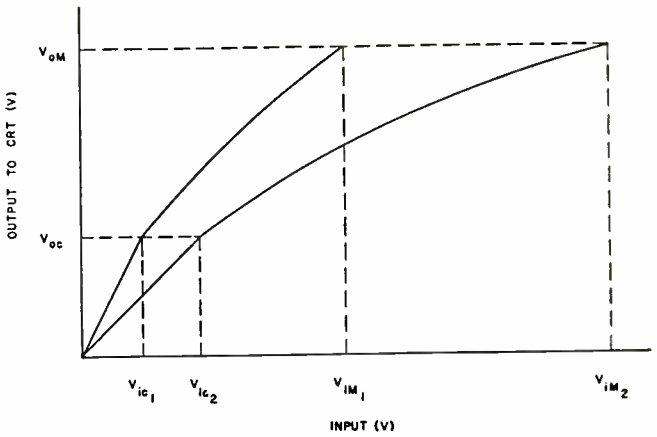


Fig. 5: Curves illustrate the lin-log receiver output.

$$v_o = \begin{cases} \dfrac{v_{oM}}{v_{iM}'} v_i = v_{oM}' \dfrac{\dfrac{v_i}{v_{iN}}}{\dfrac{v_{iM}'}{v_{iN}}}, & (0 \leqq v_i \leqq v_{iM}') \\ \dfrac{v_{oM} - v_{oM}'}{v_{iM} - v_{iM}'} (v_i - v_{iM}') + v_{oM}', & (v_{iM}' \leqq v_i \leqq v_{iM}) \end{cases}. \quad (7)$$

If the curve in Fig. 4 representing the first linear region is identical to the 30-db linear characteristic, then

$$v_o = \frac{8}{\sqrt{1000}} \frac{v_i}{v_{iN}} = 0.2525\,\frac{v_i}{v_{iN}}. \quad (8)$$

For $v_{oM}' = 2$, Eq. 8 yields

$$\frac{v_{iM}'}{v_{iN}} = \sqrt{62.5} = 7.91. \quad (9)$$

Thus, for larger signals,

$$v_o = 2 + \frac{6}{\dfrac{v_{iM}}{v_{iN}} - \dfrac{v_{iM}'}{v_{iN}}} \left(\frac{v_i}{v_{iN}} - \frac{v_{iM}'}{v_{iN}}\right)$$

$$= 2 + \frac{6}{\text{antilog}\left(\dfrac{D}{20}\right) - 7.91} \left(\frac{v_i}{v_{iN}} - 7.91\right). \quad (10)$$

Curves of dynamic compression and brightness are given in Figs. 6 and 7. As with the second contrast receiver discussed in item 2. *b*, the 60-db receiver, when adjusted for a 30-db signal by means of a video gain control, has a poor compression characteristic. This characteristic is indicated by the dashed curves in the illustrations.

d. Lin-Log Receiver—The curves of Fig. 5 illustrate the notation to be used in the following discussion of lin-log compression.

The equation of the gain curve[d] is

$$\left.\begin{aligned} v_o &= G_L v_i, & (0 \leqq v_i \leqq v_{ic}) \\ v_o &= \gamma\,(20 \log v_i) + \alpha, & (v_{ic} \leqq v_i \leqq v_{iM}) \end{aligned}\right\}. \quad (11)$$

At the change-over point,

$$v_{oc} = \gamma\,(20 \log v_{ic}) - \alpha. \quad (12)$$

[d] In present receivers, the initial slope of the logarithmic segment does not exceed that of the linear segment of the receiver, *i.e.*,

$20\,\gamma/v_{ic} \leqq G_L$.

while the maximum output voltage is

$$v_{oM} = \gamma\,(20 \log v_{iM}) + \alpha. \tag{13}$$

The difference between Eq. 12 and 13 is

$$v_{oM} - v_{oc} = \gamma\,(20 \log v_{iM} - 20 \log v_{ic}), \tag{14}$$

and

$$\gamma = \frac{v_{oM} - v_{oc}}{20 \log \left(\frac{v_{iM}}{v_{ic}}\right)}. \tag{15}$$

The substitution of Eq. 15 into Eq. 12 then yields

$$\alpha = v_{oc} - \frac{v_{oM} - v_{oc}}{20 \log \left(\frac{v_{iM}}{v_{ic}}\right)} (20 \log v_{ic}). \tag{16}$$

Consequently, the logarithmic section may be written as

$$\begin{aligned} v_o &= \frac{V_{oM} - v_{oc}}{20 \log \left(\frac{v_{iM}}{v_{ic}}\right)} (20 \log v_i) + v_{oc} \\ &\quad - \frac{v_{oM} - v_{oc}}{20 \log \left(\frac{v_{iM}}{v_{ic}}\right)} (20 \log v_{ic}) \\ &\equiv v_{oc} + \frac{v_{oM} - v_{oc}}{20 \log \left(\frac{v_{iM}}{v_{ic}}\right)} 20 \log \left(\frac{v_i}{v_{ic}}\right). \end{aligned} \tag{17}$$

Then the complete equation is

$$v_o = \begin{cases} \dfrac{v_{oc}}{v_{ic}} v_i, & (0 \leqq v_i \leqq v_{ic}) \\ v_{oc} + \dfrac{v_{oM} - v_{oc}}{20 \log \left(\frac{v_{iM}}{v_{ic}}\right)} 20 \log \left(\dfrac{v_i}{v_{ic}}\right), & (v_{ic} \leqq v_i \leqq v_{iM}) \end{cases}. \tag{18}$$

If the cross-over voltage between the linear and the logarithmic sections of the gain curve is equal to the average noise voltage, then

$$\left.\begin{aligned} v_{ic} &= v_{iN} \\ v_{oc} &= v_{oN} \\ 20 \log \left(\frac{v_{iM}}{v_{ic}}\right) &= D \end{aligned}\right\}. \tag{19}$$

For this case the dynamic compression curve is given by

$$\left.\begin{aligned} v_o &= v_{oN} \frac{v_i}{v_{iN}}, \quad (0 \leqq v_i \leqq v_{iN}) \\ v_o &= v_{oN} + \frac{v_{oM} - v_{oN}}{D} \left(\frac{v_i}{v_{iN}}\right)_{db}, \quad (v_{iN} \leqq v_i \leqq v_{iM}) \end{aligned}\right\}. \tag{20}$$

To introduce numbers for purposes of graphing, let

$$\left.\begin{aligned} v_{oN} &= 0.25 \text{ volts} \\ v_{oM} &= 8 \text{ volts} \\ D &= 30 \text{ and } 60 \text{ db} \end{aligned}\right\}, \tag{21}$$

so that the logarithmic region is

$$v_o = 0.25 + \frac{7.75}{D} \left(\frac{v_i}{v_{iN}}\right)_{db}. \tag{22}$$

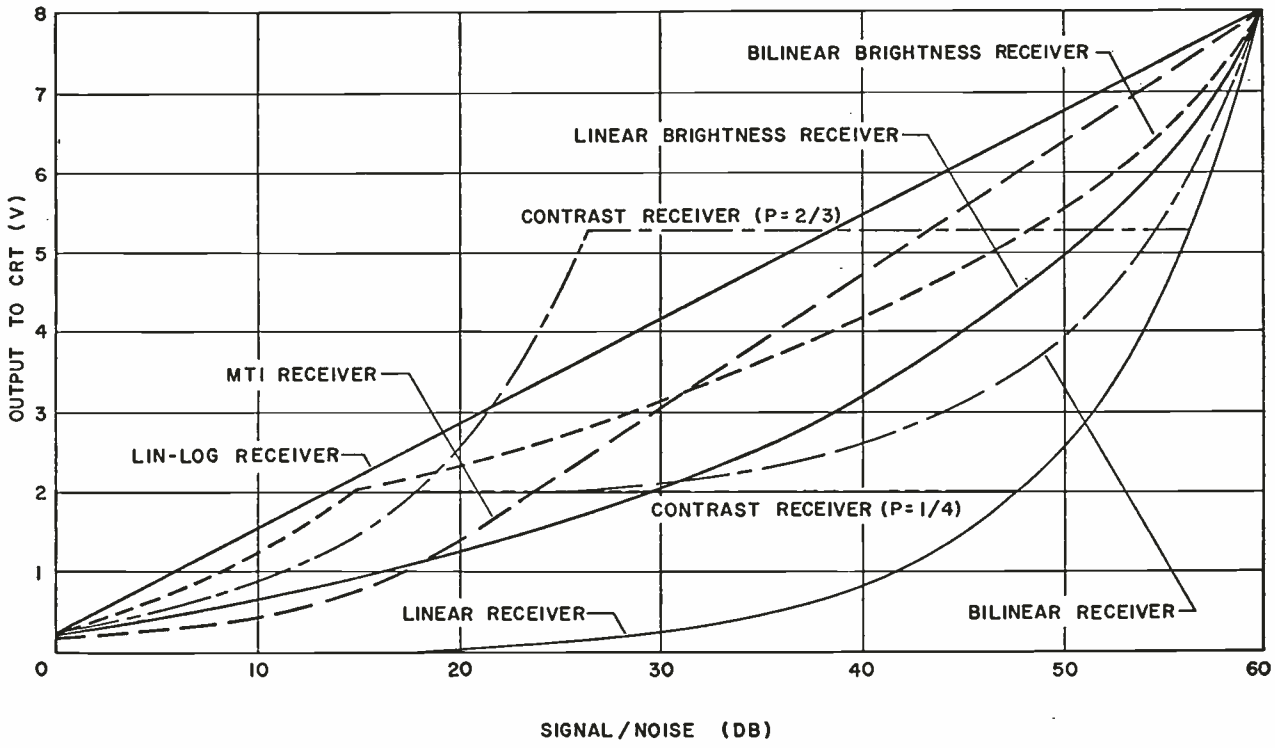
It is common to require that the curve have a continuous first derivative, as for moving target indicators (MTI); then

$$\frac{v_{oc}}{v_{ic}} = \frac{0.4343\,(v_{oM} - v_{oc})}{v_{ic} \log \left(\frac{v_{iM}}{v_{ic}}\right)},$$

and therefore

$$v_{oc} = \frac{0.4343\, v_{oM}}{0.4343 + \log \left(\frac{v_{iM}}{v_{ic}}\right)}. \tag{23}$$

Fig. 6: Curves of dynamic compression for the various receivers discussed are shown together to facilitate comparison.



Dynamic Compression *(Continued)*

If the dynamic characteristic of a lin-log receiver satisfies this condition, it may be called an MTI receiver. Following present MTI practice, the cross-over is taken at

$$v_{ic} = 10\, v_{iN} \qquad (24)$$

for the curves of Figs. 7 and 6.[5]

From the preceding discussion it is evident that a receiver is not uniquely defined by identifying it as a "lin-log" type. It is necessary to specify in detail the precise equation of the compression curve.

e. Linear Brightness Receiver—"Linear brightness receiver" is a term of convenience applied to a receiver that is linear in units of log (foot-lamberts) plotted against log (signal power/noise power). (Fig. 7.)[6e] The corresponding voltage curves, obtained with the help of Fig. 1, are given in Fig. 6.

In drawing the linear brightness curves of Fig. 7 the noise level was set at 3 brightness units above the level of visibility. This choice provides the same noise level as that found in the lin-log receiver defined by Eq. 22.

The brightness curve of a bilinear brightness receiver are given in Fig. 7, with the break point of the 60-db curve occurring at 15 brightness units for purposes of illustration. The corresponding curves of dynamic compression appear in Fig. 6.

f. Comparisons—The dynamic compression curves of all the 60-db receivers described appear in Fig. 6; their brightness curves are shown in Fig. 7. The latter figure indicates that:

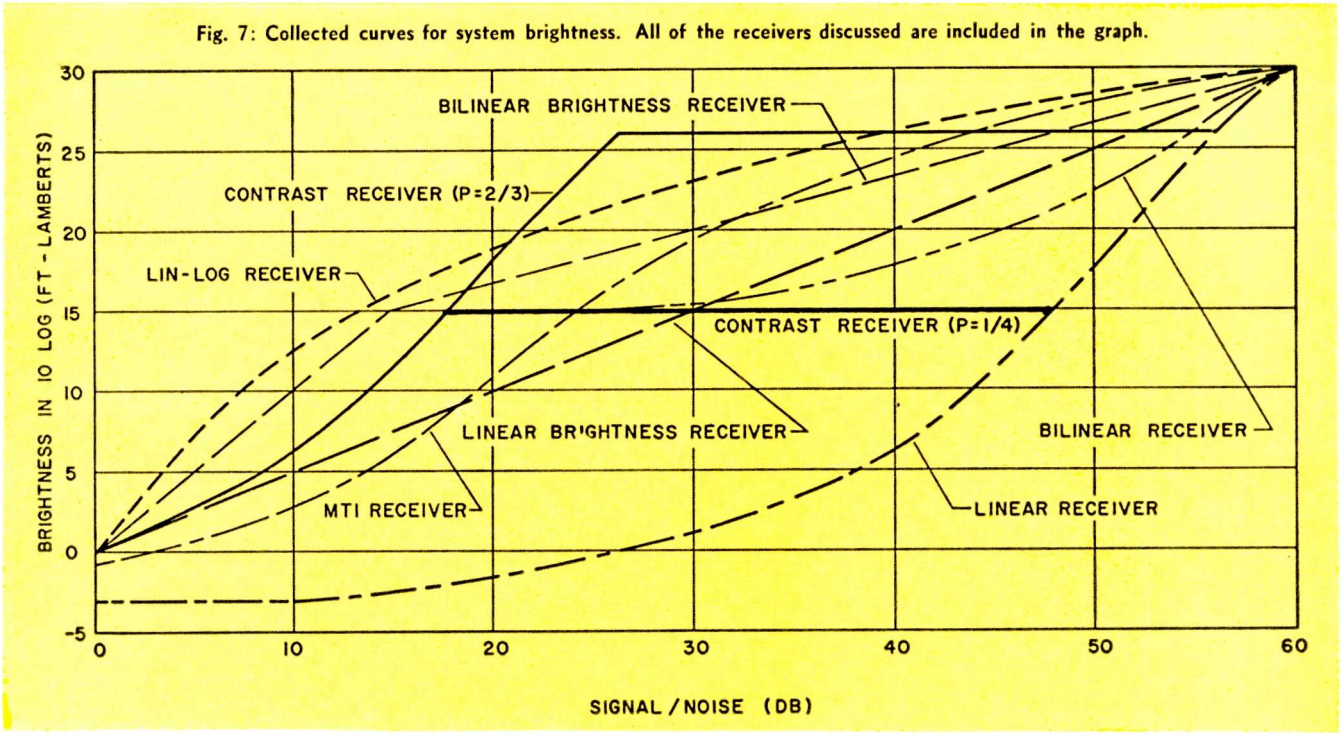
1. A linear receiver provides excessive compression of weak signals (*i.e.*, signals less than 30 db above noise).
2. The contrast receiver having P = ⅔ fails to discriminate among strong signals if their amplitude is only 4 db less than the assumed maximum signal.
3. The MTI receiver, while superior to the linear receiver in the weak-signal range, still suffers from excessive compression of signals less than 13 db above noise.
4. The contrast receiver having P = ¼ has an extended range of 12 db of strong signals on the high end of the plateau. Even so, a significant change in terrain or an increase of aircraft altitude could so reduce the magnitude of the strong targets that they would all appear at the plateau level. This receiver has the noteworthy feature that if 60-db targets should be absent then automatic gain control of the strong-signal channel would permit obtaining 8-v. of video output for a smaller input signal. Change of the upper end point of the characteristic curve is not so readily accomplished for the other new receivers.
5. The linear and bilinear brightness receivers, as well as the lin-log receiver (as specified by Eq. 22), provide good characteristics for all target amplitudes. Which of the receivers is most desirable cannot be specified until more information is available on the relative frequency of occurrence of different target amplitudes, and on the relative importance of the targets.

The first three receivers enumerated above are the only ones that have been used extensively. It is apparent that each of them have one or more limitations, and further receiver development appears desirable. The direction of such development may be guided by the characteristics of the other receivers described above.

(Continued Next Month)

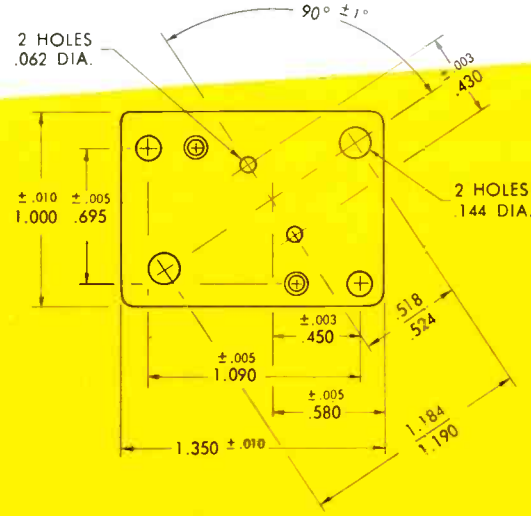
[e] Cedrone gives an alternative analysis using Blackwell's data on minimum detectable brightness difference as a function of brightness of the surround. It is questionable whether or not such a refinement is warranted.

Fig. 7: Collected curves for system brightness. All of the receivers discussed are included in the graph.



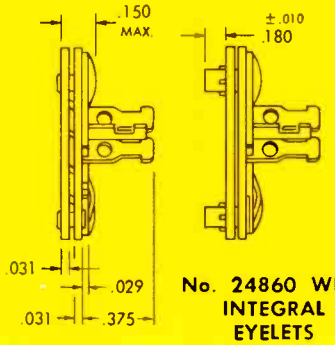
NEW POWER TRANSISTOR SOCKETS BY CINCH

LAMINATED TYPES:



No. 24324

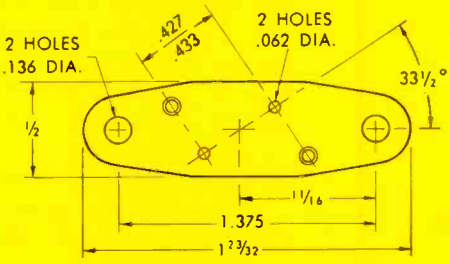
No. 24860
WITH INTEGRAL EYELETS



No. 24860 WITH INTEGRAL EYELETS

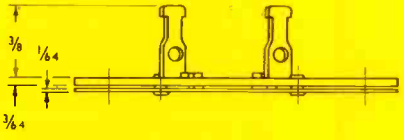
No. 24324

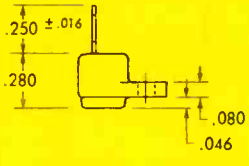
No. 22831

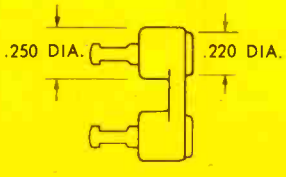


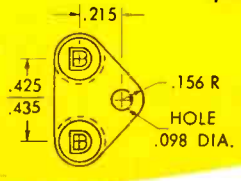
MOLDED TYPE

No. 24246
(SHOWN BELOW)









Military version of the above sockets are available. Information on request.

There are three laminated type sockets; 22831, 24324 and 24860. No. 22831 is elongated in shape, top plate is of 1/64" chocolate colored XP Bakelite, bottom plate is of 3/64" chocolate colored XP Bakelite; both vacuum wax impregnated. The contacts are of brass, cadmium plated.

No. 24324 is rectangular in shape. Top and bottom plates are of natural XP Bakelite, vacuum wax impregnated. Contacts are of brass, cadmium plated. Formed thread for 6-20 screw. .104/.110 dia. hole in C R steel plate. Provides easy attachment to a heat sink.

No. 24860 is identical with 24324 except it is equipped with integral eyelets for easy assembly to chassis.

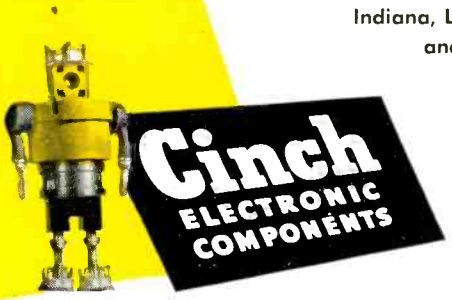
No. 24246 is a molded socket with general purpose Bakelite casting. Contacts are phosphor bronze, cadmium plated.

Dimensions are shown at the left.

ALL SOCKETS FIT FOLLOWING TRANSISTORS:

Bendix	2N-235, 2N-235A
CBS Hytron	2N-155, 2N-554, 2N-555, 2N-556
Mallory	2N-230
Motorola	2N-176, 2N-178, 2N-179, 2N-350, 2N-351, 2N-375, 2N-618
Cleavite	2N-257, 2N-268, 2N-297
RCA	2N-301, 2N-301A
Sylvania	2N-242, 2N-296, 2N-307, 2N-325, 2N-326
Texas Instrument	2N-250, 2N-251

Centrally located plants at Chicago, Illinois, Shelbyville, Indiana, La Puente, California and St. Louis, Missouri.



CINCH MANUFACTURING CORPORATION
1026 South Homan Ave., Chicago 24, Illinois
Subsidiary of United-Carr Fastener Corporation, Cambridge, Mass.

Circle 57 on Inquiry Card, page 121

Applications for Zener Diodes

One of the newest of the electronic components, the zener diode offers high current handling capabilities in a small package, useful in the design of light-weight, compact equipment

By GEORGE PORTER,
Product Engineer,
Special Products Dept.
International Rectifier Corp.
El Segundo, Calif.

ZENER diodes, although a relatively new regulating device, offer the design engineer a versatile component that may be used to good advantage in many electrical industries.

The small size and high current handling capabilities of the zener diode permits design of light-weight, compact equipment, and is particularly attractive when compared to its bulkier counterpart.

In addition to the military, manufacturers of industrial equipment, appliances, and electrically operated machinery represent a large and growing market for this simple semiconductor device. Designers of automatic machinery, communications equipment, aircraft, electronic computers, etc., are constantly finding new applications for the silicon regulator.

The following tabulation indicates, in general, manufacturing groups who at present are making use of the zener diode in new equipment design. The survey includes ten basic industry classifications, type of product manufactured, and a few of the typical applications. This is followed by a breakdown of the particular rating or style of zener regulator normally encountered in such equipment.

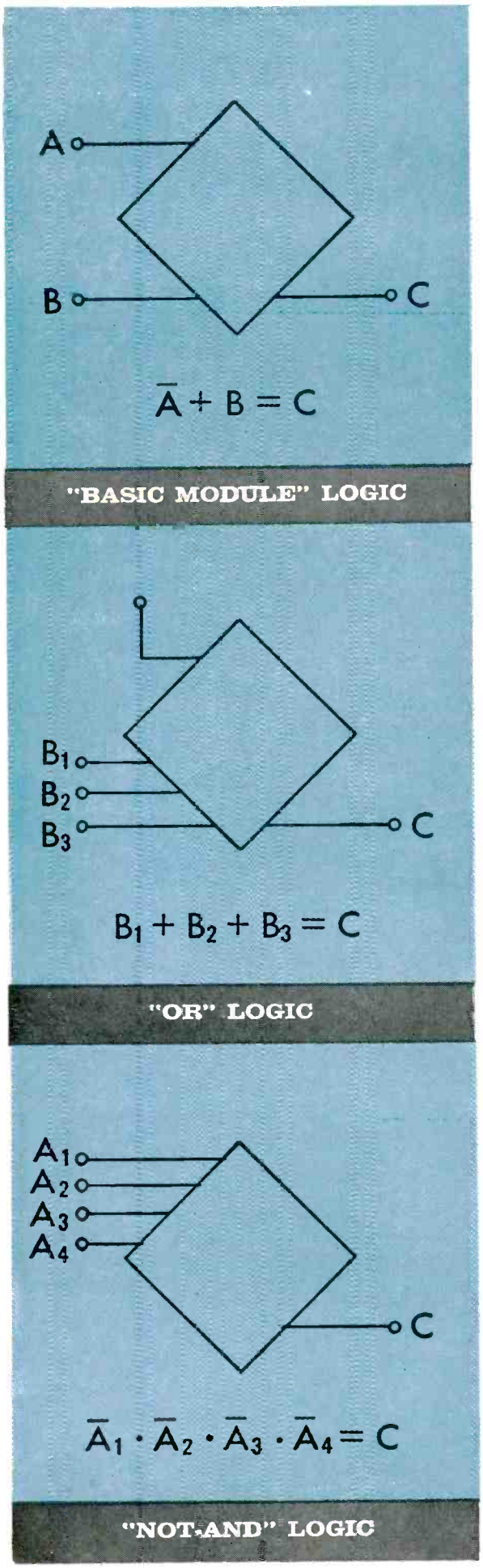
These statistics were compiled by the Applications Advisory Group of International Rectifier Corporation, and are fairly representative of the present use of these devices.

Although the industries and products listed represent only a small segment of the total number of electrical equipment manufacturers, the applications and diode types shown are indicative of their present utilization.

It is quite evident that producers of other types of equipment will, in time, incorporate these regulators in new equipment design.

MANUFACTURERS PRODUCING ZENER DIODES IN THE VARIOUS WATTAGES USED IN THE TABLE

150 milliwatt types	U. S. Semiconductor Texas Instrument Hoffman Raytheon
250 milliwatt types	Transitron Hoffman
750 milliwatt types	International Rectifier Corp. Transitron
1 watt types	International Rectifier Corp. Automatic Mfg. Hoffman
3.5 watt types	International Rectifier Corp. Automatic Mfg.
10 watt types	International Rectifier Corp. Transitron Hoffman
50 watt types	Motorola
Multiple Junction Types	International Rectifier Corp.
Double Anode Types	International Rectifier Corp. Hoffman
Reference Elements	International Rectifier Corp. Transitron Hoffman

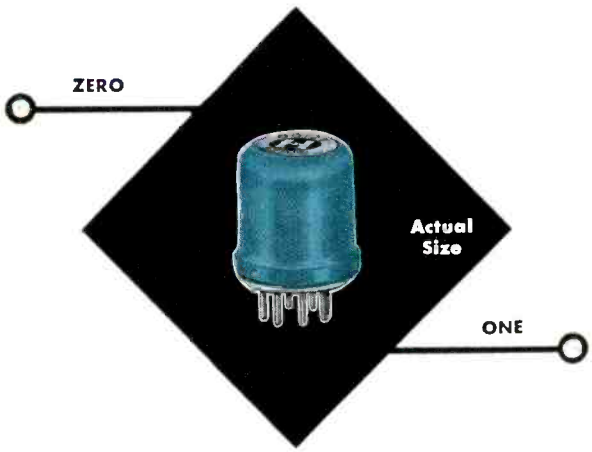


NEW for Logic Design

Hoffman Magnalog System

featuring

ZENER MAGNETIC LOGIC MODULE



* *Designed for miniaturization and simplicity of circuitry.*

Typical applications include: bistable; binary half and full adder; shift register; binary counters; decimal counters; "one" generator; "AND", "OR", "NOT" functions.

FEATURES:

- 100 KC information rate
- High Temperature Operation
- Silicon Zener Diodes
- Miniature Size
- 7 pin, miniature plug-in cases
- Synchronous Operation
- All Static Components
- Low Cost
- Flexibility of Use
- Versatility of Application

Hoffman Electronics
CORPORATION
SEMICONDUCTOR DIVISION

930 Pitner Avenue • Evanston, Ill. • UNiversity 9-9850
Regional Offices: WASHINGTON, D.C. . . . CHICAGO . . . LOS ANGELES

LEADING THE FIELD IN SILICON ZENER SEMICONDUCTOR DEVICES

Circle 58 on Inquiry Card, page 121

Applications for Zener Diodes

BASIC INDUSTRY	PRODUCTS	APPLICATIONS	*BASIC DIODE STYLES USED								
			150 mw. Type	250 mw. Type	750 mw. Type	1 watt Type	3.5 watt Type	10 watt Type (and higher)	Multiple Junction Type	Double Anode Type	Reference Element
Guided Missles	Guidance Systems	Regulators, Limiters, Bias	x	x	x					x	
	Power Supplies	Regulators, References				x	x	x	x		x
	Missle Launchers	Regulators				x	x	x	x		
	Ground Support	Misc. Regulators	x	x	x	x	x	x	x	x	x
Elect. Measuring Instruments	Inst. Movements	Meter Protection	x	x	x					x	
	Digital Voltmeters	Reference, Bias	x	x	x	x					x
	Oscilloscopes	Regulators, Bias	x	x	x	x			x		
	D.C. Amplifiers	Reference, Limiters								x	x
	Diode Testers	Meter Protection, Regulator	x	x	x	x					
	Signal Generators	Limiter, Bias	x	x	x					x	
	Transistor Testers	Regulators, Limiters	x	x	x	x				x	
	Voltage Calibrators	Regulators, Limiters	x	x	x	x			x	x	
	Continuity Checkers	Go-No Go Indicators	x	x	x	x					
	Recorders	Reference, Bias	x	x	x					x	
	Telemetering Equipt.	Reference							x		x
Computing Machines	Aircraft Comp.	Reference, Coupling Elem.	x	x	x						x
	Analog-Digital Converter	Bias, Regulators	x	x	x	x				x	x
	Data Processing	Reference, Limiters									
	Digital Computers	Regulators, Limiting	x	x	x	x	x			x	x
		Gating, Coupling, Reg.	x	x	x	x					
Communications	Comm. Receivers	Noise Limiting	x	x						x	
	Radio Transmitters	Bias, Regulators	x	x	x	x	x	x	x		
	TV Transmitters	Bias, Regulators	x	x	x	x	x	x	x		
	Facsimile	Bias, Regulators	x	x	x	x	x	x	x		
	Airborne Comm.	Regulators, Limiters	x	x	x	x				x	
	Telephone Systems	Limiting	x	x	x					x	
	Alarm Systems	Threshold Control	x	x	x						
	Radar Systems	Regulators, References	x	x	x	x	x	x	x		x
Scientific Instruments	Nuclear Monitor Systems	Regulators, Limiters	x	x	x				x	x	
	Magnetic Locators	Regulators	x	x	x						
	Water Purity Testers	Threshold Control	x	x							
	Medical Diagnostic Equipt.	M. S. C. Regulators	x	x	x	x	x	x	x	x	x
Auto. Machinery	Milling Machinery	References, Regulators			x	x	x	x			x
	Rolling Mills	References, Regulators				x	x	x			x
	Balancing Machines	References									x
	Coil Winders	References									x
	Surface Grinders	References									x
	Positioning Tables	References, Regulators	x	x	x	x					x
Aircraft Parts and Accessories	Aircraft Insts.	Meter Protection	x	x	x	x					
	Prop. Controllers	Regulators			x	x	x	x			
	Aircraft Temp. Controls	Temp. Sensors	x	x	x						
	Fuel Controllers	Regulators	x	x	x	x					
	Brake Controllers	Regulators	x	x	x	x					
	Navigation Systems	Reference, Regulators	x	x	x	x	x				x
	Fire Control Systems	Misc. Reg., References	x	x	x	x	x	x	x	x	x
Industrial Controls	D.C. Adjustable Voltage Drives	Regulators, References			x	x	x	x			x
	Engine-Generators	Regulators					x	x			
	Alternator Exciters	Regulators				x	x	x			
	Auto Light Control	Regulators			x	x	x				
	Auto. Temp. Control	Temp. Sensors	x	x	x						
	Cont. Process Controls	References, Regulators	x	x	x	x	x	x	x		x
	Electronic Timers	Threshold Control	x	x	x	x					
	Frequency Reg.	References, Bias	x	x	x						x
	Furnace Control	Regulators, Temp. Sensors	x	x	x			x			
	Mag. Amplifiers	Reference, Regulators	x	x	x	x				x	x
	Servo Amplifiers	Bias, References	x	x	x	x					x
	Remote Solenoid Control	Regulators			x	x	x	x			
	Quality Control System	References									x
Food Processing	Package Filling	Threshold Control	x	x	x	x					x
	Package Weighing	References									x
Printing Trades Machinery	Auto. Typesetters	Regulators			x	x	x	x			
	Paper Cutters	Regulators, References			x	x	x	x			x
Special Industry Machinery	Battery Chargers	Regulators					x	x	x		
	Elec. Welding	Limiters, Regulators				x	x	x	x		
	Mag. Clutches	Regulators			x	x	x	x			
	Electro-Plating	Regulators					x	x	x		

* *See Table for manufacturers of various styles.*

NEW MOTOROLA ZENER REGULATORS

10 and 50 WATT types up to 200 VOLTS

Here's an entirely new Motorola product line . . . silicon junction Zener Regulator diodes produced under Motorola's extreme quality standards and offering ratings and characteristics not previously obtainable.

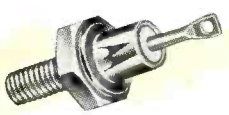
- Very high power ratings — both 10 and 50 watt types available.
- Wide voltage range — up to 200 volts in both 10 and 50 watt types.
- Very low Zener impedance limits.
- "Soft" or unstable Zener knees eliminated — by impedance limits at 5 mA for 50 watt type . . . at 1 mA for 10 watt types.
- Forward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

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

  50 WATT TYPES plug-in or solder-in TO-3 package with series interlock construction for protection against overvoltage on load.

TYPICAL APPLICATIONS —

Regulation of DC voltage
DC level changing and coupling
Surge protection of voltage-sensitive components
Regulation of vacuum tube heaters
Arc suppression



10MZ SERIES
10 watts @ 55°C

50MZ SERIES
50 watts @ 55°C

FOR COMPLETE TECHNICAL INFORMATION

concerning these new Zener Regulators, contact the nearest Motorola regional office or

MOTOROLA, INC.,
5005 East McDowell Road, Phoenix, Ariz.
BRidge 5-4411. Teletype Px 80.

"DEPENDABLE QUALITY — IN QUANTITY"

MOTOROLA SEMICONDUCTORS

MOTOROLA, INC.
5005 E. McDOWELL
PHOENIX, ARIZONA

Regional Offices

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540 Bergen Boulevard
WHitney 5-7500

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

HOLLYWOOD 28, CALIFORNIA
6555 Sunset Boulevard
HOllywood 5-3250

Circle 59 on Inquiry Card, page 121

WASHINGTON News Letter

BATTING ZERO—The 85th Congress terminated with a zero batting record in legislative enactment in the radio-electronics field, but it is considered that the next Congress starting in January will pass measures which in a number of instances will be helpful to our industry. The major failure of the last Congress was the rejection of the much-needed reduction in the 10% excise tax on TV sets and other entertainment electronic products and, because of the government's increasing budgetary needs, it is doubtful that this tax revision will be effected in the new Congress. However, the proposal to create a commission of experts to study spectrum allocations, shelved in the 85th session by the opposition of TV broadcasters, is certain to be renewed in the upcoming Congress with excellent prospects of enactment.

FUTURE COURSE OF ACTION—The Special Spectrum Study Committee of the Electronic Industries Association, headed by Hoffman Electronics President H. Leslie Hoffman, is to hold an extraordinary meeting in San Francisco Sept. 17 to determine the EIA's future action and position on the high-level spectrum allocation study which failed passage in the last session of Congress. Officials of electronics-radio manufacturing companies—General Electric, Hughes Aircraft, Motorola, Packard-Bell, Philco, RCA, Sperry and Sylvania—are members of the special committee. Two TV networks, National Broadcasting and Columbia Broadcasting, as well as the National Association of Broadcasters, will participate.

HAMS' DEFENSE VALUE—The importance of the 150,000 American radio amateurs to the military services and to civil defense keynoted the recent 10th annual convention of the American Radio Relay League in Washington. Leading government and military officials lauded the role of the amateurs and their contributions to electronics-radio technical knowledge in relation to the national defense. Speakers included Vice President Nixon and Leo A. Hoegh, Director of the Office of Civil & Defense Mobilization, and from the armed services Lieut. Gen. James D. O'Connell, Army Chief Signal Officer; Rear Admiral Frank Virden, Director of Naval Communications; and Brig. Gen. John B. Bestic, Deputy Director of Air Force Communications-electronics.

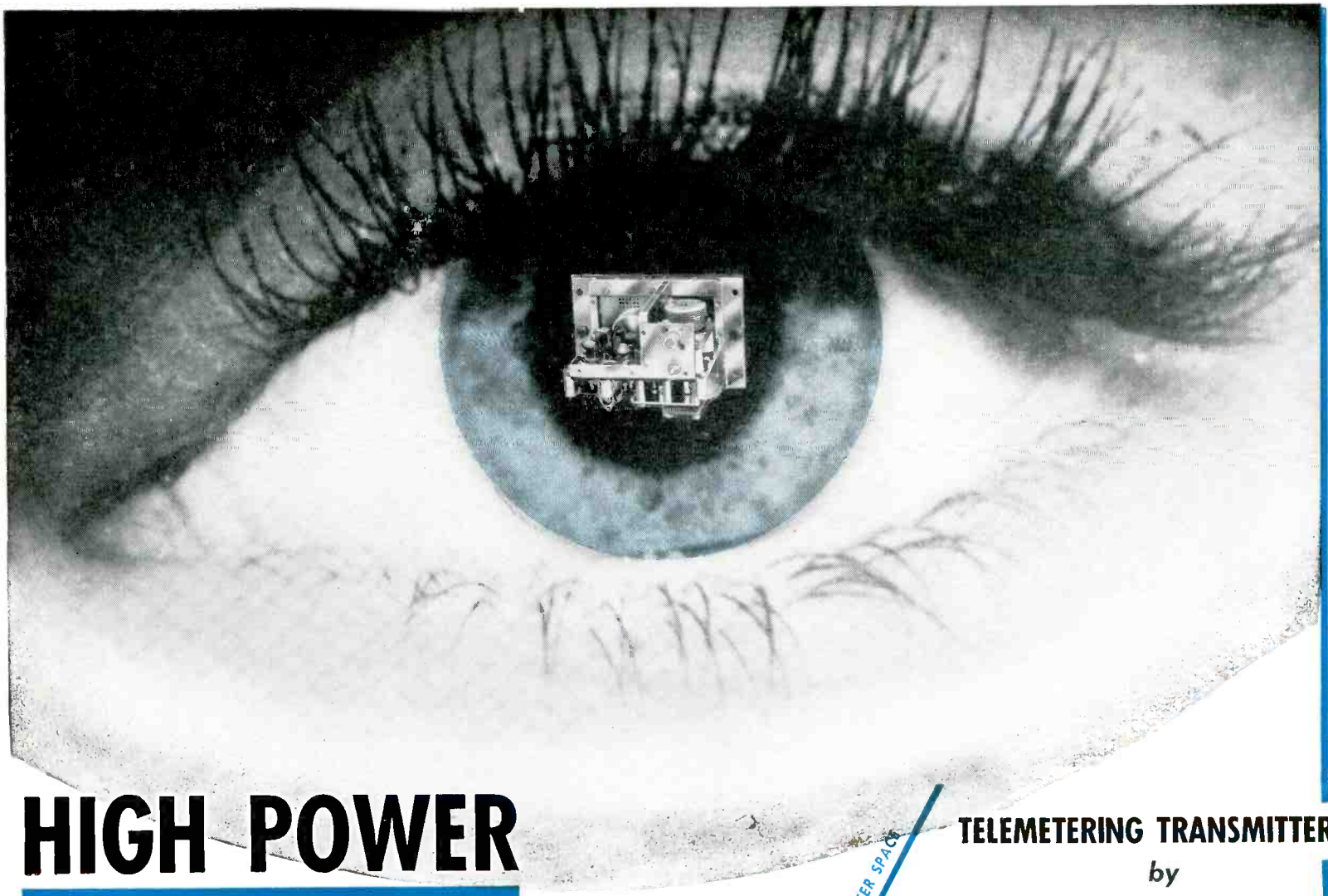
FURTHER EVALUATION—The development and operational evaluation of the single sideband radio transmission technique for aviation communications should be vigorously pursued in order that performance characteristics for a specific SSB system for the commercial and civilian aviation field may be formulated, it has been recommended by the Radio Technical Commission for Aeronautics. The RTCA reported that the use of the single sideband technique in aeronautical service is not in a suitable state of development at the present time for standardization of commercial and civilian aviation field, even though it has been gaining increasing military application. The RTCA study was undertaken at the request of government communications officials making preparation for the 1959 International Radio Conference to be held in Geneva, Switzerland.

FULL INVESTIGATION—The FCC was recently asked by Motorola, together with five mobile radio organizations, to institute a full-scale investigation into the operation and regulation of public mobile radio facilities by the Bell System. Motorola stressed to the FCC that "at stake is not only the future of the manufacturing segment of the industry, but also the fate of all of the present and future independent radio common carriers, the thousands of local radio maintenance organizations and all categories of private mobile radio users." Motorola also raised the issue whether common carrier mobile radio systems should be owned and operated independently of wireline telephone carriers to promote the development of mobile radio by those who have no conflicting interests in a rival communications technology.

UNFOUNDED ATTACK—The American Telephone & Telegraph Company in reply to the Motorola petition emphasized to the FCC that Motorola and its associates in seeking to oust the telephone companies from mobile communications field had engaged in "an unfounded attack on the entire telephone industry in the United States." The FCC, the AT&T stated, has all the information needed for a proper determination of the future requirements of mobile radio and the role of telephone companies in its current investigation of present and future uses of the frequency between 25 and 890 MC.

National Press Building
Washington 4

ROLAND C. DAVIES
Washington Editor



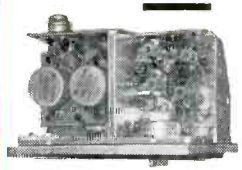
HIGH POWER

in Small Packages

Unhampered by traditional thinking, TELECHROME engineers have developed an entirely new concept in telemetering equipment — unequalled in compactness, ruggedness and dependability. Write for Specifications & Details

FOR MESSAGES FROM OUTER SPACE

Direct FM Transmitters Crystal controlled 215-235 megacycles. 125kc deviation.

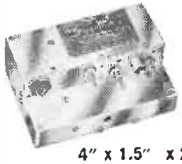


Model 1462

6″ x 4¼″ x 3¾″ 50 to 80 Watts

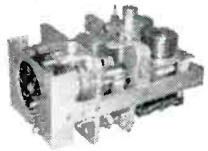
Model 1463

5 19/32″ x 3 3/16″ x 4″ 15 to 30 Watts



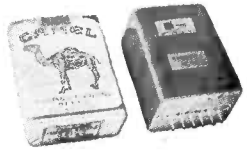
Model 1472

4″ x 1.5″ x 2.7″ 2 Watts



Model 1466A
6.5″ x 4″ x 3.25″ RF Amplifier
2 watts in — 100 watts out

SUB-CARRIER OSCILLATOR.



Model 800C — 1.5″ x 1.9″ x 2.45″
Deviation stability ±1% of band width. Deviation linearity less than 1% of band width under all conditions measured from a straight line drawn between end points.

TELEMETERING TRANSMITTERS

by

TELECHROME MFG. CORP.

The Nation's Leading Supplier of Color TV Equipment

28 RANICK DRIVE, AMITYVILLE, N. Y. • Lincoln 1-3600

Western Engineering Division — 13635 Victory Blvd., Van Nuys, Calif., State 2-7479

New Tech Data for Engineers

Closed Circuit TV

A new 12-page bulletin has just been published by the Electronics Div. of Diamond Power Specialty Corp., Lancaster, Ohio. The bulletin describes their major types of industrial TV equipment, gives 5 basic suggestions for equipment selections, and illustrates each with case histories of successful operations.

Circle 178 on Inquiry Card, page 121

Thermostats

Bulletin 5000, issued by Stevens Mfg. Co., Inc., P. O. Box 1007, Mansfield, Ohio, describes their line of Stemco Type C Thermostats. Bulletin covers the operating principle of both the hermetically sealed and semi-enclosed types and illustrates them with schematic diagrams and photographs, gives performance data, ratings, dimensions and construction details.

Circle 179 on Inquiry Card, page 121

Decade Counters

Technical Product Information Bulletin No. 826 just released by Burroughs Corp., Plainfield, N. J., contains specifications and descriptive information on their line of decade counters containing Beam Switching Tubes and Nixie Indicators. The 6-page brochure contains photographs, schematic drawings and specifications.

Circle 180 on Inquiry Card, page 121

Epoxy Casting Resins

Two technical bulletins available from Isochem Resins Corp., 221 Oak St., Providence 9, R. I., describes two new epoxy casting systems of wide industrial application. Complete technical information is included in these bulletins.

Circle 181 on Inquiry Card, page 121

Stereo Wire

The Alpha Wire Corp., 200 Varick St., New York 14, N. Y., has issued a technical bulletin which describes their line of stereo wire for all stereo cartridges and tone arms. Complete information is contained in the technical bulletin.

Circle 182 on Inquiry Card, page 121

Diode Tester

A new technical bulletin describing Model 1001 Dynamic Diode Tester, an instrument for rapid and accurate testing of semiconductor diodes, has been published by Technitrol Engineering Co., 1952 E. Allegheny Ave., Philadelphia 34, Pa. Complete electrical and physical specifications are included along with prices.

Circle 183 on Inquiry Card, page 121

Component Packaging

Western Lithograph Co., 600 E. 2nd St., P. O. Box 2980 Term. Annex, Los Angeles 54, Calif., has made available to the electrical and electronic manufacturers a "Western Presentation" which shows unique means of packaging diodes, plugs, transistors, fuses, terminals and scores of other electronic components. The aid contains designs and procedures for the protection of their products in break-a-way, film and blister packages.

Circle 184 on Inquiry Card, page 121

Planning Aids

A 16-page booklet issued by Planoramics, 631 E. 1st St., Boston 27, Mass., describes their layout kits for offices, laboratories, production boards, planning boards, warehouse layouts, and templates for electronics. Samples are included in the booklet. The layout material is a form of plastic which adheres without adhesive. They may be removed and used hundreds of times.

Circle 185 on Inquiry Card, page 121

Electronic Hardware

A comprehensive reference manual of standard electronic hardware has been prepared by Amatom Electronic Hardware Co., Inc., 88 Drake Ave., New Rochelle, N. Y., to facilitate the selection and procurement of hardware by electronic equipment manufacturers. Prepared for convenient reference, the 75-page booklet pictures, diagrams, dimensions and lists thousands of sizes of more than a hundred different types of standard parts that are available directly from stock.

Circle 186 on Inquiry Card, page 121

Neoprene Jacketed Cable

Pacific Automation Products, Inc., 1000 Airway, Glendale 1, Calif., has just issued a multi-paged booklet which describes in detail bulk cable, cable assemblies, brakeout cable assemblies, underwater cables, high temperature cables which are custom designed neoprene jacket cables. Booklet is complete with photographs, electrical and mechanical specifications and Mil Spec numbers.

Circle 187 on Inquiry Card, page 121

Precision Power Supplies

The Electric Regulator Corp., Pearl St., Norwalk, Conn., has issued a technical bulletin describing their Series 2.050 Regohm-controlled precision power supplies. Complete electrical and mechanical specifications are included.

Circle 188 on Inquiry Card, page 121

Transistor Cooling

An 8-page catalog of retention and cooling devices for transistors and diodes is offered by the Birtcher Corp., 4371 Valley Blvd., Los Angeles 32, Calif. Brochure gives test results on diode radiator cooling units, as used on both metallic and phenolic chassis. Specifications on these components and a number of transistor clips and heat radiators (indexed by transistor type) are given.

Circle 189 on Inquiry Card, page 121

Epoxy Glass Laminates

A 21-page technical data manual containing test values and curves, plus specification data, on high reliability epoxy glass copper clad and unclad laminates for printed and other circuitry has been issued by the Mica Corp., 4031 Elenda St., Culver City, Calif.

Circle 190 on Inquiry Card, page 121

Toroidal Cores

A 12-page handbook for designers on the use of Genalex toroidal cores is available from Wallace E. Connolly & Co., P. O. Box 295, Menlo Park, Calif. Handbook covers such things as permeability, temperature coefficient of inductance, dc stability, core size and finish. Complete graphs and technical data on the loss characteristics of Genalex cores are presented. The handbook charts physical and electrical properties of these cores. Design notes on the use of toroidal cores are also included.

Circle 191 on Inquiry Card, page 121

Regulated Power Supplies

A 2-color, 16-page catalog, B-587, available from Kepco Laboratories, Inc., 131-38 Sanford Ave., Flushing 55, N. Y., describes in graph and tabular form their complete line of transistorized, vacuum tube type, and magnetic tubeless voltage regulated power supplies. Complete electrical and mechanical specifications are given along with photographs.

Circle 192 on Inquiry Card, page 121

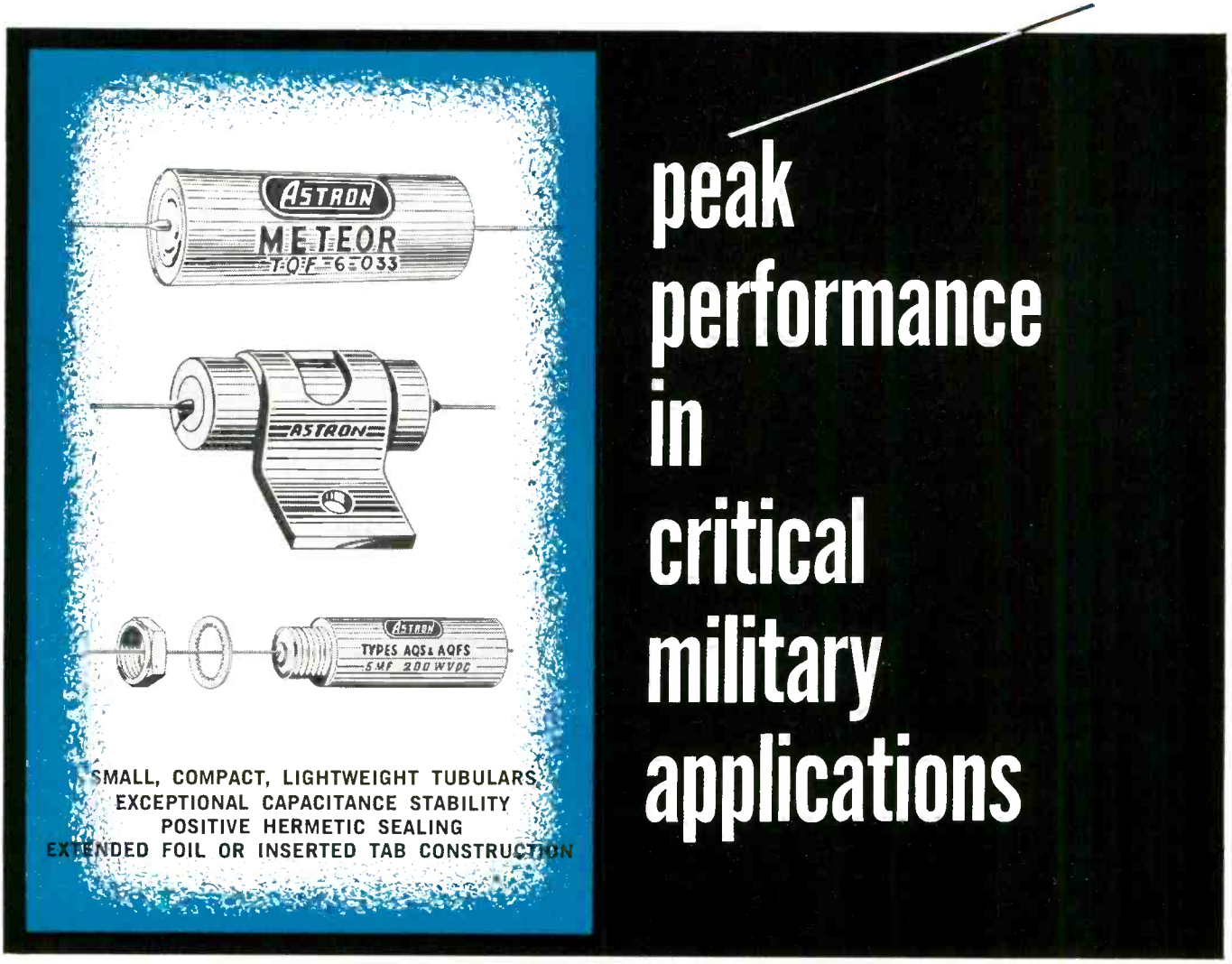
Research & Development

A 4-page brochure issued by Automation Dynamics Corp., 255 County Rd., Tenafly, N. J., describes their services available for development and construction of electronic equipment measurement, communication, computing and control. A brief outline of the facilities and thumb-nail sketches of the technical leaders are presented.

Circle 193 on Inquiry Card, page 121

(*Continued on page* 118)

QUALITY EXTRAS WITHOUT ADDED COST IS ONE REASON WHY ENGINEERS SELECT ASTRON METEOR* AQ & TQ SUBMINIATURE PAPER CAPACITORS FOR



PREMIUM VALUE AT NO PREMIUM PRICE

Astron types AQ and TQ Subminiature Paper Capacitors meet specification MIL C-25A. Their operating temperature range is from —65°C. to +125°C. without derating.

Astron has exceeded MIL requirements in critical trouble-source areas with these extras:

- **Superior Terminals** — rugged compression glass terminals eliminate cracks and breaks during operation.
- **Stronger Lead Wires** — hot tinned before assembly to ensure a perfect solder.
- **Exclusive Impregnant** — X-250 silicone base impregnant offers higher I.R., excellent capacitance stability and exceptionally high dielectric strength.
- **Dry Foil** — Astron requires that residual lubricant, necessary to foil processing, be completely removed. (Lubricant film may materially alter electrical characteristics.)
- **Complete Stamping** — for immediate identification Astron stamps not only the military number and the Astron commercial equivalent, but also voltage and capacity ratings.

Write today for complete technical information.

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ASTRON®

SKOTTIE ELECTRONICS CORPORATION
PECKVILLE, PENNSYLVANIA
MANUFACTURER OF QUALITY DISC AND TUBULAR CERAMIC CAPACITORS — SUBSIDIARY OF ASTRON CORPORATION

EXPORT DIVISION:
ROCKE INTERNATIONAL CORP.
13 EAST 40TH ST., N. Y., N. Y.

IN CANADA:
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6 ALCINA AVENUE
TORONTO, ONTARIO

ON THE WEST COAST QUICK DELIVERY OF ASTRON PRODUCTS IS AVAILABLE THROUGH AUTHORIZED ASTRON STOCKING DISTRIBUTORS.

*REGISTERED TRADEMARK

New Silicon Rectifier for Radio and TV Use

Developed by P. R. Mallory & Co. Inc., the new Type T encapsulated silicon rectifier has a diffused junction and is designed for 85°C ambient temperature. It produces several superior operating properties, including low reverse leakage current and low forward voltage drop.

In life testing of production samples, the new units have been operated above rated temperature in all typical rectifier circuits for periods in excess of 2,000 hours. No failures have occurred after 1,500,000 switching cycles, and operating characteristics have remained virtually unchanged from original values.

Encapsulation of the rectifier in a new type of coating compound gives unusually high stability under severe moisture and humidity conditions. Called "Mallo-Seal," this coating is a unique formula developed by Radio Materials Company, a Mallory division. The Mallory rectifiers using this seal have been tested under MIL-Std. 202A, Method 106, which calls for 240 hours of humidity cycling. The Mallory units have passed 1,000 hours of this test without failure. Rectifiers have also been subjected to 250 hours of exposure to boiling water, with power alternately on and off for 8 and 16 hour periods respectively, without showing appreciable deterioration of characteristics.

"New Transistor Design—The 'Mesa' "

Shortly after this article went to press in the Sept. 1958 issue of ELECTRONIC INDUSTRIES a communication was received from the author, C. H. Knowles, that certain of the technical specifications were incorrect and should be altered. They are as follows: under "Typical Characteristics," page 57, Collector capacities should read 0.8 $\mu\mu$f; Small Current Gain at 100 mcps should read 4; Small Signal Current Gain, hfe should read 10; and Base Connection Resistance, rb' should read 50 ohms.

Under "The 2N695" on page 60, all the switching speeds indicated should be in milli-microseconds. And in Fig. 12b, captions should read "Input Capacitance." Switching speed should be read as "10 milli-microsecs per division."

New Tech Data for Engineers

Coils, Transformers & Filters

Toroidal coils, filters, magnetic amplifiers, converters and transformers are covered in 25-page, 2-color Basic Catalog No. 858, from Communications Accessories Co., Lee's Summit, Mo. Included are prices of all units and descriptions of a new line of aircraft and transistor transformers.

Circle 161 on Inquiry Card, page 121

High Current Connector

Illustrated bulletin gives specifications, outline dimensions and general information on new Series C-2, two-contact hexagonal, high current connector. This miniature component is suitable for high altitude applications requiring a high breakdown voltage under critical environmental conditions. DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.

Circle 162 on Inquiry Card, page 121

Solid State Capacitor

"A Voltage Variable Capacitor" is a reprint, in booklet form, of a two-part article which describes in detail the unique new component for electronic equipment. This new component is an electronically variable, solid state capacitor. Pacific Semiconductors, Inc., 1041 West Jefferson Blvd., Culver City, Calif.

Circle 163 on Inquiry Card, page 121

Resistors Cartoons

As a sequel to its immensely successful folder "How Not to Use Transistors," General Transistor Corp., now makes available another idiot's delight entitled "How Not To Use Resistors." General Transistor Corp., 91-27 138th Place. Jamaica 35, N. Y.

Circle 164 on Inquiry Card, page 121

Silicon Rectifiers

Technical information is available from Sarkes Tarzian, 415 N. College Ave., Bloomington, Ind., which describes their new H series high reliability, low current silicon rectifiers. They feature an extra heavy duty silicon junction and hermetically sealed, welded case.

Circle 165 on Inquiry Card, page 121

UHF Transistor

A 2-color bulletin issued by Motorola Semiconductors, 5005 E. McDowell, Phoenix, Ariz., describes in complete detail their UHF Mesa transistor. Bulletin contains charts, graphs, outline drawings and specifications.

Circle 166 on Inquiry Card, page 121

Test Equipment

Panoramic Radio Products, Inc., 520 S. Fulton Ave., Mt. Vernon, N. Y. has just issued a 12-page, 2-color catalog digest which describes, in complete detail with photographs and specifications, their line of test equipment such as spectrum analyzers, microwave analyzers and telemetering instrument along with the available accessories.

Circle 167 on Inquiry Card, page 121

Synchro Test Equipment

A 6-page brochure has been issued by the Kearfott Co., Inc., 1378 Main Ave., Clifton, N. J., which describes in detail their complete line of synchro test equipment. Brochure contains electrical and mechanical specifications, photographs and tables.

Circle 168 on Inquiry Card, page 121

Magnetic Toggle Relay

A 4-page, 2-color bulletin issued by the American Electronics Co., 2801 27th Ave., N.E., Minneapolis 18, Minn., describes their new magnetic toggle relay. Relay is a polarized, bistable relay with a binary memory. Bulletin contains photographs, circuit diagrams, electrical and mechanical specifications.

Circle 169 on Inquiry Card, page 121

Wires and Cables

Wires and cables for aircraft, missiles, and rockets is the subject of a new 16-page publication No. 19-268 just issued by General Electric's Wire & Cable Dept., Bridgeport 2, Conn. The booklet contains a comprehensive listing of wires and cables which have armed service qualification approvals, meeting or exceeding the construction, test, and performance requirements of the armed services specifications as noted for each product.

Circle 170 on Inquiry Card, page 121

Variable Resistors

Chicago Telephone Supply Corp., Elkhart, Ind., has issued a bulletin which lists in tabular form their various types of variable resistors. Variable resistors listed meet Mil Specs.

Circle 171 on Inquiry Card, page 121

Phosphors

A new technical bulletin, "Sylvania CR-405 Phosphor," describing a blend of silver-activated zinc and zinc cadmium sulfides designed especially for use in aluminized television picture tubes, has been issued by Sylvania Electric Products, Inc., Towanda, Pa.

Circle 172 on Inquiry Card, page 121

Transistorized Circuits

Catalog No. TR-758 contains schematics of 29 Germanium Transistor Plug-In Circuits with specifications and 27 pages of circuit applications; schematics of 9 different Silicon Transistor Plug-In circuits with specifications; operating characteristics and applications on two typical Minisig Sensitive Indicators; price information—in fact, a total of 70 pages of valuable transistorized circuit information. Engineered Electronics Co., 506 E. First St., Santa Ana, Calif.

Circle 173 on Inquiry Card, page 121

Potentiometers

Bourns Laboratories, Inc., P. O. Box 2112, Riverside, Calif., has issued a technical bulletin which describes completely their line of high temperature humidity-proof Trimpots.

Circle 174 on Inquiry Card, page 121

Precision Electronic Equipment

A 2-color technical bulletin issued by Industrial Test Equipment Co., 55 E. 11th St., New York 3, N. Y., describes in short form their various lines of test equipment such as phase meters, null meters, impedance comparators, precision power oscillators, phase shifters, null detectors, frequency standards and automatic hipot testers.

Circle 175 on Inquiry Card, page 121

2-Channel Oscillograph

Fully described in a 4-page bulletin now available from Brush Instruments, Div. of Clevite Corp., 3405 Perkins Ave., Cleveland 14, Ohio, is a new and portable 2-channel oscillograph package, complete with built-in amplifiers—the Brush Mark II. It has been designed for applications normally considered impractical for direct writing recording of electrical and physical phenomena. The recording unit requires no additional equipment for operation and features push-button selection of 4 chart speeds.

Circle 176 on Inquiry Card, page 121

Gyro Information

A new 64-page illustrated Gyro Primer has been prepared that explains how gyros work, gyro terms, and gyro operating principles. Specifications for rate gyros, free gyros, directional gyros and compensated vertical gyros are also included. This easy-to-read booklet is complete with sketches and drawings. Ketay Dept., Norden Div., United Aircraft Corp., Commack, L. I., N. Y.

Circle 177 on Inquiry Card, page 121

Circle 64 on Inquiry Card, page 121 ⟶

SILICON RECTIFIERS

designed and manufactured to meet

THE NEW JAN SPECIFICATIONS

For AXIAL LEAD TYPES

JAN 1N538 (MIL-E-1/1084A)	JAN 1N540 (MIL-E-1/1085A)	JAN 1N547 (MIL-E-1/1083A)

now from AUTOMATIC

Maximum Values for AUTOMATIC Military Type Silicon Rectifiers designed to meet the new JAN MIL-E-1 Specification

Type No.	Peak Reverse Voltage (VDC)	DC Output Current @ 25° C. Ambient (MA)	DC Output Current @ 150° C. Ambient (MA)	Maximum Reverse Current* (MA)	Mounting	MIL-E-1 Technical Spec. Sheet No.
JAN 1N538	200	750	250	0.350	Axial lead	1084A
JAN 1N540	400	750	250	0.350	Axial lead	1085A
JAN 1N547	600	750	250	0.350	Axial lead	1083A

*Averaged over 1 cycle for inductive or resistive load with rectifier operating at full rated current at 150° C. ambients.

PRODUCTION QUANTITIES OF ALL TYPES AVAILABLE FOR FAST DELIVERY

Naturally, you can get these new axial lead JAN types direct from AUTOMATIC, and from authorized distributors throughout the country – and at prices that reflect General Instrument's years of volume production experience.

Together with the earlier JAN type stud mount group, AUTOMATIC now covers the entire medium power silicon rectifier field for the requirements of every military application.

More information? A complete set of data sheets is yours for the asking. Please write us today.

GENERAL INSTRUMENT SEMICONDUCTORS

General Instrument Corporation also includes F. W. Sickles Division, Radio Receptor Co., Inc., and Micamold Electronics Manufacturing Corporation (Subsidiaries)

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MASS PRODUCERS OF ELECTRONIC COMPONENTS

AUTOMATIC MANUFACTURING DIVISION OF GENERAL INSTRUMENT CORPORATION
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A COMPLETELY NEW *Concept* IN

BOBBINLESS RESISTORS*

New Subminiature Precision Wirewound Bobbinless Resistors feature exceptional stability, reliability and performance

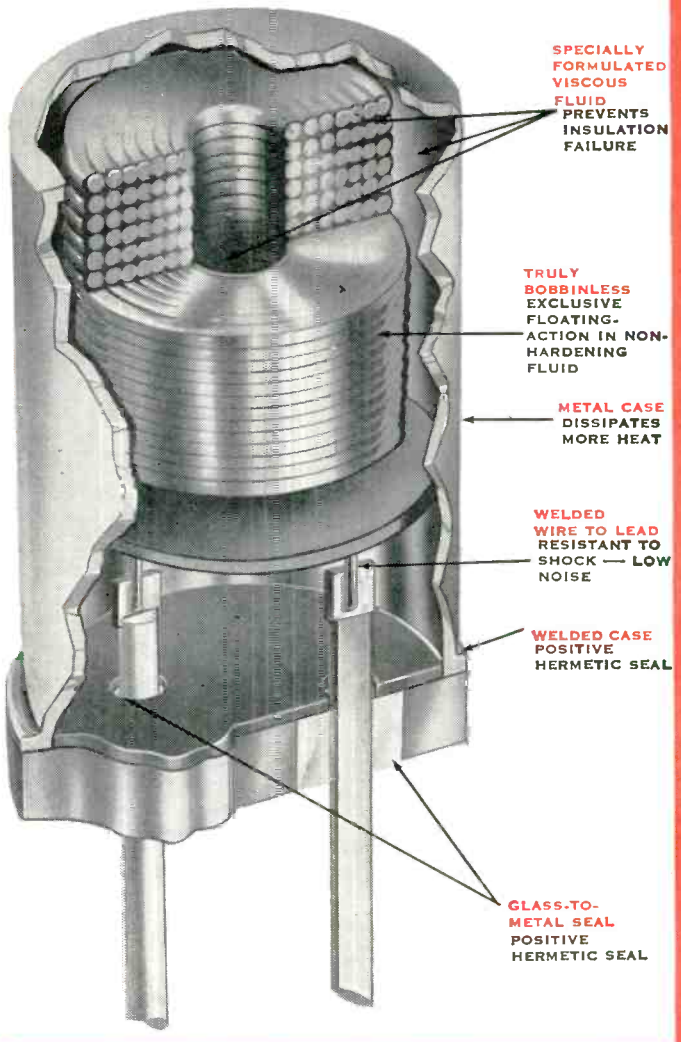
General Transistor has developed a new concept for precision bobbinless resistors incorporating these exclusive features . . . the bobbinless construction eliminates wire stress and strain . . . a special viscous medium is used providing extreme shock and vibration resistance . . . welded case for positive hermetic sealing . . . the temperature coefficient of resistance of the finished resistor is the same as the wire and is not affected by the container. This insures repeatability and minimum hysteresis of resistance characteristics with temperature cycling.

These positive hermetically sealed units are designed for printed circuit boards and subminiature assemblies for airborne and missile applications.

The quality of materials and production superiority of these resistors is the same that has made General Transistor the Fastest Growing Name in Transistors.

Write today for complete technical information.

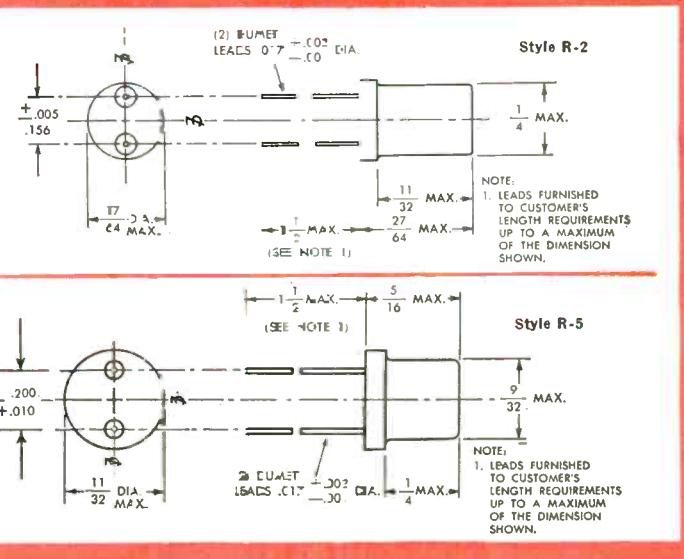
another QUALITY PRODUCT FROM GENERAL TRANSISTOR

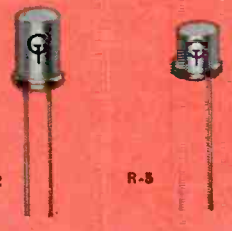


S P E C I F I C A T I O N S

	Style R-2	Style R-5
Resistance Range	0.1Ω to 750KΩ	0.1Ω to 750KΩ
Resistance Tolerance	±0.05% min. at 25°C	±0.05% min. at 25°C
Power Rating	¼ watt continuous in free air (increased dissipation possible with heat sink)	⅓ watt continuous in free air (increased dissipation possible with heat sink)
Temperature Range	—65°C to +125°C	—65°C to +125°C
Maximum Operating Voltage	250V DC	500V, DC
Temperature Coefficient of Resistance	±20 parts per million/°C	±20 parts per million/°C
Dielectric Strength	500V rms, winding to case	1000V rms, winding to case

Construction — Terminations — Welded





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*Pat. Pending.

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FOR EXPORT: GENERAL TRANSISTOR INTERNATIONAL CORP., 91-27 138TH PLACE, JAMAICA 35, NEW YORK

Circle 65 on Inquiry Card, page 121

GET THE FACTS!

USE THIS FREE READER SERVICE CARD

Keep up to date—get the facts about the new products and equipment as they hit the market. ELECTRONIC INDUSTRIES' advertisers will be glad to send you complete literature giving specifications and data relating to those products advertised in this issue. To help you, the new product items, new literature and advertisments in this issue are numbered consecutively, from the front to the back of the book. The extra cards are for the use of your associates with whom you share your copy of ELECTRONIC INDUSTRIES.

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Circle the item number, fill in your name, title, company; detach and mail.

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Please send me further information on the items I have circled below. 2

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CIRCLE THE NUMBERS OPPOSITE THE NAMES OF THE

3 Aetna Life Insurance Company—"Key man" insurance
78 Aircraft Radio Corp.—Ceramic insulated connectors
104 Alden Products Company — Tube cap connectors
128 Alford Manufacturing Co., Inc.—Automatic impedance plotters
132 Allen-Bradley Co.—Precision resistors and stand-off capacitors
83 Allied Radio—Electronic supply catalog
90 Alpha Wire Corporation—Custom electronic cables
10 American Lava Corporation—Alumina ceramics
24 Amperex Electronic Corp.—Twin tetrode tubes
18 Amphenol Electronics Corp.—Connectors
30 Arnold Engineering Company, The—Powder cores
62 Astron Corporation—Subminiature capacitors
111 Audio Devices, Inc.—Magnetic tape reel
98 Augat Brothers, Inc.—Component cradles & clips
114 Auricon Division, Berndt-Bach, Inc.—Sound-on-film recording cameras
64 Automatic Mfg. Division of General Instrument Corp.—Axial lead type rectifiers
92 Automatic Metal Products Corp.—Connectors
47 Barker & Williamson, Inc.—Bandpass filters
77 Birtcher Corporation, The, Industrial Div.—Diode radiators
107 Biwax Corp.—Potting compounds
110 Blaw - Knox Company — 85' diameter tracking antenna
99 Bliley Electric Co.—Crystals and components ovens
2 Bomac Laboratories, Inc. — Microwave tubes & components
106 Borg Equipment Division, The George W. Borg Corp.—Electronic components
109 Borg Equipment Division, The George W. Borg Corp.—Multi-turn precision potentiometers
19 Bourns Laboratories, Inc.—Potentiometers
74 Bruno-New York Industries Corp.—"Pig-tailoring" machine
7 Brush Instruments Division of Clevite Corporation—Recorder
73 Bulova Watch Co., Electronics Div.—Bandpass filter
22 Burnell & Co., Inc.—Crystal filters
34 Bussmann Mfg. Division McGraw-Edison Co.—Fuses and fuseholders
93 Caledonia Electronics and Transformer Corp.—Transformers
67 Centralab A Division of Globe-Union Inc.—Sub-miniature variable resistor
69 Chicago Standard Transformer Corporation—Voltage stabilizing transformers
80 Chicago Telephone Supply Corporation —Military & industrial variable resistors
57 Cinch Manufacturing Corporation—Power transistor sockets
5 Clevite Electronic Components Division of Clevite Corp.—High resolution magnetic heads
116 Connecticut Hard Rubber Co., The—Pressure sensitive TEFLON tapes
53 Corning Glass Works—Fixed glass capacitors
87 Cutler-Hammer, Inc.—Transistorized relay
28 Dale Products, Inc.—Power resistors
29 Dale Products, Inc.—Trimmer potentiometers
66 DeJur-Amsco Corp., Electronic Sales Div. —Sine-cosine potentiometers
39 Delco Radio Division of General Motors —High power transistors
118 Dialight Corporation—Sub-miniature pilot light
131 Dimco-Gray Company—Snapslide fasteners
68 Eitel-McCullough, Inc.—Ceramic Reflex klystrons
76 Electro Motive Mfg. Co., Inc.—Capacitors
79 Electronic Tube Corporation—Rack panel oscilloscope
23 Elgin National Watch Company, Electronics Div.—Sub-miniature relays
15 Engelhard Industries, Inc., American Platinum & Silver Div.—Silver plating process
16 Engelhard Industries, Inc., H. A. Wilson Div.—Metal for accurate temperature control
17 Engelhard Industries, Inc., Chemical Div.—Gas purification unit
9 Engineered Electronics Co.—Transistor plug-in circuits
14 Erie Resistor Corp., Electronics Div.—Ceramic condensers
96 Ferroxcube Corporation of America—Pre-adjusted filter cores
126 Filtors, Inc.—Micro-miniature relay
102 Fluke Manufacturing Co., Inc., John— D C Power supply & D C voltmeter
127 Freed Transformer Co., Inc.—Transformers
33 General Chemical Division, Allied Chemical Corp.—"Electronic Grade" chemicals
65 General Transistor Corporation—Bobbinless resistors
70 Graphic Systems—Visual control board
41 Greater San Antonio Development Committee—Electronic industrial opportunity
11 Hallamore Electronics Company—Closed circuit TV camera
58 Hoffman Electronics Corp., Semiconductor Div. — Zener magnetic logic module
122 Houston Fearless Corporation—TV camera pedestal
8 Hughes Products, Hughes Aircraft Company—Storage type oscilloscope
94 Illinois Condenser Company—Sub-miniature electrolytic capacitors
95 Illumitronic Engineering—Plastics for the electronic industry, cable wrap
36 Jennings Radio Manufacturing Corp.—Vacuum overload circuit breakers
81 Johnson Company, E. F.—Variable capacitors
117 Jones Division, Howard B., Cinch Manufacturing Corp.—Terminal strips
44 Kester Solder Company — Flux-core solder
26 Klein & Sons, Mathias—Midget pliers
48 Kleinschmidt Laboratories, Inc., A Subsidiary of Smith-Corona—Teletype
71 Kulka Electric Corp.—Terminal blocks
75 Lerco Electronics, Inc.—Insulated terminals, catalog
45 Magnetic Metals Company—Stamped and tape wound core parts
20 Minnesota Mining & Mfg. Co., Instrumentation Tape Div.—Instrumentation tape
59 Motorola, Inc., Motorola Semiconductors —Zener regulator diodes
50 Narda Microwave Corporation—Coaxial and Waveguide Instrumentation
55 Narda Ultrasonics Corporation, Subsidiary of Narda Microwave Corp.—Ultrasonic cleaners
49 National Lead Company—Solder specialists
38 National Vulcanized Fibre Co.—Copper clad Laminate, vulcanized fibre, nylon
86 Nems Clarke Company—Preamplifier-multicoupler
91 New Hermes Engraving Machine Corp. —Portable tracer-guided engraving machine
130 Onan & Sons, Inc., D. W.—Air-cooled electric plant
88 Panoramic Radio Products, Inc.—Sonic analyzers
112 Phelps Dodge Copper Products Corp.—Coaxial cable with protective jacket
1 Radio Materials Company—Subminiature disc capacitors
61 Radio Receptor Co., Inc., Subsidiary of General Instrument Corp.—Selenium rectifiers
115 Raytheon Manufacturing Co., Commercial Equipment Div.—Television Microwave relay systems

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ADVERTISERS IN THIS ISSUE

ADVERTISERS FROM WHOM YOU DESIRE FURTHER INFORMATION

13 Raytheon Manufacturing Co., Microwave & Power Tube Operations—Backward wave oscillators
42 Raytheon Manufacturing Co., Semiconductor Division — Diodes and rectifiers

PROFESSIONAL ENGINEERING OPPORTUNITIES

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

504 Fogg, Stewart K.—Personnel consultant, Administrative & engineering
506 Garrett Corporation, The—Engineering personnel
501 Hughes Aircraft Company—Engineering personnel
503 International Telephone & Telegraph Corp., Federal Electric Corp.—Engineering personnel
512 Martin Company, The — Engineering personnel
510 Melpar, Incorporated, A Subsidiary of Westinghouse Air Brake Co.—Engineering personnel
509 National Cash Register Company, The—Engineering personnel
507 National Company, The—Engineering personnel
508 Norden Laboratories, Norden Div., United Aircraft Corp.—Engineering personnel
511 Raytheon Manufacturing Co., Missile Systems Division—Engineering personnel
505 Republic Aviation—Engineering personnel
502 System Development Corp.—Engineering personnel

21 Reeves Soundcraft Corp.—Instrumentation tape for digital recording
113 Reeves Soundcraft Corp.—Motion picture film with pre-applied magnetic sound stripe
4 Revere Copper and Brass Incorporated—Rolled copper for printed circuits
100 Rheem Manufacturing Company, Electronics Div.—Universal meter
119 Rohn Manufacturing Co.—Communication tower
32 Sangamo Electric Company—Specialty filters
129 Sarkes Tarzian Inc., Broadcast Div.—Video level control unit
27 Sarkes Tarzian Inc., Rectifier Div.—Silicon rectifiers
125 Scintilla Division, Bendix Aviation Corporation—Connectors
124 Secode Corporation (formerly Electrical Communications, Inc.)—Selected control devices
105 Slip Ring Company of America—Guidance slip rings
40 Sperry Gyroscope Company, Electronic Tube Div.—S-band amplifier klystron
6 Sprague Electric Company—Resistors
58 Sprague Electric Company—High temperature capacitors
52 Stackpole Carbon Co., Electronic Components Div.—Slide switches
89 Stromberg-Carlson A Division of General Dynamics Corp.—Relay
31 Sylvania Electronic Products, Inc.—Switching transistors
54 Sylvania Electronic Products, Inc.—Electron tube news
60 Telechrome Mfg. Corp. — Telemetering transmitters
97 Templet Industries Incorporated—Progressive economy dies
35 Tensolite Insulated Wire Co., Inc.—Hook-up wire insulated with TEFLON
12 Tinnerman Products, Inc.—Live spring tension push-on nut

Employment—Use the handy card below to get more information on the engineering positions described in the "Professional Opportunities" Section which begins on page 169 of this issue.

Postcard valid 8 weeks only. After that use own letterhead fully describing item wanted. **OCT. 1958**

PROFESSIONAL ENGINEERING OPPORTUNITIES

Please send me further information on the engineering positions I have circled below.

501	506	511	516	521
502	507	512	517	522
503	508	513	518	523
504	509	514	519	524
505	510	515	520	525

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Name: ..... Position .....

Company Address: .....

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

Specific Products Manufactured .....

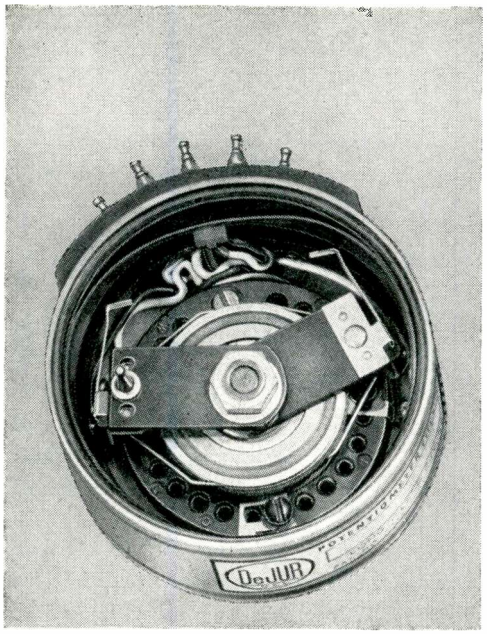
New Products and Technical Data—October '58

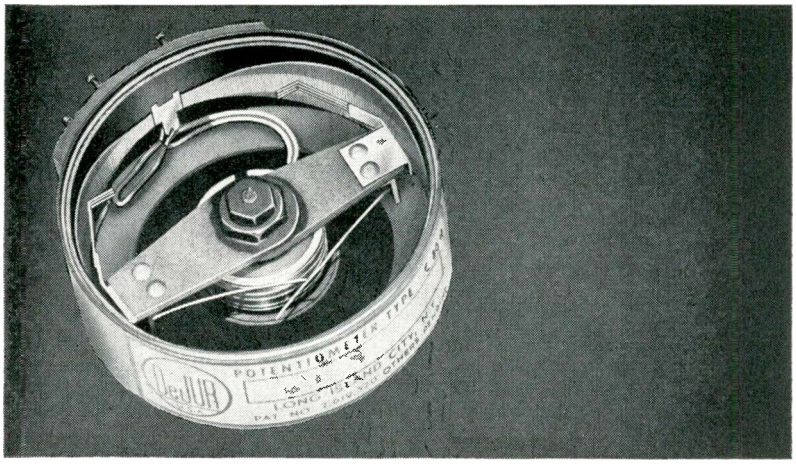
200 Capacitor, variable—E. F. Johnson Co.
197 Cartridge, stereo—Electro-Voice, Inc.
226 Ceramics—American Lava Corp.
231 Communications power package—General Electric Co.
218 Connector, arm & safe—The Deutsch Co.
201 Filters, crystal—Bulova Watch Co.
196 Filter, 4-section—Airtron, Inc.
212 Display, 90° in-line—Industrial Electronic Engineers
233 Instrumentation—Arnoux Corp.
229 Loudspeaker—Atlas Sound Corp.
204 Meter, panel—Triplett Electrical Instrument Co.

208 Meter scale drawing—Sensitive Research Instrument Corp.
228 Network, transmitter—Kahn Research Labs., Inc.
213 Pliers, midget—Klein & Sons
214 Plugs, banana—Goe Engineering Co.
222 Plugs, miniature—Cannon Electric Co.
217 Power supply, dc lab.—Westinghouse
203 Ratiometer, universal — F-R Machine Works
209 Recorder, airborne — Aerophysics Development Corp.
205 Rectifiers, power—IT&T
206 Rectifier, silicon—Fansteel Metallurgical Corp.
211 Relay, l-f cut-off—G-V Controls, Inc.
210 Relay, miniature—Babcock Radio Engineering
207 Resistors—Sprague Electric Co.
216 Resistor, precision—Ohmite Mfg. Co.
225 Soldering iron—Weller Electric Corp.
232 Stabilizer, voltage—Acme Electric Corp.
199 Standards, laboratory—Heath Co.
230 Strobe, tape—Scott Instrument Labs.
234 Switches, rotary—The Daven Co.
202 Switch, sampling—Applied Science Corp.
221 Timer, magnetic—Bendix Aviation Corp.
220 Transducer—Ultradyne, Inc.
224 Transformers, transistor — Chicago Standard Transformer Corp.
198 Transistors, power — Bendix Aviation Corp.
223 Transistors, power—CBS-Hystron
219 Tube, cathode-ray—A. B. DuMont Labs.
215 Tube, display storage—RCA
194 Tubes, frame grid—Amperex Electronic Corp.
195 Tubes, image orthicon — Westinghouse Electric Corp.
227 VTVM—Hewlett-Packard Co.

NEW TECH DATA

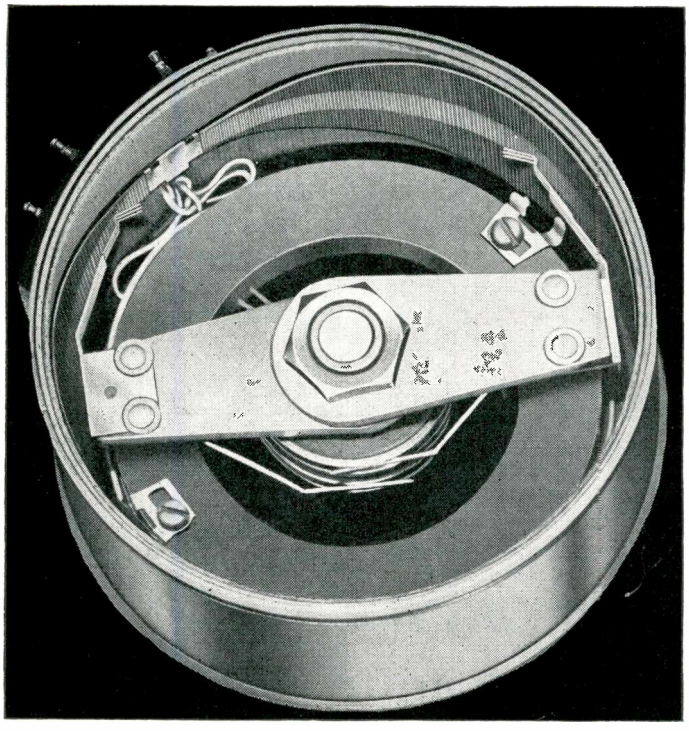
187 Cable, Neoprene Jacketed—Pacific Automation Products, Inc.
163 Capacitor, Solid State—Pacific Semiconductors, Inc.
164 Cartoons, Resistors—General Transistor Corp.
173 Circuits, Transistorized — Engineered Electronics Co.
161 Coils, Transformers & Filters—Communications Accessories Co.
162 Connector, High Current—DeJur-Amsco Corp.
191 Cores, Toroidal—Wallace E. Connolly & Co.
180 Counters, Decade—Burroughs Corp.
175 Equipment, Precision Electronic—Industrial Test Equipment Co.
177 Information, Gyro—Ketay Dept. Norden Div. United Aircraft Corp.
186 Hardware, Electronic — Amatom Electronic Hardware Co., Inc.
190 Laminates, Epoxy Glass—Mica Corp.
176 Oscillograph, 2-Channel—Clevite Corp.
184 Packaging, Component—Western Lithograph Co.
172 Phosphors—Sylvania Electric Products
185 Planning Aids—Planoramics
188 Power Supplies, Precision—Electric Regulator Corp.
192 Power Supplies, Regulated—Kepco Laboratories, Inc.
174 Potentiometers — Bourns Laboratories, Inc.
183 Tester, Diode—Technitrol Engineering Co.
167 Test Equipment—Panoramic Radio Products, Inc.
168 Test Equipment, Synchro—Kearfott Co., Inc.





NEW DeJUR SINE-COSINE POTENTIOMETERS

achieve exceptional functional conformity



Unique design and production techniques make it possible for DeJUR to offer sine-cosine function accuracies previously unknown in wire-wound potentiometers.

The new line includes 1⅞" and 2" diameter units with standard function accuracies of 0.5% peak-to-peak. BOTH ARE AVAILABLE WITH 0.25% ACCURACIES ON SPECIAL ORDER. Also available is a 3" diameter unit in the same group with standard peak-to-peak conformity of 1%; or 0.5% on special order.

All DeJUR Sine-Cosine Potentiometers are fully enclosed, self-contained units with independent brush contacts 90° apart and mounted on a common shaft, to produce accurate sine-cosine voltages. Any practical number of ganged units are available with individual sections in simultaneous function or other conformity.

For complete details on DeJUR potentiometers write today to Electronic Sales Division, DeJUR-Amsco Corporation, 45-01 Northern Boulevard, Long Island City 1, New York.

You're always sure with

DeJUR

ELECTRONIC COMPONENTS

Manufacturers of precision potentiometers for over thirty years

Circle 66 on Inquiry Card, page 121

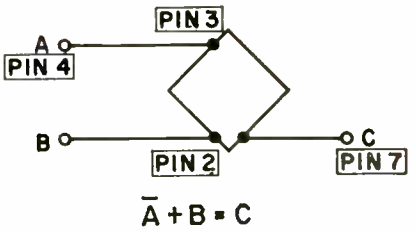


Fig. 2: The basic logic configuration.

Plug-In Logic

(*Continued from page* 93)

modules may be used and any number of additional "A" inputs from AZ100 modules may be used.

The logic configuration in Fig. 3 is an "OR" circuit. The three diodes of an OZ100 module are connected to pin 2 of an NZ100 module to set-up this circuit. The

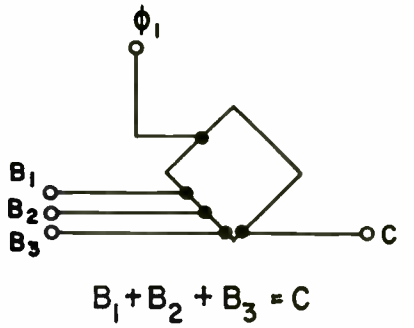


Fig. 3: Configuration for an "OR" ckt.

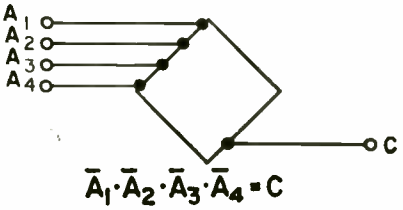
circuit waveshapes illustrate the "Boolean" expression $B_1+B_2+B_3=C$, for the circuit operation.

The logic configuration in Fig. 5 is a "NOT-AND" circuit. The three inputs A_2, A_3, and A_4, are the diodes of an AZ100 module, connected to pin 3 of an NZ100 module.

Simply by manipulating jumpers, the designer can now free himself from circuitry involvement and concentrate on logic development.

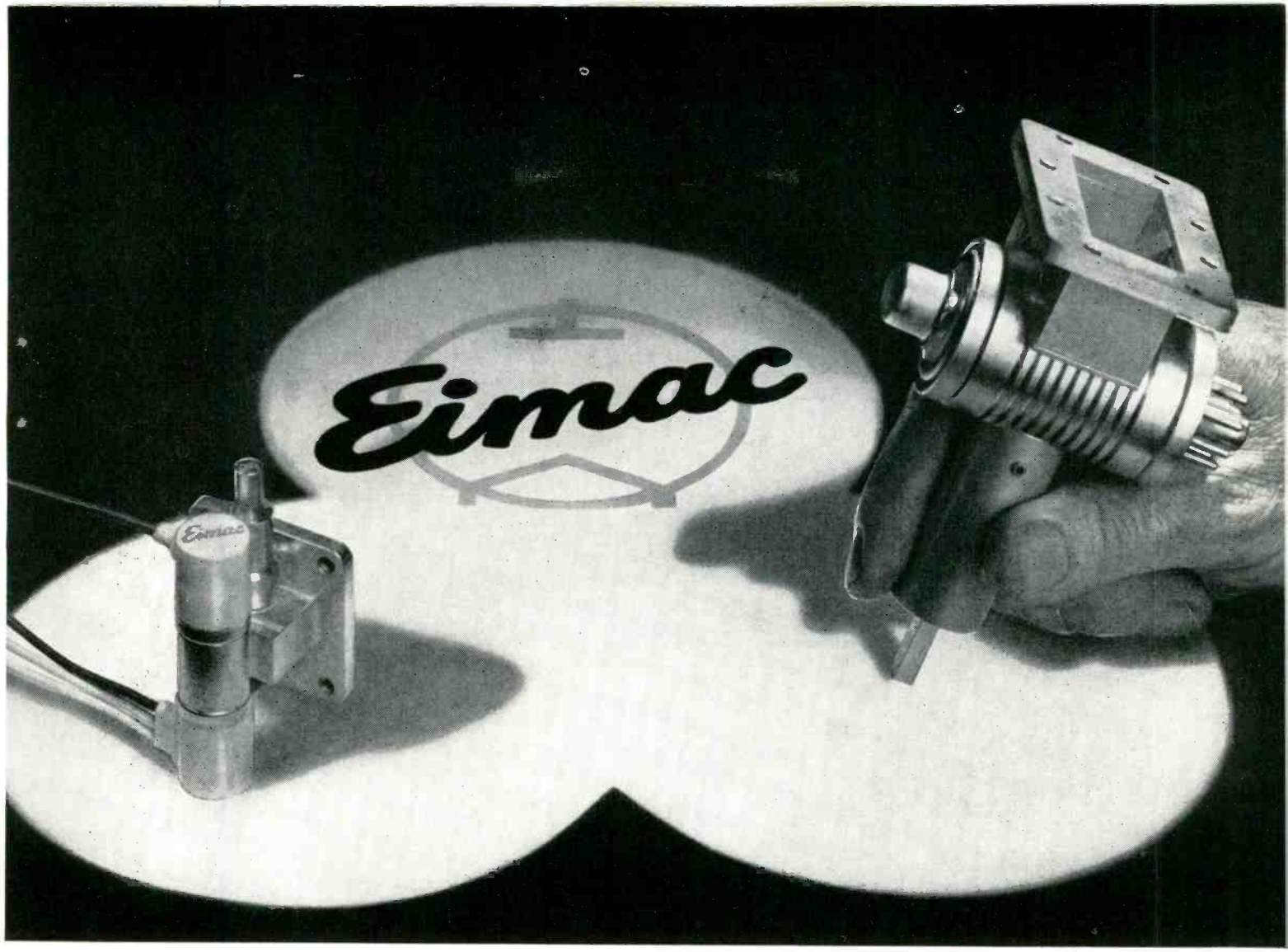
In cascading NZ-100 modules, alternate phases are connected to alternate modules, so that the input and output are out of phase.

Fig. 4: "NOT-AND" logic configuration.



Circle 67 on Inquiry Card, page 121

Circle 68 on Inquiry Card, page 121 ⟶



1K20 Series X and K Band Klystron (left)
1K125C Series C Band Klystron (right)

Eimac Announces...

Six New Ceramic Reflex Klystrons

Two important frequency ranges in the C, X and K bands are now covered by Eimac ceramic reflex klystrons. Eimac's advanced stacked ceramic design gives these tubes exceptional ruggedness and frequency stability.

The four new tubes of the 1K20 series cover 8500 to 11,700 Mc. at power levels to 50 milliwatts. These tubes are specifically designed for use in the severe vibration and temperature environment of air-borne and missile radar systems. They will withstand vibration levels of 15G in any reference plane with less than 100 kilocycle frequency deviation. Rated for use at any altitude, the 1K20 series tubes are conservatively rated at +250°C seal temperature. A new non-contacting, non-microphonic tuner permits noise-free tuning of the tubes through their complete ranges. Low beam voltage requirement and simple radiation cooling minimize the weight and complexity of associated equipment.

Two new C-band tubes comprising the 1K125 series cover 3700 to 5000 Mc. Power levels up to 2 watts make these tubes ideal for reliable broadband point-to-point communication. Tuning by dielectric slug rather than variable RF gap avoids sensitivity to shock and vibration. Integral-finned cooler and higher operating temperature ratings minimize cooling requirements.

Eimac know-how in the field of ceramic-metal tube design now brings compactness, ruggedness, high performance and reliability to these important microwave frequencies.

For further information request a copy of the brochure "A New Line of Eimac Reflex Klystrons"

EITEL-McCULLOUGH, INC.

SAN CARLOS, CALIFORNIA

Cable Address: EIMAC, SAN CARLOS

Eimac First for ceramic reflex klystrons

Eimac®

GENERAL CHARACTERISTICS

Type	Freq. Range Mc.	Beam Voltage	Power Output Range	Reflector Voltage
1K125CA	3700-4400	1000 Vdc	1.5 to 2.0 W	0 to —500 Vdc
1K125CB	4400-5000	1000 Vdc	2.0 to 2.3 W	0 to —500 Vdc
1K20XS	8500-9300	300 Vdc	25 to 50 mW	0 to —250 Vdc
1K20XK	9200-10,000	300 Vdc	25 to 50 mW	0 to —250 Vdc
1K20XD	10,000-10,800	300 Vdc	25 to 50 mW	0 to —250 Vdc
1K20KA	10,700-11,700	300 Vdc	25 to 50 mW	0 to —250 Vdc

Electronic Refrigerator

(*Continued from page* 93)

reductions and heighten operating efficiency in electronic equipment now using thermally-sensitive components. As an example, he pointed to the present method of cooling infrared sensors by liquid nitrogen, noting that the Peltier refrigerator will permit the same function to be performed with greater reliability and much smaller equipment volumes. One version of the Nortronics device without envelope is only ¼ in. square x 1¼ in. long.

According to Grier, the Peltier refrigerator principle has a vast potential for both military and commercial applications. It is possible, he said, to cascade Peltier units to obtain unusually high levels of refrigeration. While the present Nortronics unit has been designed for use with infrared seeker heads for guided missiles, advanced research is being conducted at Nortronics for application of the principle to high capacity cooling. While it is not now possible to apply the principle to the home refrigerator, because of the scarcity of the rare metals used in forming the hot and cold junctions, Grier said that this is a distinct possibility for the future.

Bendix Transistors

The 1958-59 Germanium and Silicon Transistor Specifications in the June All-Reference Issue of Electronic Industries listed the technical specifications on some 14 transistors manufactured by Bendix Semiconductor Products. Bendix advises that their line is considerably larger, and that the following transistors should also be included:

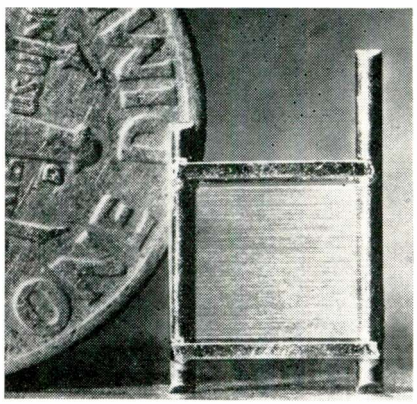
2N234, 2N420A, 2N1009, 2N1031B, 2N234A, 2N421, 2N1029, 2N1031C, 2N235A, 2N677, 2N1029A, 2N1032, 2N235B, 2N677A, 2N1029B, 2N1032A, 2N236A, 2N677B, 2N1029C, 2N1032B, 2N236B, 2N677C, 2N1030, 2N1032C, 2N285A, 2N678, 2N1030A, B-113, 2N400, 2N678A, 2N1030B, B-159, 2N418, 2N678B, 2N1030C, B-177, 2N419, 2N678C, 2N1031, B-178, 2N420, 2N1008, 2N1031A, B-179.

A revised, composite listing of all Bendix transistors, together with technical specifications, is available from Reader Service Dept., ELECTRONIC INDUSTRIES, 56th & Chestnut Sts., Phila. 39, Pa.

New Products

FRAME GRID TUBES

Two new type TV tubes (type 6ES8 and type 6DJ8) incorporating the frame grid construction are available. The use of these tubes will make possible an increase in effective

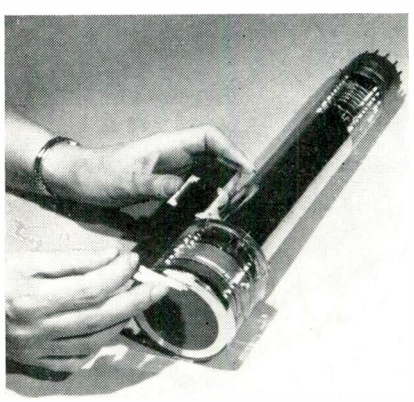


TV signal reception area of up to 35% over what is now attainable. Low noise is the outstanding feature of these tubes. Amperex Electronic Corp., 230 Duffy Ave., Hicksville, Long Island, N. Y.

Circle 194 on Inquiry Card, page 121

IMAGE ORTHICON TUBE

A rugged image orthicon tube (WL-7198) for military, industrial and scientific applications subject to extreme environmental conditions of shock, vibration, temperature and humidity is available. It operates throughout range of vibration specified in MIL-E-5272A. At 5 G's acceleration (50 to 500 cps), horizontal resolution is at least 350 lines with $3x10^{-2}$ ft-candles illumination on the photocathode. 250 lines horizontal



resolution may be obtained with 0.0003 ft-candles illumination on the photocathode. Westinghouse Electronic Tube Div., P. O. Box 284, Elmira, N. Y.

Circle 195 on Inquiry Card, page 121

New Products

ROTARY SWITCHES

A standard line of high speed rotary switches is available. A typical switch of this nature, illustrated, is a double rotor unit with 80 contacts/-pole. This specific switch can be operated at speeds up to 600 rpm with a minimum life of 1500 hours. Physically, this unit is 4½ in. in dia. and 2½ in. in depth. It has make-before-break action and cannot bridge 2 contacts for more than 1° of rotation. The bridging tolerance is ±½°. Voltage between contacts is 10 v. max., and current rating is 10 ma. in this particular application, although higher ratings are available. The Daven Co., Livingston, N. J.

Circle 234 on Inquiry Card, page 121

Signal Corps Contract Awarded To Sylvania

A $2.6 million research and development contract has been awarded to Sylvania Electric Products Inc.'s electronic defense laboratory by the U. S. Army Signal Research & Development Laboratory, Ft. Monmouth, N. J.

The contract is for continuation of development work in electronics but because of the high security classification of the contract no further details can be given.

Missile Market Info

Missile market services are being offered by the Association of Missile & Rocket Industries at the introductory rate of $100 for the rest of the year. This includes the Missile Salesmen's Guide, listing the work of 200 main contractors, with plant locations and key names.

AMRI is at 1079 National Press Bldg., Washington 4, D. C.

New Products

4-SECTION FILTER

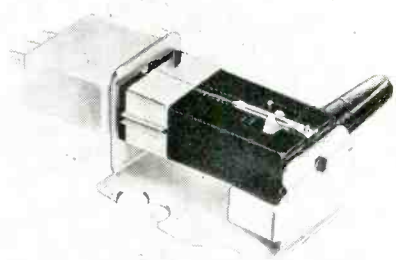
The multi-element single-knob tunable filter is for interference reduction and spectrum control in radar systems. Preselector filter offers high selectivity and precise gang-tuning of

its 4 sections. The maximally flat design utilizes quarter-wave aperture couplings between cylindrical Invar cavities. These cavities are operated in the low-loss circular TE_{on} mode, with non-contacting choke-type plungers as tuning elements. The design can be modified to handle high peak powers as a spectrum limiting filter. Airtron, Inc., 1096 W. Elizabeth Ave., Linden, N. J.

Circle 196 on Inquiry Card, page 121

STEREO CARTRIDGE

The PZT Magnetic Stereo Cartridge eliminates the problem of electro-magnetic hum pickup which is characteristic of conventional magnetic cartridges. It features 13 mv. output. All models have a replaceable stylus. Stylus assembly simply snaps in or out without the use of tools. It is totally compatible with all monaural and stereo records. Available in four models with diamond and sapphire stylii in turnunder and fixed type cartridges. Electro-Voice, Inc., Buchanan, Mich.

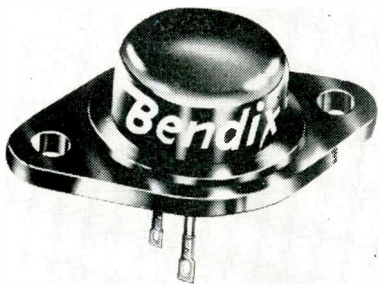


Circle 197 on Inquiry Card, page 121

New Products

POWER TRANSISTORS

Two new series of high current power transistors with typical current gains of 40 and 75 at 10 a. are now in production. These transistors have a maximum collector current

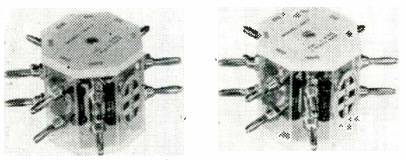


rating of 15 a. The transistors have collector-to-emitter breakdown voltage ratings of 30, 40, 70, and 80 v. to eliminate burnout in high voltage applications. The corresponding collector-to-base breakdown ratings are 20 volts higher. The transistors are supplied in the standard power transistor package with soldering lugs, straight pins or flying leads. Semiconductor Products, Bendix Aviation Corp., Long Branch, N. J.

Circle 198 on Inquiry Card, page 121

LABORATORY STANDARDS

These units are designed for calibrating, or checking calibration of various laboratory instruments, such as ohmmeters, capacity meters, impedance bridges, and other measurement equipment. They are also handy in substitution tests to determine unknowns in circuits where precision components were necessary. The lab



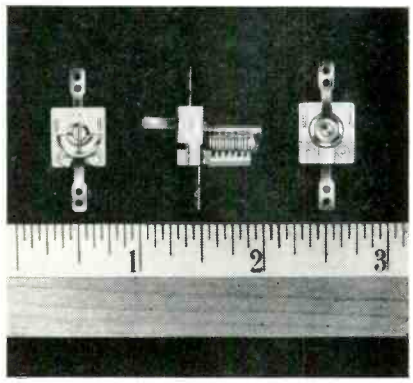
standards are comprised of 4 separate units, 2 resistive and 2 capacitive, each containing 7 accurate precision standards. Heath Co., 305 Territorial Rd., Benton Harbor, Mich.

Circle 199 on Inquiry Card, page 121

New Products

VARIABLE CAPACITOR

Type "U" sub-miniature air variable capacitor requires less than 0.2 sq. in. for chassis or panel mounting. The rotor and stator are machined from one piece of solid brass provid-

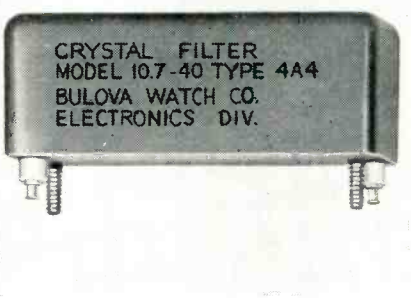


ing mechanical stability and uniformity. It is designed to provide long, trouble-free life and absolute freedom from moisture entrapment found in trimmer capacitors of the enclosed or solid dielectric type. All metal parts are silver plated. Breakdown ratings to 1,300 vdc. E. F. Johnson Co., Waseca, Minn.

Circle 200 on Inquiry Card, page 121

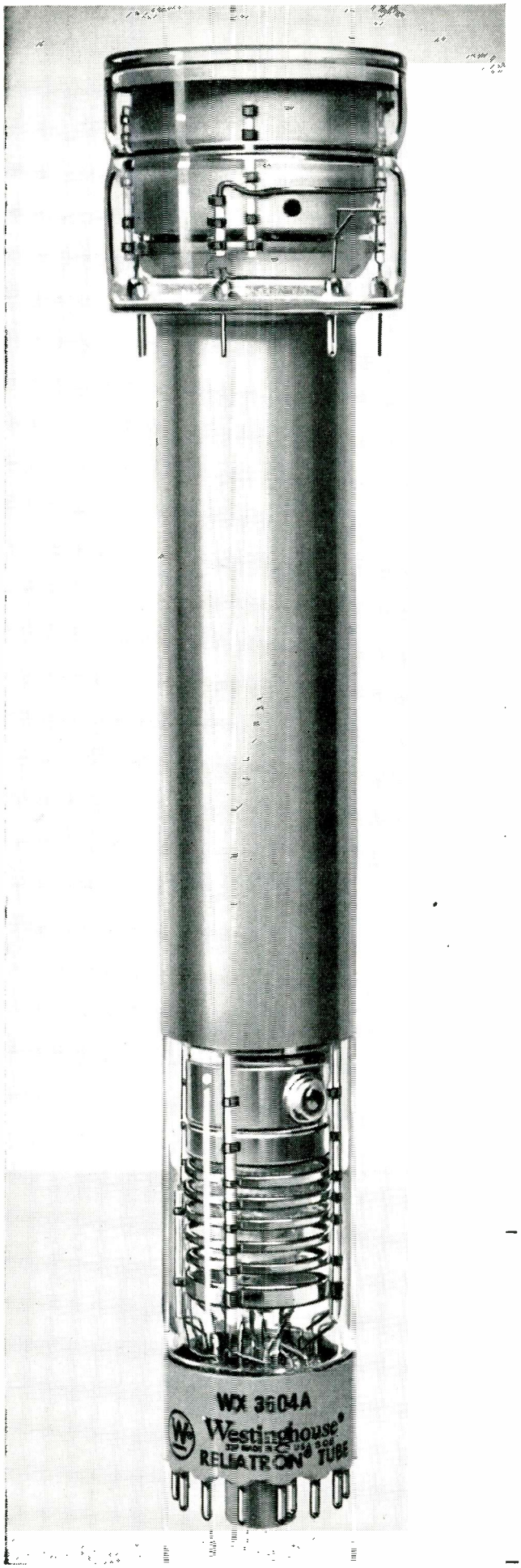
CRYSTAL FILTERS

Five bandwidths are available in the new "A" Series 10. 7 MC Crystal Filters now being manufactured. These bandwidths at the 3db points are 15 kc, 20 kc, 30 kc, 40 kc, and 50 kc wide, with shape factor to the 60db points better than 2:1. The miniature size, hermetically sealed filters



find application as i-f filters, carrier pickoffs, in telemetering, personal message signaling service and radar. Bulova Watch Co., Electronics Div., P-1003, Woodside 77, N. Y.

Circle 201 on Inquiry Card, page 121



New Ruggedized Westinghouse Image Orthicon!

DURABLE NEW WL-7198 WITHSTANDS SEVERE ENVIRONMENTAL CONDITIONS, SHOWS NO DEGRADATION AFTER 30 G'S!

Now Westinghouse has developed an image orthicon tube that's rugged enough to withstand 30 g's . . . yet sensitive enough to perform efficiently at low light levels. The new WL-7198 is ideal for military, industrial and scientific applications subject to extreme environmental conditions.

TYPICAL CHARACTERISTICS OF THE WL-7198 ARE:

Vibration: (1) Operable throughout MIL-E-5272A Procedure I (10 g's from 50 to 500 cps)
(2) 350 lines horizontal resolution at 5 g's from 50 to 500 cps with 3×10^{-2} foot-candles on photocathode.

Shock: No degradation after 30 g's.

Low light level performance: 250 lines minimum resolution 3×10^{-4} foot-candles on photocathode.

Sample quantities of the WL-7198 are available for immediate delivery.

WESTINGHOUSE ENGINEERS WILL HELP YOU SOLVE YOUR IMAGE ORTHICON PROBLEMS UPON YOUR REQUEST.

YOU CAN BE SURE...IF IT'S

Westinghouse

Please send me complete information on the new Westinghouse WL-7198.

NAME_____

ADDRESS_____

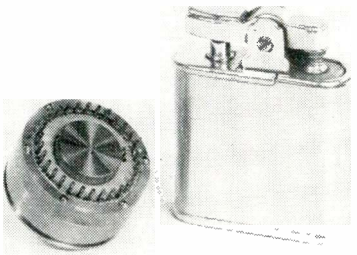
Send to: Westinghouse Electric Corporation, Electronic Tube Division, Elmira, New York.

Circle 150 on Inquiry Card, page 121

New Products

SAMPLING SWITCH

The Miniplexer is a small rotary sampling switch that promises to contribute significantly to the reduction of weight, size and power requirements in airborne and ground-based

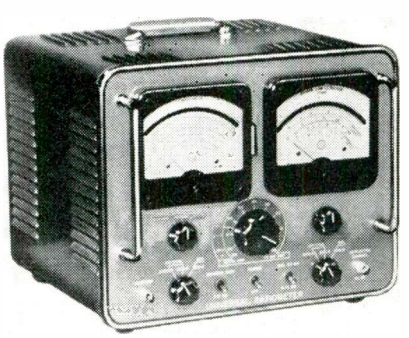


electronic systems. This tiny time-division multiplexing device provides greater service free life, reliability and a wider range of environmental operating conditions. The Miniplexer weighs 2.37 oz. and is ¾ in. long and 1¼ in. in diameter. It has 60 contact pins for 30 channels of make-before-break operation. Applied Science Corp. of Princeton, P. O. Box 44, Princeton, N. J.

Circle 202 on Inquiry Card, page 121

UNIVERSAL RATIOMETER

B811A Universal Ratiometer incorporates both a ratiometer and a VSWR amplifier in one compact package by use of printed wiring construction. Built-in input transformers provide increased sensitivity for more accurate measurements. For convenience, VSWR, DB, and reflection coefficient scales are supplied and either bolometer or crystal operation is available. A special two-cycle



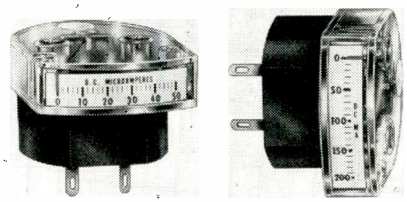
precision logarithmic front panel meter allows for VSWR reflectometer readings of 1.02 to infinity on 2 ranges. F-R Machine Works, 26-12 Borough Place, Woodside 77, N. Y.

Circle 203 on Inquiry Card, page 121

New Products . . . for the Electronic Industries

PANEL METER

Model 120 miniature meter will fit into even the most restricted area—yet gives the readability, performance and reliability expected from the conventional 2½ in. sizes. Weighing 4 oz.,

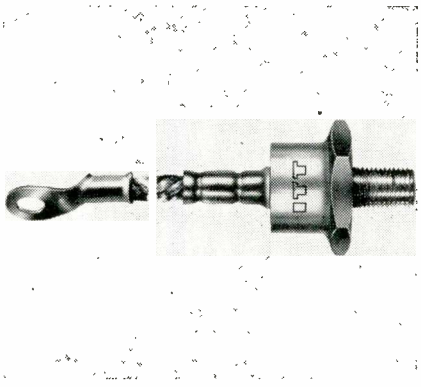


it also is of value to the user who has a weight limitation factor. It fits a panel hole 9/16 x 1 11/16 in. Although primarily developed for use on complex, crowded panels, edgewise meters have an appealing modern simplicity of design. Meter incorporates a self-shielded Bar-Ring magnet, and is not affected by magnetic panels. The Triplett Electrical Instrument Co., Bluffton, Ohio.

Circle 204 on Inquiry Card, page 121

POWER RECTIFIERS

A line of diffused-junction silicon power rectifiers rated from 5 to 70 a. at a case temperature (with normal convection-cooling) of 150°C. is available. These ratings can be increased by forced air cooling and apply at peak inverse ratings up to 800 v. The rectifiers feature standard and proposed JETEC case designs using ¼ in.-28 studs up to 20 amperes and ⅜ in. - 24 studs for higher currents, true dual hermetic seal, very low for-

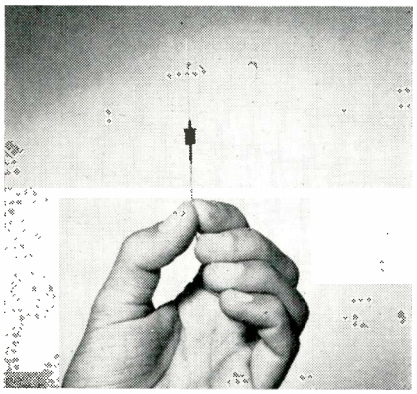


ward drop and low reverse current. They meet military specifications. International Telephone & Telegraph Corp., 100 Kingsland Rd., Clifton, N. J.

Circle 205 on Inquiry Card, page 121

SILICON RECTIFIER

A series of 10 new silicon rectifiers is available. These rectifiers are rated at a maximum dc output current (at 50°C ambient) of 750 ma., which is two and one-half times the

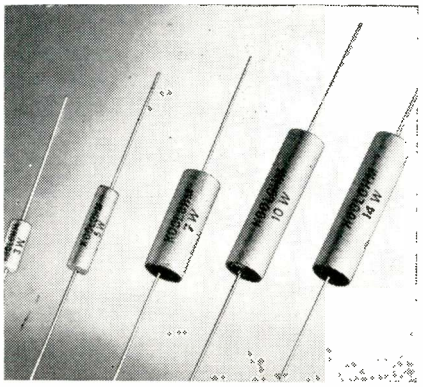


current rating of Type 2A rectifiers with no increase in size. Known as Type Number One, they are 7/32 in. diameter by 19/64 in. long, exclusive of leads. The 10 rectifiers are rated in steps from maximum peak reverse voltage of 50 v. to 600 v. inclusive. Maximum full load forward voltage drop (full cycle average at 150°C) is ½ v. Fansteel Metallurgical Corp., North Chicago, Ill.

Circle 206 on Inquiry Card, page 121

RESISTORS

Axial-lead Koolohm Resistors with improved performance characteristics are available. A new tiny 3 w. unit and a reduced size 5 w. unit will be of especial interest to equipment designers. In addition, a 7 w. resistor, which is the size of the previous 5 w. Koolohm, a 10 w. rating, and a new 14 w. rating, which is the same size as the 10 w. rating but with limited resistance values, complete the line. Wirewound resistors are furnished in

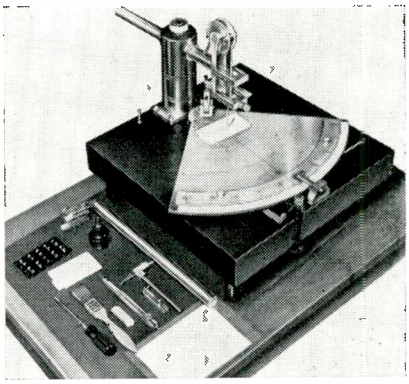


standard and non-inductive constructions. They operate at "hottest-spot" temperatures up to 350°C. Sprague Electric Co., 233 Marshall St., North Adams, Mass.

Circle 207 on Inquiry Card, page 121

METER SCALE DRAWING

The SCAMA scale-drawing machine is a hand-operated device which will allow the redrawing of any flat electrical indicating instrument's scale. By redrawing the scale, any



instrument may be returned to service within its original accuracy, thus eliminating calibration curves. In thermocouple instruments, the scale can be redrawn to match inexpensive uncalibrated thermal elements. Special scales are readily drawn. It will either completely draw or redraw any or part of any scale. Sensitive Research Instrument Corp., 310 Main St., New Rochelle, N. Y.

Circle 208 on Inquiry Card, page 121

AIRBORNE RECORDER

A recoverable 25-Channel On-Board Digital Tape Recorder designed for use in missile and air-borne test vehicles has been developed. Although primarily designed for missile instrumentation, this unit is readily adaptable to commercial applications. It requires a minimum of pre-flight checkout and maintenance and provides a large amount of data after recovery. With no antennas to complicate missile design the

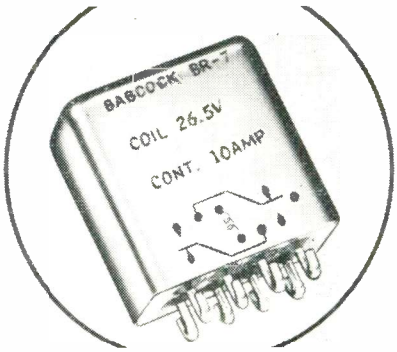
recorder requires less than 65 cu. in. As a complete on-board recording system, it ties up no ground facilities. Aerophysics Development Corp., P. O. Box 689, Santa Barbara, Calif.

Circle 209 on Inquiry Card, page 121

New Products

MINIATURE RELAY

Miniaturization in power relays. The magnetic structure and diversity of contact configuration provides single design for a wide variety of applications. Coil power from 480mw for



10 amp. contacts through 80 mw for 2 amp. contact to 50mw for dry circuit requirements. Rated: —65°C. to 125°C. 100 G. shock—30 G. 10-2000 Cycles vibration resistance. The BR-7 meets or exceeds MIL R-5757C and MIL R-25018. Babcock Radio Engineering, 1640 Monrovia Ave., Costa Mesa, Calif.

Circle 210 on Inquiry Card, page 121

L-F CUT-OFF RELAY

Automatic protection of electronic equipment against damage due to low supply frequencies is provided by a new Frequency Sensing Relay, Model BS-5003. The unit consists of a high-pass filter feeding a thermal sensing relay. The thermal relay disconnects the protected equipment from the line only after the low frequency condition has existed long enough to be significant. It responds quickly to a large drop, but tolerates a minor de-

viation much longer. Thermal relays with time constants from 6 sec. to several minutes are available. G-V Controls Inc., 28 Hollywood Plaza, East Orange, N. J.

Circle 211 on Inquiry Card, page 121

New Products

90° IN-LINE DISPLAY

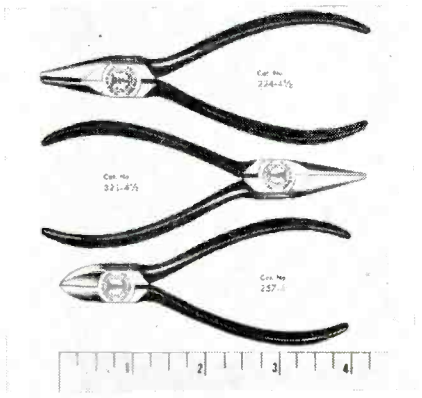
A new 90° In-Line Display is available. It offers the same features as the standard In-Line Display but with the added convenience of erect position where depth space is a factor.

This readout unit will display any number 0 through 9, a plus or minus symbol, or any combination thereof. In addition, it may be used in annunciator applications where data such as TEST, TEMP, STOP, etc., is desired. Industrial Electronic Engineers, 3973 Lankershim Blvd., N. Hollywood, Calif.

Circle 212 on Inquiry Card, page 121

MIDGET PLIERS

A line of midget pliers designed for delicate work in confined space, such as model building, wiring amplifiers or electronic assemblies, etc., is available. These pliers measure from 4 to 4½ in. long and are of high quality. Four models of midget pliers are available: 257-4 oblique cutting plier, 321-4½ long nose plier, 322-4½ long nose plier with knurl, and 224-4½ end cutting plier. All of these pliers



are available with a coil spring to keep jaws open and may be had with handles plastic-dipped if desired. Mathias Klein & Sons, 7200 McCormick Rd., Chicago 45, Ill.

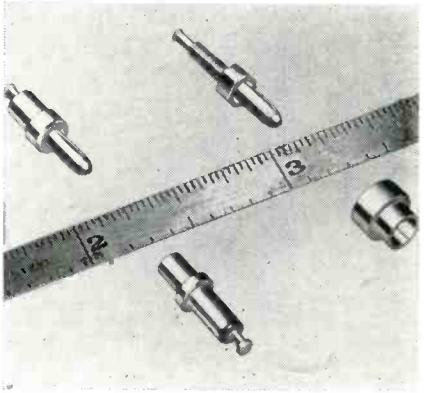
Circle 213 on Inquiry Card, page 121

Circle 82 on Inquiry Card, page 121

New Products

BANANA PLUGS

Silver plated swage No. 2000 and screw type No. 2020 Banana Plugs are designed to fit 0.104 dia. holes. Body is brass and the spring is heat-treated Beryllium copper. Matching



sockets constructed of brass with silver plated finish are also available. Both the banana plugs and sockets may be obtained in other finishes upon request. Goe Engineering Co., 219 So. Mednik, Los Angeles 22, Calif.

Circle 214 on Inquiry Card, page 121

DISPLAY STORAGE TUBE

A 5 in. display storage tube of the direct-view type, with separate necks for the magnetically deflected writing gun and for the viewing gun, has been introduced. Tube (RCA-7183) is designed to produce a bright, non-flickering display of stored information for 20 or more seconds after writing has ceased. It is particularly useful for airplane-cockpit radar display; airport surveillance; data transmission including half-tones; and

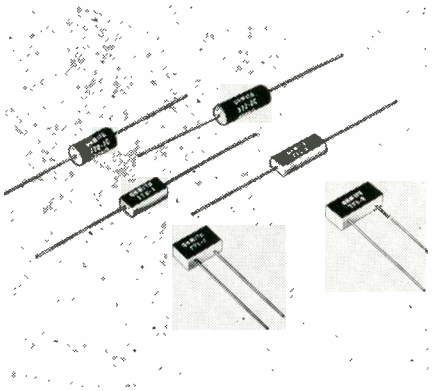
visual communications requiring steady - non - flickering narrow-bandwidth transmission over telephone lines. Electron Tube Div., RCA, Harrison, N. J.

Circle 215 on Inquiry Card, page 121

New Products

PRECISION RESISTORS

Series 77 Metal Film Precision Resistors are now smaller, yet offer higher maximum resistance than the previous models. At the same time, prices of these units have been reduced sharply. In the axial lead style, 2 shapes are now available—a tubular shape and a flat-side shape which offers maximum space economy. A radial lead style is also furnished. Resistance range is now 25 ohms to 400K ohms. Standard tolerance is ±1%. Tolerances as low as 0.1% can be furnished. Ohmite Mfg. Co., 3695 Howard St., Skokie, Ill.



Circle 216 on Inquiry Card, page 121

DC LAB SUPPLY

A moderately priced general-purpose dc power supply for industrial laboratory and production line use is available. Designated the model 646 "Volt-Pak," rated output of the unit is 0-450 vdc, 250 ma continuous, or 500 ma intermittent load. Large meters on the face indicate output voltage and current. Outputs terminate in multipurpose nylon binding posts. Several units may be paralleled for continuous output currents above 250 ma. Westinghouse Electric Corp., 356 Collins Ave., Pittsburgh 6, Pa.

Circle 217 on Inquiry Card, page 121

New Products

ARM & SAFE CONNECTOR

Where critical circuitry is a problem and an absolutely safe switching system is required, "arm-and-safe" connector is the answer. The receptacle is guarded against tampering

while connected with the "safe" side of the unit. Then, when the switch is to be made, simply pull-back on the coupling ring, turn the connector around and push-in for a positive connection. Special wiring within the shell provides the key to completing the circuit. Available in all shell sizes with pin insert arrangements adapted to suit. The Deutsch Co., 7000 Avalon Blvd., Los Angeles 3, Calif.

Circle 218 on Inquiry Card, page 121

CATHODE-RAY TUBE

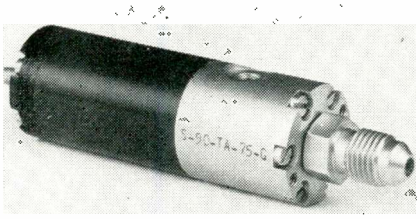
This standard CRT is capable of producing a spot size less than 0.001 in. without the need of special external accessories. Designated the K1725, it is powered and operated by conventional methods and will be important where a super resolution CRT is essential and where weight and space requirements are stringent. This tube will find immediate importance in the areas of flying spot scanners and photo-recording. It is a 5 in. CRT with electro-magnetic focus and deflection. A. B. Du Mont Labs., Inc., 750 Bloomfield Ave., Clifton, N. J.

Circle 219 on Inquiry Card, page 121

New Products

TRANSDUCER

A temperature compensated, single coil, variable reluctance diaphragm transducer to be used as the variable inductor in commercially available inductance and reactance controlled

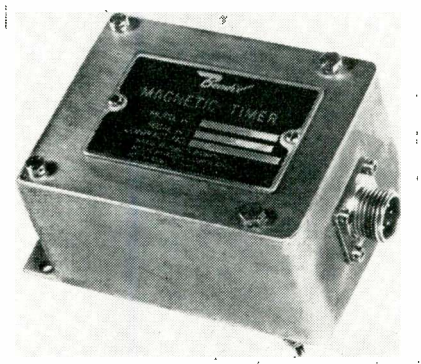


FM/FM sub-carrier oscillator systems is available. Differential, gage and absolute models are offered with numerous pressure ranges from 0-10 through 0-5000 psi. Called the S-90, the unit combines very low sensitivity to shock, vibration and acceleration with a rise time of 75-150 μsecs. The size is ⅞ in. dia. x 2¼ in. lg., excluding fittings. This model can be supplied with a wide variety of fittings and cable adaptors. Ultradyne, Inc., P. O. Box 3308, Albuquerque, N. M.

Circle 220 on Inquiry Card, page 121

MAGNETIC TIMER

Solid state components such as transistors, diodes and special magnetic amplifiers have been combined successfully to develop a magnetic timer with no moving parts. The design which is suitable for use on most rocket engines will provide an accurate timed interval of a few millisec-



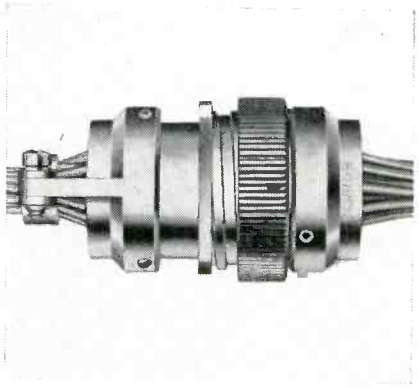
onds to several seconds. The new timer, while small in size, is rugged, accurate, versatile and reliable. Bendix Products Div., Bendix Aviation Corp., South Bend 20, Ind.

Circle 221 on Inquiry Card, page 121

New Products

MINIATURE PLUGS

A new miniature MS series of plugs is now in production. Designated "KM," the new miniature is designed and qualified to MIL-C-25955 (USAF). Developed for appli-



cations in aircraft, missiles and equipment, the new KM features crimp-type, snap-in contacts to eliminate the soldering process and to facilitate field servicing. Contacts are crimped prior to insertion and then snapped into the zytel monobloc insulation with a special contact insertion tool. A special moisture-sealing Neoprene grommet also eliminates potting the connector. Cannon Electric Co., 2208 Humboldt St., Los Angeles 31, Calif.

Circle 222 on Inquiry Card, page 121

POWER TRANSISTORS

A new flexible line of PNP germanium power transistors has just been announced. The customer may specify his choice of five packages—and thirty-six collector-to-base volt ages and large signal current gains—in 20-, 30-, or 40-watt sizes. Complete

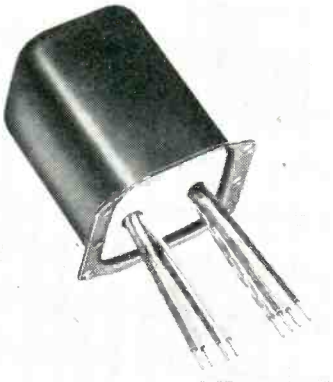
data on the over one hundred EIA, military and special types in this broad new line are available. CBS-Hytron, Parker Street, Newburyport, Mass.

Circle 223 on Inquiry Card, page 121

New Products

TRANSISTOR TRANSFORMERS

Two transverter transformers used in the construction of transistor power supplies for mobile communication equipment are available. One, DCT-1 converts 12 vdc, to 275 vdc, at

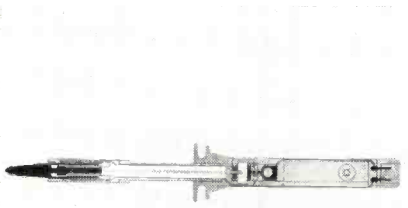


125 ma dc. The other, DCT-2 converts 12 vdc to 250 vdc at 275 ma dc or 500 vdc at 165 ma dc. Both units are compact. They have color-coded leads and are cased in "Sealed-in-Steel" one-piece drawn steel cases. Chicago Standard Transformer Corp., 3501 Addison St., Chicago 18, Ill.

Circle 224 on Inquiry Card, page 121

SOLDERING IRON

Sketched is a new soldering iron which automatically controls the soldering iron temperature. The small dark section at the interior of the tip of the iron is a special alloy that is magnetic. When this alloy is treated to a predetermined temperature it loses its magnetic qualities and the spring at the other end of the alloy pulls the alloy from the tip, thus



breaking electrical contact. Allegheny Ludlum Steel Corp. supplied the stainless steel tubing used. Weller Electric Corp., 601 Stones Crossing Rd., Easton, Pa.

Circle 225 on Inquiry Card, page 121

Circle 91 on Inquiry Card, page 121

New Products

CERAMICS

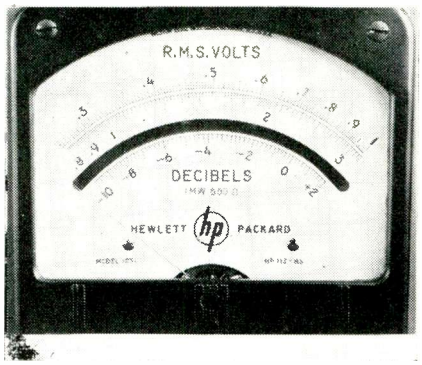
AlSiMag 614 Alumina Ceramic wafers 0.310 x 0.310 x 0.010 are now available. These small thin ceramics are an extension of their production experience in thin ceramic sections

and small precision ceramics for such applications as internal electron tube insulation and printed circuitry. Class I and Class II ceramic dielectrics for capacitors and R-C networks are available for micro-module construction. American Lava Corporation, Chattanooga 5, Tenn.

Circle 226 on Inquiry Card, page 121

VTVM

The logarithmic meter was especially designed to eliminate optical confusion and to provide an accuracy which is a constant percentage of the reading. The 400L has 2 voltage scales, ranging from 0.8 to 3.2 and from 2.5 to 1. The 12 db scale i spread across a scale length of 4.9 in. Since the O db reading on the new meter is referenced to 1 mw in 600 ohms, output power can be measured directly in dbm from the common 600



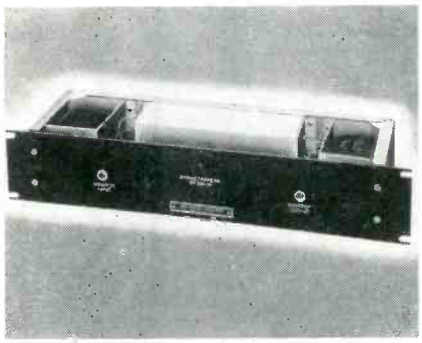
ohm systems. It measures any voltage from 0.3 mv to 300 volts in the frequency range from 10 CPS to 4 MC. Hewlett-Packard Co., 275 Page Mill Rd., Palo Alto, Calif.

Circle 227 on Inquiry Card, page 121

New Products

TRANSMITTER NETWORK

Specifically designed for AM, FM, TV audio, and HF communications transmitters, the Model SP-58-1A "Symmetra-peak" network redistributes unequal positive or negative



peak energy of audio waves symmetrically about the zero axis. Any asymmetry resulting from certain voice characteristics, improperly phased microphones, or switching between local and distant program sources is eliminated. With peak energy considerably reduced, average modulation level can be increased. Kahn Research Labs., Inc., 22 Pine St., Freeport, N. Y.

Circle 228 on Inquiry Card, page 121

LOUDSPEAKER

The Model W-6 Cone-Projector Loudspeaker is designed for use in a wide variety of applications such as extensions speakers, industrial music systems, outdoor installations of all types—where good musical reproduction is desired but where the ultimate in high frequency response is not necessary. The W-6 has a special heavy-duty, 6 in. cone type driver; the

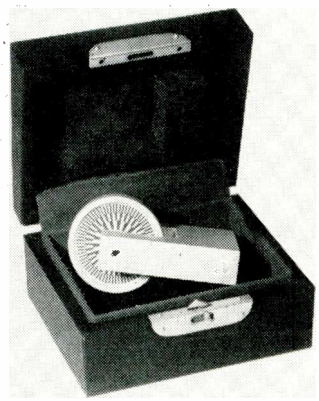
speaker diaphragm is horn loaded, which contributes to the overall efficiency and results in effective low frequency response. Atlas Sound Corp., 1451 39th St., Brooklyn 18, N. Y.

Circle 229 on Inquiry Card, page 121

New Products

TAPE STROBE

A stroboscopic device for checking tape speeds of all tape recorders and players is available. It is a precision mounted wheel housed in a machined aluminum yoke that user may apply



directly to moving past the capstan at correct speeds; 7½ ips, 15 ips and 30 ips. Only a 60-cycle light source is necessary. Strobe can be used to check speed accuracy when the supply reel is fully loaded and the take up reel is empty and again, when the supply reel is almost empty and the tape reel is almost loaded. Scott Instrument Labs., 17 E. 48th St., New York 17, N. Y.

Circle 230 on Inquiry Card, page 121

POWER PACKAGE

An add-on 250/330 w. economy power package promises substantial savings to 2-way radio owners who need greater communications range. The package known as the Power-Mate, enables users of transmitters in the lower power ranges to upgrade their present systems to as high as 330 w. at half the cost they normally would pay for a complete 330 w. station. It combines a newly-engineered power amplifier and a new power sup-

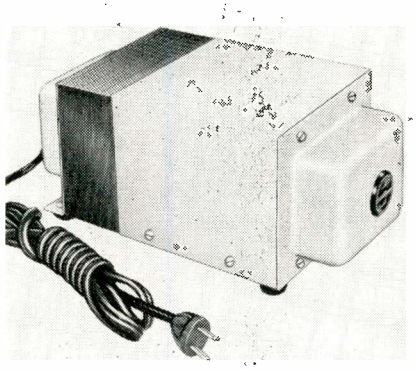
ply in a compact, convenient office-style cabinet. It may be added to any existing ac FM communications system. General Electric Co., Syracuse, N. Y.

Circle 231 on Inquiry Card, page 121

New Products

VOLTAGE STABILIZER

An automatic voltage stabilizer, that will maintain a 118 v. output when the input varies from 95 to 130 v. is available. Designed especially for TV receivers, amplifiers, hi-fi sets

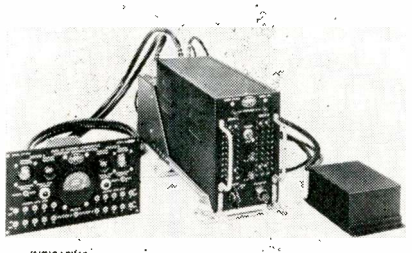


and other electronic equipment, where excessive voltage or low voltage conditions often are the cause of many performance troubles. Unit is rated at 200 VA. Stabilizer's operation is completely noiseless and free from harmonic radiation. Unit has a built-in relay which automatically disconnects primary circuit when equipment is turned off. Acme Electric Corp., Cuba, N. Y.

Circle 232 on Inquiry Card, page 121

INSTRUMENTATION

A flight-safety device (Model CT1-10-2D) for monitoring critical temperatures sequentially at up to 20 locations is available. It requires no external amplification of signals and uses combined magnetic and transistor circuitry. Units comprising the system are: indicating and warning, balance and power, commutator assembly, temperature transducers, and interconnecting cabling. The indicat-



INDICATING AND WARNING UNIT | BALANCE AND POWER UNIT | COMMUTATOR ASSEMBLY

ing and warning unit is separate for mounting in a convenient location clearly visible to the observer. Arnoux Corp., 11924 W. Washington Blvd., Los Angeles 66, Calif.

Circle 233 on Inquiry Card, page 121

Technical discussions continue right through lunch. Here Prof. Dr. Ing. K. Potthoff of West Germany makes his point with Dr. Ing. E. Scharstein on his left. Immediately behind is Ray York, Chief delegate SC 39-2, and further behind are delegates from People's Republic of China.

IEC Conference Report

(*Continued from page 77*)

Swedish National Committee. Space does not permit us to detail all of the extracurricular activities here, but we did attend the IEC receptions extended by the city of Ves-

(*Continued on page 152*)

Table 3: Draft Recommendations Accepted for Final Publication

TC 3: Graphical Symbols

Second list of graphical symbols—resistances, windings, etc.

Symbols for machines and transformers

TC 12: Radio Communication

Methods of measurement on receivers for television broadcast transmissions

Methods of radiation - measurements on receivers for A.M., F.M., and T.V. broadcast transmissions

Amendments to Clause E of Publication 94, Recommendations for magnetic tape recording and reproducing systems—dimensions and characteristics

Methods of measurement of the electroacoustical characteristics of hearing aids

TC 40: Components for Electronic Equipment

Specification for carbon resistors, lized mica capacitors

Specification for carbon resistors, type I

Supplement to the specification for carbon resistors, type II

Specification sheets for cables, IEC 50-7-11- or 13

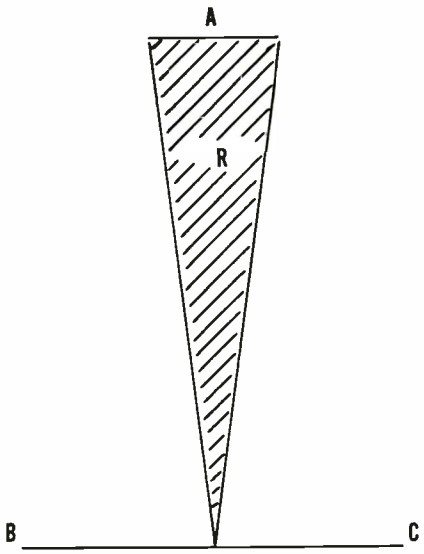


Fig. 5: Effective angular width that is created by the vehicle's physical dimensions.

Radio Interferometers

(Concluded)

herent phase differential of 180°, changing at the included null.)

Directive Antennas

The use of directive receiving antennas, focused in the measurement plane, allows a measurement compatible with the geometry of Fig. 1. Accuracy in the determination of Cos θ is then a function only of an operating range, R, which satisfies the equation

$$\frac{R_2 - R_1}{2\,L} = \text{Cos}\,\theta \pm \text{Cos}\,\theta \text{ error} \quad (2)$$

First, the directive antennas individually perform a collimation to artificially remove the radio source to a near infinite distance (by enforcing a degree of planeness on the approaching wave, or reciprocally, by 'illuminating' the source with a plane wave). Secondly, the identical uniformity of illumination by each individual receiving antenna, across the entire vehicle dimension, prohibits the occurrence of measured phase-difference being inclusive of any inherent net phase error. The inherent net phase error is caused (in the case of omni-directional receiving antennas) by the non-identical attitude of the total vehicle with respect to antennas at B and C. With antennas that are focused in the measurement plane, the illumination from each antenna is identical across the vehicle so that direction indications are truly functional of radial path difference, $R_2 - R_1$.

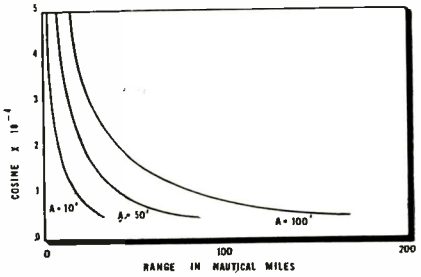


Fig. 6: Minimum range for several vehicle sizes while using omni-directional antennas.

An elementary statute of antenna theory is Huygens' Principle which states . . . "each point of a wavefront can be considered as a source of a secondary wave. The secondary spherical waves from these points then combine to form a new wavefront, this new wavefront being the envelope of the secondary wavelets." Fig. 8 compares (for the transmitting case) the relative phase patterns of an unfocused or omni-directional antenna, and a four element broadside array focused to provide a more uniform contour of equal phase across any vehicle proportion.

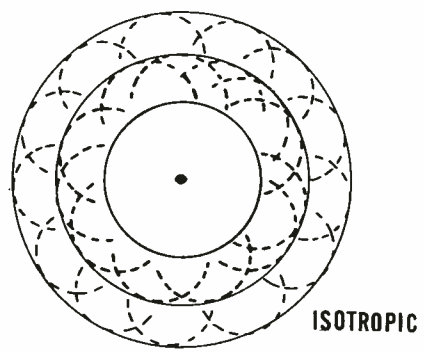
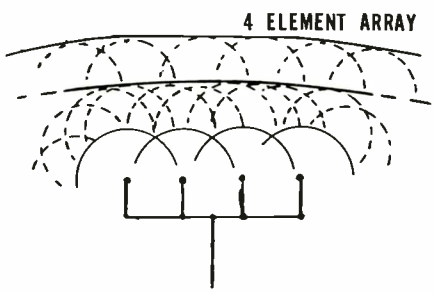


Fig. 8: Huygen's principle illustrated.



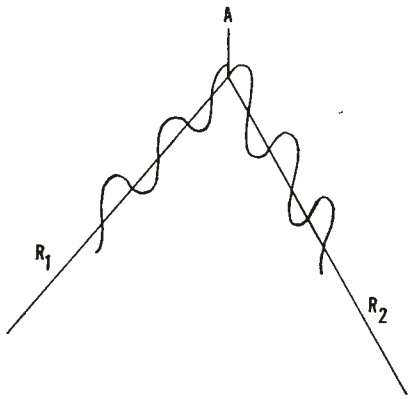


Fig. 7: "Starting phase" differential.

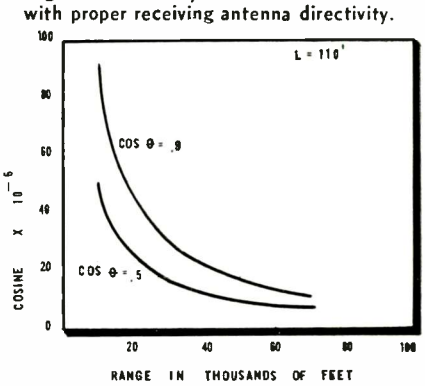
Reciprocity, being also a fundamental theorem in antenna design, permits the inspection of these antenna phase characteristics regardless of whether they are transmitting or receiving. The necessary planeness of phase is of course a function of vehicle dimensions and particular operating wavelength. The error path difference with properly focused antennas is the difference between equations (3) and (4) below.

$$\frac{dR_1}{dR} = \frac{R - 2\,L\,\text{Cos}\,\theta}{(R^2 + L^2 - 2\,RL\,\text{Cos}\,\theta)^{1/2}} \quad (3)$$

$$\frac{dR^2}{dR} = \frac{R + 2\,L\,\text{Cos}\,\theta}{(R^2 + L^2 + 2\,RL\,\text{Cos}\,\theta)^{1/2}} \quad (4)$$

When the proper relationship is established between antenna directivity and vehicle proportions, the system accuracy is adequately quoted as shown in Fig. 9.

Fig. 9: Accuracy that is obtainable with proper receiving antenna directivity.



(*Continued from page* 150)
taras and of Stockholm and we took part in the technical tours through the ASEA works and the plants of L. M. Ericsson.

Returning now to the technical meetings, again available space and USNC policy will not allow a comprehensive discussion of the work of the individual committees. Each U. S. committee chairman is required to file a report of the activities of his committee and the results achieved with the IEC secretary. The overall results of this years activities are summarized in Tables III and IV. However, in order to provide a deeper insight into some of the problems or situations that develop in IEC work and which in turn may motivate the thinking of committees we list the following thoughts:

1. Not all points can be decided in favor of U. S. manufacturing practice. This is especially true where safety requirements are items of law in many countries represented on IEC.

2. European manufacturers like to sell tubes for electronic equipment as a complete package. They are thus prone to be more flexible on the technical specs of a given tube type than we are.

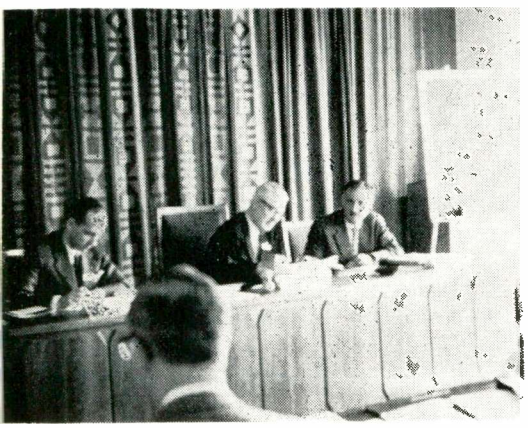
3. It is interesting this year to note the increasing interest of the Russian delegation. They sent 39 delegates and this year they participated in both written and oral comments in perfect English. Compared to last year it's amazing how quickly they learned to speak English.

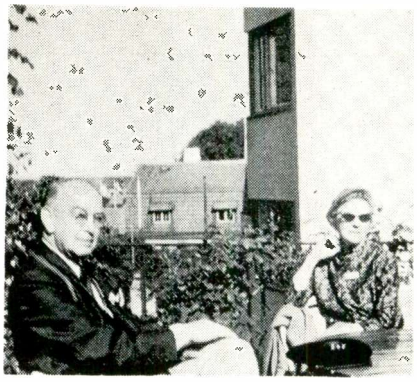
4. In testing temperatures for semiconductors U. K. delegates were anxious to have 25°C recorded as standard. This was supported by the U. S. but other countries want 20°C.

5. A new committee whose scope includes standardization of electronic instruments met for the first time. No U. S. delegate was present at this first meeting where it was decided to work on the standardization of Signal Generators. Many representatives do not consider this an appropriate item to begin standardization on.

Next year the general meetings

L. C. Morton, General Electric Co., presides on committee TC-22-Power Converters.





Mr. & Mrs. R. C. Sogge, President of USNC and head of delegation, relax momentarily in Visby, one of the interesting sight-seeing centers in Sweden.

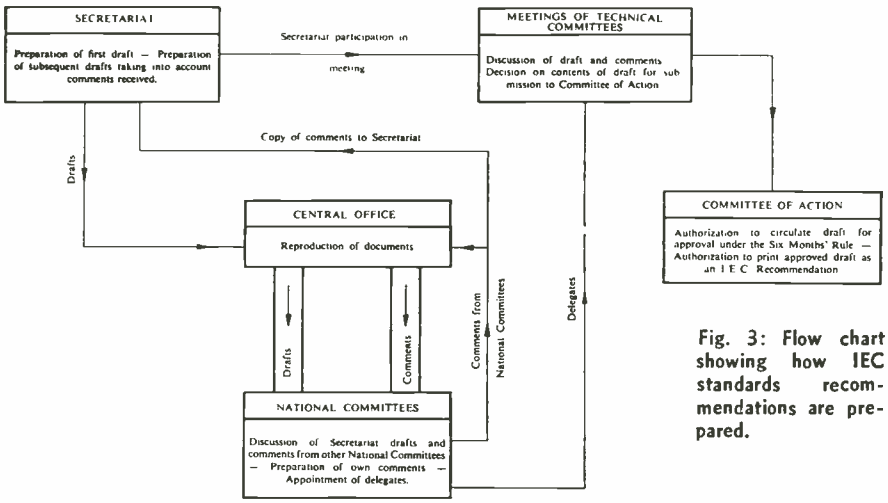


Fig. 3: Flow chart showing how IEC standards recommendations are prepared.

of IEC will be held in Madrid. Some of the technical meetings may have to be held at other locations because the constantly increasing participation in this work also presents problems in finding locations having a suitable number of accommodations. Nevertheless, the electronic industries have much to gain by participation in international standardization work and it is hoped that *all* technical committees representing the U. S. will be fully manned and supported!

See Page 154 for Table 4

References

1. "The International Technical Commission . . . What it is, What it does, How it works" Central Office IEC, 1 rue Varembe, Geneva, Switzerland
"A Look at the International Electrotechnical Commission," Electronic Industries, February 1958, Professional Opportunities Section
2. "A Salute to International Standardization," Tele-Tech & Electronic Industries, Nov. 1954
3. "Needed: International Technical Representation" Electronic Industries, July 1958
4. "General Directives for the Work of the I.E.C." Central Office of International Electrotechnical Commission, 1 rue de Varembe, Geneva, Switzerland
5. "The I.E.C. in Scandinavia," S. David Hoffman, The Magazine of Standards, September 1958.

Herlitz New IEC President

Dr. Ivar Herlitz, director of technology, ASEA, Västeras, Sweden, is the new president of the International Electrotechnical Commission. An electrical engineer, educated at the Technical University of Stockholm, he is a member of the Royal Swedish Academy of Engineering. Dr. Herlitz has been active in electrical engineering, with emphasis on standardization problems, for 40 years. He has served IEC as a member of the Committee of Action and the President's Preparatory Committee, and has taken part in the work of such important standardizing committees as those concerned with switchgear and controlgear.

His work with ASEA started in the early 1920's, and he has worked both at Ludvika and at Vasteras. He is author of many articles published in technical periodicals, notable among them "The Dynamic Stability of Long Transmission Lines" (1928).

Dr. Herlitz has been president of the Swedish National Committee of the IEC, and vice-president of the Swedish Testing Station for Electrical Appliances and Installation Equipment. He is a member of the American Institute of Electrical Engineers.

1958 IEC Conference Report

Table IV. U. S. National Committee Delegation to 1958 IEC General Meeting

R. C. Sogge, President, USNC, Head of Delegation
H. Blackmon, Vice-President, USNC
V. M. Graham, Vice-President, USNC
G. F. Hussey, Jr., Treasurer, USNC
S. D. Hoffman, Secretary, USNC

Delegate	Company Affiliation	T/Cs Attending
M. A. Acheson	Sylvania Electric Products, Inc.	39, 39-1, 39-2, 39/40
C. E. Asbury	Commonwealth Associates, Inc.	2C, 17, 17A, 17B
L. Batchelder	Raytheon Manufacturing Co.	29, 29-1, 29-3, 29-5, 29-6, 29-7, 29-8
B. S. Beall III	General Electric Co.	17, 17A, 17B
E. Beck	Westinghouse Electric Corp.	37 Exp., 42
H. Blackmon	Westinghouse Electric Corp.	Com. of Action, Council, Delegate-at-Large
M. L. Bright	Westinghouse Electric Corp.	8, 14, 28, 37 Exp., 38, 42
J. T. Brothers	Philco Corp.	12-2
C. C. Chambers	University of Pennsylvania	24, 25
R. K. Cook	National Bureau of Standards	29, 29-3, 29-6
J. F. Dexter	Dow-Corning Corp.	2C, 15, 15-5, 15-7
I. K. Dortort	I-T-E Circuit Breaker Co.	22, 22-2
I. G. Easton	General Radio Co.	15-1, 15-2, 15-3, 15-4, 15-5, 15-6, 15-7, 29-8
J. H. Foote	Commonwealth Associates, Inc.	7, 7-1, 8, 17, 17A, 17B, 20, 28
H. J. Geisler	International Business Machines	40, 40-1, 40-4, 40-5
A. Glorig	Subcom. on Noise in Industry, AA00	29, 29-6
B. Goldsmith	Essex Electronics	40-5, 40-6
V. M. Graham	Electronic Industries Assn.	39, 39-1, 39-2, Com. of Action, Council
C. M. Harris	Columbia University	25, 29, 29-5
G. W. Heumann	General Electric Co.	17B
S. D. Hoffman	American Standards Assn.	Com. of Action, Council
L. F. Hunt	Ralph M. Parsons Co.	17, 17B
E. M. Hunter	General Electric Co.	14, 28, 38, 42
G. F. Hussey, Jr.	American Standards Assn.	Com. of Action, Council, Delegate-at-Large
R. A. Johnson	Syracuse University	39-2
S. C. Killian	K. H. Porter Co.	17, 17A, 17B
W. M. Leeds	Westinghouse Electric Corp.	17, 17A, 17B
S. L. Levy	Lansdale Tube & Semiconductor Co.	39-2
G. F. Lincks	General Electric Co.	37 Exp., 42
J. Marsten	International Resistance Co.	40-1
K. N. Mathes	General Electric Co.	2C, 15, 15-3, 15 Exp.
A. L. McClay	Radio Corp. of America	29, 29-1, 29-3, 29-5
L. W. Morton	General Electric Co.	22, 22-2
C. Muller	Federal Telecommunication Labs.	40-5
A. M. Okun	Bell Aircraft Corp.	40, 40-2, 40-4
B. F. Osbahr	Chilton Publications	39, 39-1, 39-2
J. R. Perkins	E. I. duPont de Nemours & Co., Inc.	15-4
R. L. Pritchard	Texas Instrument Co.	39-2
A. C. Rockwood	Raytheon Manufacturing Co.	39-1
H. E. Roys	Radio Corp. of America	29, 29-1
J. H. Schumacher	Soc. of Mot. Pict. & Telev. Engrs.	29-1
A. H. Scott	National Bureau of Standards	1, 2C, 15, 15-1, 15-2, 15-3, 15-4, 15-5, 15-6, 15-7, 25
F. B. Silsbee	National Bureau of Standards	24
R. C. Sogge	General Electric Co.	Com. of Action Council
G. M. L. Sommerman	Westinghouse Electric Corp.	1, 8, 15, 15-1, 15-2, 15-3, 15-4, 15-5, 15-6, 15-7, 15 Exp.
J. D. Stacy	General Electric Co.	40-1, 40-5
W. R. Torn	DuKane Corp.	29, 29-3
H. M. Turner	Yale University	1, 24, 25
C. F. Wagner	Westinghouse Electric Corp.	8, 28
S. R. Warren, Jr.	University of Pennsylvania	24, 25
W. F. Wetmore	Detroit Edison Co.	17, 17A, 17B
H. Williams	Philco International Corp.	39, Delegate-at-Large
R. J. Wiseman	The Okonite Co.	20, 42
R. A. York	General Electric Co.	39-2
R. W. Young	U. S. Navy Electronics Lab.	29, 29-8
S. Zwerling	General Electric Co.	39/40, 40-2, 40-4, 40-5

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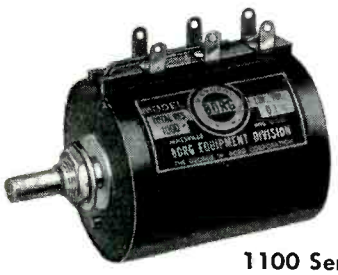

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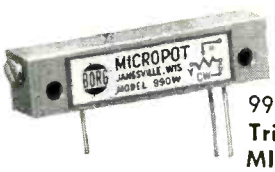

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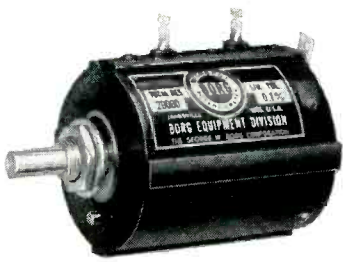

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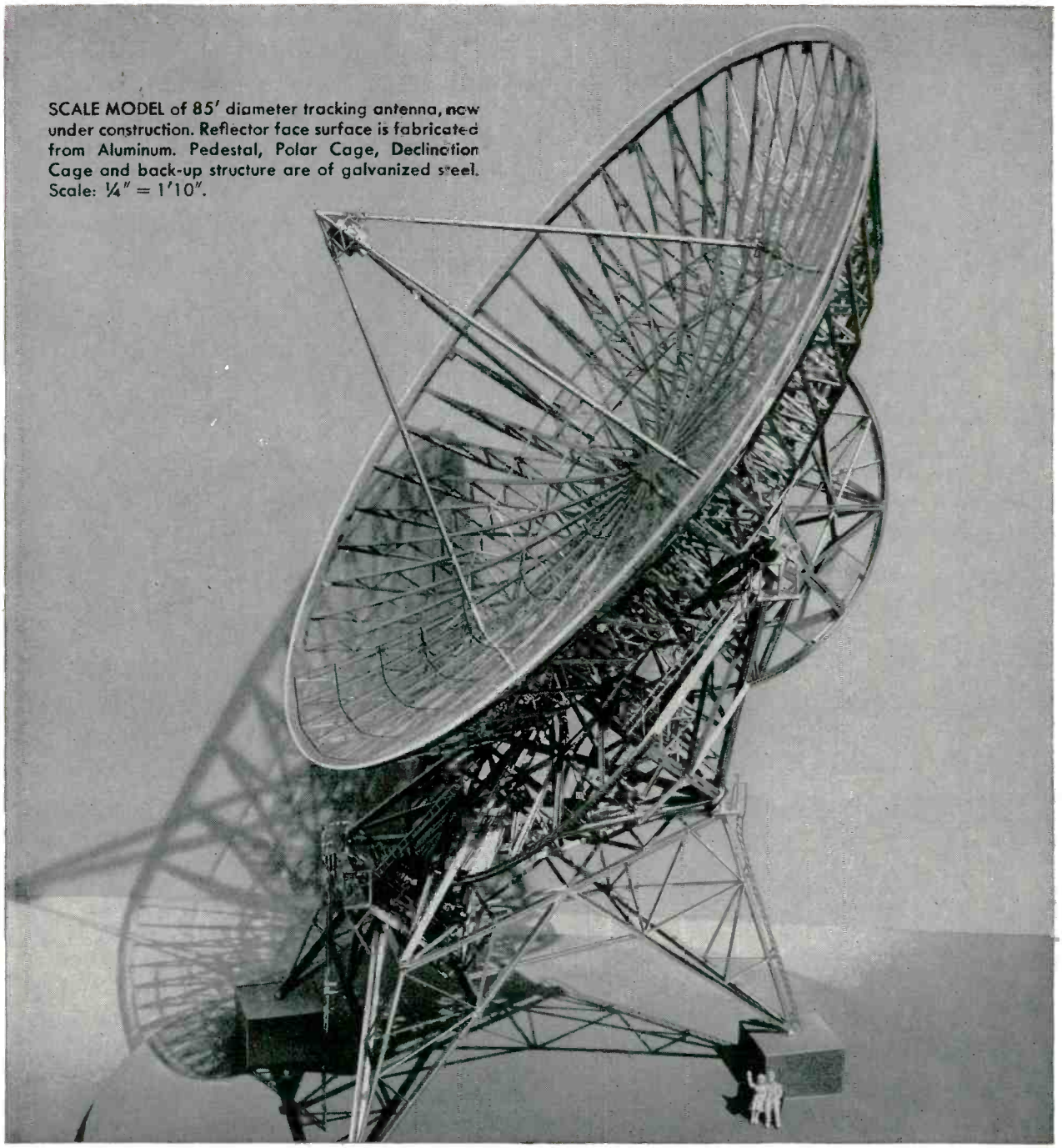

SCALE MODEL of 85′ diameter tracking antenna, now under construction. Reflector face surface is fabricated from Aluminum. Pedestal, Polar Cage, Declination Cage and back-up structure are of galvanized steel. Scale: ¼″ = 1′10″.

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ANTENNAS, PROPAGATION

Determining the Phase Center of a Radiator Using the Method of Least Squares, A. A. Borodulin. "Radiotek." July 1958. 4 pp. The method of least squares is used to derive simple and accurate formulas for determining the coordinates of the phase center of a radiator. The error of the method is computed. (U.S.S.R.)

The Practicality of Using the Term "Tropospheric Radiowaves," M. P. Dolukhanov. "Radiotek." June 1958. 2 pp. Using new data on the long-range propagation of ultrashort waves proof is given of the practicality of introducing the concept of "tropospheric waves"; this is an addition to the conventional subdivision of radiowaves into classes corresponding to the method by which they are propagated around the earth's sphere by "earth and ionospheric" waves. (U.S.S.R.)

A Conical Helical Antenna with a Constant Pitch Angle, N. P. Timirev. "Radiotek." June 1958. 8 pp. The paper gives a theoretical analysis of the computation of directivity patterns for a conical helical beam antenna with a constant pitch angle. It is shown that when a conical helix is used it is impossible in principle to obtain circular polarization in the axial direction. Recommendations are made on selecting the optimum constant parameters for the radiator. (U.S.S.R.)

On a Certain Method of Successive Approximations in the Theory of Reflectors Having Special Shapes, B. V. Kinber. "Radiotek." May 1958. 9 pp. The paper represents the directivity patterns of scattering reflectors in the form of the sums of the patterns corresponding to geometric-optics and diffraction patterns. The resulting pattern, due to the phase difference between the components of the pattern, has a slightly "chopped up" appearance. An equation is derived for correcting the shape of the reflector; this equation makes it possible to use the computations and experiments to refine the shape of the reflector and to improve the approximation to the specified directivity pattern. Experimental results are given demonstrating the verification of the correction equation. (U.S.S.R.)

General Formulas for Computing the Field Produced by an Arbitrary Oriented Dipole Above a Plane Homogeneous Earth, L. S. Tartakovskii. "Radiotek." Apr. 1958. 8 pp. The paper presents and analyzes the general formulas for computing fields in the wave region produced by vertical and horizontal suspended electric dipoles which are located above a plane homogeneous earth. The paper indicates the special features of radiowave propagation over a region with a surface containing iron ore. (U.S.S.R.)

Use of Scale Model Techniques in the Design of VHF and UHF Aerials, F. J. H. Charman et al. "El. Eng." Aug. 1958. 4 pp. In this article the theory and practical methods of measuring radiation patterns of complex aerial systems by scale modeling are shown, and several examples illustrated. (England.)

Propagation in Discontinuous Periodic Structures and its Application to Wave Guides, M. Jouget. "Cab. & Trans.," Vol. 12, No. 1. Jan. 1958. 14 pp. The author discusses the propagation of unlimited plane waves within a stratified medium in an infinite space, and in a wave guide with an inner laminated structure. Determined are the rejected and transmitted frequency bands, the attenuation, and the influence of dielectric losses. (France.)

Suppression of Undesired Radiation of Directional HF Antennas and Associated Feed Lines, H. Brueckmann. "Proc. IRE." Aug. 1958. 7 pp. An analysis of the situation in point-to-point radio communication circuits at fre-

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REGULARLY REVIEWED

AUSTRALIA
AWA Tech. Rev. AWA Technical Review
Proc. AIRE. Proceedings of the Institution of Radio Engineers

CANADA
Can. Elec. Eng. Canadian Electronics Engineering
El. & Comm. Electronics and Communications

ENGLAND
ATE J. ATE Journal
BBC Mono. BBC Engineering Monographs
Brit. C.&E. British Communications & Electronics
E. & R. Eng. Electronic & Radio Engineer
El. Energy. Electrical Energy
GEC J. General Electric Co. Journal
J. BIRE. Journal of the British Institution of Radio Engineers
Proc. BIEE. Proceedings of Institution of Electrical Engineers
Tech. Comm. Technical Communications

FRANCE
Ann. de Radio. Annales de Radioelectricite
Bull. Fr. El. Bulletin de la Societe Francaise des Electriciens
Cab. & Trans. Cables & Transmission
Comp. Rend. Comptes Rendus Hebdomadaires des Seances
Onde. L'Onde Electrique
Rev. Tech. Revue Technique
Telonde. Telonde
Toute R. Toute la Radio
Vide. Le Vide

GERMANY
AEG Prog. AEG Progress
Arc. El Uber. Archiv der Elektrischen Uebertragung
El Rund. Electronische Rundschau
Freq. Frequenz
Hochfreq. Hochfrequenz-technik und Electroakustik
NTF. Nachrichtentechnische Fachberichte
Nach. Z. Nachrichtentechnische Zeitschrift
Rundfunk. Rundfunktechnische Mitteilungen
Vak. Tech. Vakuum-Technik

POLAND
Arch. Auto. i Tel. Archiwum Automatyki i Telemechaniki
Prace ITR. Prace Instytutu Tele-I Radiotechnicznego
Roz. Elek. Rozprawy Electrotechniczne

USA
Auto. Con. Automatic Control
Av. Age. Aviation Age
Av. Week. Aviation Week
Bell J. Bell Laboratories Journal
Comp. Computers and Automation
Con. Eng. Control Engineering
El. Electronics
El. Des. Electronic Design
El. Eq. Electronic Equipment
El. Ind. ELECTRONIC INDUSTRIES
El. Mfg. Electronic Manufacturing
IRE Trans. Transactions of IRE Prof. Groups
I. & A. Instruments & Automation
Insul. Insulation
M/R. Missiles and Rockets
NBS J. Journal of Research of the NBS
NRL. Report of NRL Progress
Proc. IRE. Proceedings of the Institute of Radio Engineers
Rev. Sci. Review of Scientific Instruments

USSR
Avto. i Tel. Avtomatika i Telemakhanika
Radio. Radio
Radiotek. Radiotekhnika
Rad. i Elek. Radiotekhnika i Elektronika
Iz. Acad. Bulletin of Academy of Sciences, USSR.

OTHER
Radio Rev. La Radio Revue (Belgium)
Kovo. Kovo Export (Czech)
J. ITE. Journal of the Institution of Telecommunication Engineers (India)
J. IECE. Journal of the Institute of Electrical Communication Engineers (Japan)
Phil. Tech. Philips Technical Review (Netherlands)
Eric. Rev. Ericsson Review (Sweden)
J. UIT. Journal of the International Telecommunication Union (Switzerland)

quencies below MUF with respect to radiation in undesired directions brings to the fore some aspects which are useful as guide lines in antenna research, design and application engineering. (U.S.A.)

CIRCUITS

***High Frequency Wide Band Electronic Integrator, Henri Hodara.** "El. Ind." Oct. 1958. 3 pp. When integration is performed in the video range, the output tube capacity of the associated amplifiers introduces considerable distortion in the intergrated output. This article presents a compensating scheme for two types of integrators that completely eliminates the distortion caused by the output tube capacity. (U.S.A.)

Relaxation Oscillators and Relaxation Multivibrators Which Use the Driven-Multivibrator Circuit (the Schmitt Circuit), G. P. Petin. "Radiotek." July 1958. 4 pp. The paper describes relation oscillators which produce rectangular and linear-sawtooth voltages. When the magnitude of one resistance in the circuit is varied these oscillators become relaxation multivibrators with one stable state. They generate rectangular pulses or pulses with a linearly decreasing voltage. (U.S.S.R.)

Computing the Losses in a Symmetrical Three-Section UHF Filter with Quarter-Wave Coupling, B. E. Rubinshtein. "Radiotek." July 1958. 11 pp. The paper derives relationships for the insertion losses of the filter as a function of its parameters in the pass band; a graphical method is given which makes it possible to find the filter losses under conditions where the distances between elements are not equal to a quarter wavelength and the resonant wavelength is arbitrary. (U.S.S.R.)

A Bridge Circuit for a Gas-Tube Voltage Stabilizer, V. I. Kislov. "Radiotek." June 1958. 3 pp. The paper analyzes a bridge-type gas tube voltage stabilizer with compensation for the voltage increment represented by the tube drop increase which occurs when the current through the tube increases. As a result the low voltage remains rigorously constant. (U.S.S.R.)

On the Synthesis of Amplifier Circuits, V. P. Shasherin. "Radiotek." June 1958. 4 pp. The paper discusses the use of certain orthogonal polynomials (Hermitian and Cramp functions) for the analysis and synthesis of amplifiers. This proposal undoubtedly merits attention since it is possible to reduce the time required for computations. However, previous papers on this subject are based on approximations which are too coarse, and thus the results are substantially at variance with results obtained by accurate methods. The accuracy of the results is much worse than the 5-10% cited in previous papers. The following topics are treated: 1) analysis of transient response; 2) synthesizing an amplifier from the specified slope of the transient response; 3) synthesizing an amplifier according to the overshoot of the transient response; 4) synthesizing an amplifier from the duration of the rise corresponding to the interdecimal (0.1 to 0.9) differential between the ordinates of the transient response. (U.S.S.R.)

Bridge Circuits for Harmonic Quartz Oscillators, M. M. Pruzhanskii. "Radiotek." June 1958. 9 pp. The paper discusses the theoretical basis for designing harmonic quartz oscillators with LC and purely capacitive bridges in the feedback loop. (U.S.S.R.)

A Method For Increasing the Accuracy Of Pulse Demodulation, B. N. Mitiashev. "Radiotek." May 1958. 9 pp. The paper describes a method developed by the author for pulse demodulation. The method achieves a higher demodulation accuracy as compared to conventional methods. A series of pulses which is pulse-duration modulated or pulse-position modulated can easily be converted to a series which is amplitude modulated. Therefore the description of the method is given only for the case of amplitude modulation. Two demodulator circuits are given and experimental results are cited. (U.S.S.R.)

Investigating the Passage of Various Frequencies Through a Double-Tuned System With Artificially Controlled Intrinsic Dissipation in the First Tuned Circuit, E. G. Aleksandrova. "Radiotek." May 1958. 8 pp. The paper studies the frequency properties of a system consisting of two coupled tuned circuits with artificially controlled intrinsic dissipation in the first tank circuit. The paper shows that in a number of cases it is possible to appreciably widen the pass band of the system (compared to the pass band obtained when dissipation is introduced into the second tank circuit) by increasing the dissipation in the first tank circuit. (U.S.S.R.)

On the Optimum Pass Band of a Tuned System for Pulses With an Arbitrary Duty Ratio, A. L. Peisikhman. "Radiotek." May 1958. 6 pp. The paper studies the dependence of the optimum pass band of a resonant system (with respect to the reception threshold) on the pulse duty ratio. The problem is solved in general form, and also as it applies to rectangular and bell-shape pulses. (U.S.S.R.)

On the Theory of High-Frequency Oscillators With Lagging Feedback, I. F. Gonorovskii. "Radiotek." May 1958. 12 pp. The paper studies the possibility of stable generation of a spectrum of equidistant frequencies, depending on the shape of the frequency response for the tank circuit and the relationship between the system transmission band and the magnitude of the delay. The oscillator is represented as a combination of a tuned amplifier and an amplitude limiter in the feedback loop. (U.S.S.R.)

The Passage of a Pulse Through an Amplifier With High-Speed AGC, B. Kh. Krivitskii. "Radiotek." Apr. 1958. 8 pp. The paper studies the special features governing the passage of a trapezoidal pulse through an amplifier having the simplest high-speed automatic gain control. An approximate determination is made of the shape and magnitude of the pulse at the output of the amplifier. (U.S.S.R.)

Analysis of Various Circuits of Wide-Band Tuning Devices of High Voltage Line Traps, G. V. Mikutsky. "Avto. i. Tel." July 1958. 9 pp. Various circuits of wide-band tuning devices of high voltage line traps are considered. Generalized characteristics are given that make it easy to design elements. Some recommendations as to how to defend the elements of the line traps against overvoltage are suggested. (U.S.S.R.)

Automatic Compensation of Zero Drift in Electrometric Amplifiers, D. E. Polonnikov. "Avto. i. Tel." July 1958. 11 pp. Automatic compensation of zero drift in electrometric amplifiers is treated. The compensation error origin is revealed. The way to remove errors is suggested. The paper includes some circuits for compensation of zero drift. The said circuits provide minimum errors. An amplifier with a dynamic condenser and with automatic compensation of zero drift is described. (U.S.S.R.)

Two-Channel Automatic Optimizer, R. I. Stachovsky. "Avto. i. Tel." Aug. 1958. 13 pp. The circuit and some blocks of the electronic automatic optimizer enabling to find minimum points (taking into account some limitations) are described in detail. The experimental results corresponding to its different operational regimes are given. (U.S.S.R.)

Interchange of Infinite Attenuation Elements in Ladder Filters Structures, J. E. Colin. "Cab. & Trans.," Vol. 12, No. 1. Jan. 1958. 13 pp. Relationships between various types of ladder filters are discussed. Formulae are given for replacing a series anti-resonant circuit either by two series of anti-resonant circuits or by two shunt-resonant circuits, or by a shunt-resonant circuit followed by a series anti-resonant circuit. Some examples relating to conventional zobel-structures are also given showing the economic interest of such transformations. (France.)

Branching Filters, J. Oswald. "Cab. & Trans.," Vol. 12, No. 1. Jan. 1958. 43 pp. The author explains the main features of Cauer's and Piloty's theories of constant impedance branching filters. He supplements certain parts of this theory particularly those relating to scattering matrices of perfect branching filters, and of Cauer's branching filters. The last part of the paper is devoted to eight terminal branching filters. This octopole theory, which is an extension of the hexapole, seems to be novel. (France.)

Pass-Band Ladder Filter Half-Sections, J. Bimont. "Cab. & Trans.," Vol. 12, No. 2. Apr. 1958. 25 pp. This paper deals with a purely reactive half-section of single pass-band ladder filters. Rules relating to the properties and the general formulae of half-section series, shunt branches, and image impedances are given. (France.)

Theory of the Crystal Controlled Hartley Circuit, G. Becker. "Arc. El. Uber.," Vol. 12, No. 4. Apr. 1958. 7 pp. The condition of oscillation and equivalent circuits are discussed. It is shown that coupling between the partial inductances modifies the parallel attenuation of the oscillating crystal. This partial attenuation can be compensated by means of negative inductive feedback. (Germany.)

The Analysis of Lossy Symmetrical Four-Terminal Networks in the Decimeter and Centimeter Region by the Displacements of Voltage Nodes, F. Gemmel. "Arc. El. Uber.," Vol. 12, No. 4. Apr. 1958. 4 pp. The quadripole is represented by the equivalent circuit of Altschuler. This method requires that a distinction be made whether the characteristic impedance of the input line is inside or outside the limit circle. The paper treats this subject thoroughly. (Germany.)

Reactance Transformation of Low Pass and Band Pass Filters, A. Ahacic. "Arc. El. Uber.," Vol. 12, No. 5. May 1958. 6 pp. By means of reactance transformation, several equivalent forms of band pass circuits can be derived from a low pass circuit. It is shown how to avoid the tedious work of transformation by simply using partial four-terminal equivalences. (Germany.)

Conditions for a Passive Linear Four-Terminal Network with a Complex Impedance, E. R. Berger. "Arc. El. Uber.," Vol. 12, No. 4. Apr. 1958. 9 pp. A passive four-terminal network is defined by the fact that the output power must not exceed the input power. The necessary and sufficient conditions are stated first for the reciprocal networks in terms of image attenuation, phase shift, and arguments of image impedance. Subsequently, the non-reciprocal four-terminal network is discussed. (Germany.)

The Advantages and Disadvantages of Direct or A. C. Coupling for Deflection Amplifiers, H. L. Mansford. "El. Eng." Aug. 1958. 3 pp. The advantages and disadvantages of direct and a.c. coupled amplifiers are discussed, and there follows a brief description of a quasi d.c. coupling system using a vertical deflexion signal amplifier input switch covering the frequency band d.c. to 100 MC. (England.)

Performance Calculations for D.C. Chopper Amplifiers, I. C. Hutcheon. "El. Eng." Aug. 1958. 5 pp. It is shown how input resistance, output resistance and overall d.c. gain can be calculated for a chopper amplifier employing any arrangement of perfect switches, resistors and capacitors in the shopping and rectifying circuits. (England.)

Efficiency-Diode Scanning Circuits, Part 1, K. G. Beauchamp. "El. Eng." Aug. 1958. 8 pp. The basic theory behind "resonant-return" is

described and methods shown of solving problems arising out of the design of modern line-scanning circuits. (England.)

The Design and Application of a Synchronous Converter, Part 2, Associated Equipment and Applications, I. C. Hutcheon. "Brit. C. & E." Aug. 1958. 4 pp. The design problems of a low-level chopper or synchronous converter were discussed in Part 1 of this article, which appeared in our July issue. The present article discusses the design of equipment associated with the chopper and certain circuit applications. (England.)

Linear Frequency Discriminator for Sub-Carrier Frequencies, P. Kundu. "E. & R. Eng." Aug. 1958. 5 pp. The discriminator described is suitable for use with low-frequency f.m. signals having large deviations, such as are found in f.m. sub-carrier systems. A heptode valve is used, with out-of-phase signals on its two control grids. An RC phase-splitting network is provided for obtaining the correct phase relationship between the two voltages. The conditions for maximum linearity are derived. (England.)

COMMUNICATIONS

***Wind Power Gets a Diesel Engine Assist,** Paul C. Ziemke. "El. Ind. Ops. Sect." Oct. 1958. 3 pp. Using wind power is not new. However, the unique adaptation of wind power for generating electrical power to operate isolated relay stations may be coming into its own. Commercial units will easily supply 6 kw; experimental units have been designed for 1,000 kw. (U. S. A.)

Fluctuating Noise In FM Radiolines When A Pulse-Phase Modulated Multichannel Signal is Transmitted, G. A. Malolepshii. "Radiotek." July 1958. 14 pp. Based on the results cited in previous papers on fluctuating noise in FM systems, the problems of the noise stability of a pulse-phase modulation system are treated for the case when transmission is effected by means of frequency modulation. The analysis is performed for both strong and weak signals. The threshold of the system is determined. The effect of the system parameters on the noise stability is evaluated. Graphs are given for determining the noise stability of radiolines in pulse-phase modulation-FM systems. (U.S.S.R.)

On The "Volume" Of A Signal Which Acts On A Filter With Variable Parameters, A. S. Vinitskii. "Radiotek," June 1958. 8 pp. The paper uses a simple example to show that when filters with variable parameters are present in a communication channel the conventional concepts of signal volume and channel capacity are inapplicable. In order to analyze such systems a method is proposed for effecting generalized measurements of the signal and channel; the method is based on using a time scale and amplitude scale which are normalized to the selective portion of the communication channel. It is shown that the conventional formulation of generalized measurements is thus reduced to the degenerate case which applies to a selective section with constant parameters. (U.S.S.R.)

The Efficiency of Using The Standard USSR Norms For Industrial Radio-Interference For Improving Radio Reception and Television Reception, V. V. Roditi, M. S. Gartsenshtein. "Radiotek," June 1958. 8 pp. A method is given for determining the probability of interference from residual industrial radio-interference; the results of the corresponding computations are given and the efficiency of using existing norms for certain groups of noise sources is evaluated. (U.S.S.R.)

Experimental Studies Of The Extrapolation Method For Combating Pulse Noise In Radio Reception, Iu. I. Medvedev. "Radiotek," June 1958. 6 pp. The paper studies the results of an experimental analysis of a pulse noise supressor based on the method of "cutting in" the low-frequency channel of the receiver during the time that the pulse noise acts. It is shown that the use of linear signal spectrum converters yields a substantial increase in the effectiveness of the noise suppression. Detailed experimental results are given. (U.S.S.R.)

Problems of Noise Stability in a Communication System Which Receives the Signal "As A Whole," K. A. Meshkovskii. "Radiotek." June 1958. 14 pp. The paper develops methods for determining the probabilities of correct reception for certain classes of optimal and almost-optimal codes. A brief analysis is given of the advantages and disadvantages of certain communication systems which transmit a finite number of equally-probable and independent messages. A new communication system is proposed which is free from the disadvantages discussed. (U.S.S.R.)

Cross-Modulation Distortion in the High-Frequency Amplifier of an FM Receiver, Z. G. Krasnotsvetova. "Radiotek." May 1958. 4 pp. The paper studies the nonlinear mode in the RF amplifier of an FM receiver; the essential physical meaning of cross-modulation frequency distortion is studied. It is demonstrated that this type of distortion is small. The cases of zero grid current and grid current are analyzed. (U.S.S.R.)

Theory and Design of Frequency Modulators Using Semiconductor Control Elements, V. I. Samoilenko. "Radiotek." May 1958. 7 pp. The paper studies the method of varying oscillator frequency by controlling the capacitance of the n-p-junction in semiconductor diodes and triodes; this method can be used both for frequency modulation and for tuning an oscillator over a wide frequency range. The design method for a frequency modulator is given. (U.S.S.R.)

The Transmission Capacity of Communication Channels With Random Variations of the Dissipation, V. I. Siforov. "Radiotek." May 1958. 12 pp. The paper determines the lower boundary of the transmission capacity for a channel with random variations of the dissipation when additive noise is simultaneously present. It is demonstrated that single-ray channels with relatively slow random variation of the dissipation have a very high transmission capacity. (U.S.S.R.)

On the Laws Governing the Distribution of Null and Extremal Points in Russian Speech Signals When They are Severely Amplitude Limited, Iu. G. Rostovtsev. "Radiotek." Apr. 1958. 5 pp. A method is described for determining the probability distributions of the repetition frequencies for the null and extremal values of Russian speech signals. Detailed experimental results are given. (U.S.S.R.)

Phase Correlation Properties of Signals and Gaussian Noise in Two-Channel Phase-Shift Systems, V. V. Tsvetnov. "Radiotek." Apr. 1958. 10 pp. The paper studies the correlation properties for phase differences in two channel phase-shift systems when they are subjected to Gaussian noise. Analytical relationships are derived for the correlation functions of the phase differences for the case of pure noise and for the case of large signals. Correlation properties of the phase differences are compared with the correlation properties of the Gaussian noise envelope. (U.S.S.R.)

Evaluating the Transmission Capacity of Certain Practical Communication Channels, I. A. Ovseevich, M. S. Pinsker. "Radiotek." Apr. 1958. 11 pp. Using previous results, the paper evaluates the transmission capacity for the following types of channels: a) a practical communication channel with time-fixed parameters; b) a channel in which the time variation of the parameters is of the "white noise" form; c) a channel which is a combination of the first two. Examples are used to show that the derived results are generalizations of the known cases analyzed by Sunde and Feinstein. (U.S.S.R.)

Noise Stability of Telemetering Signals Transmission Along a Channel with Fluctuation Noise, V. A. Kashirin and G. A. Shastova. "Avto. i Tel." Aug. 1958. 14 pp. Potential noise stability of parameters, transmission is determined when there are amplitude, frequency, pulse-frequency, time, width and code modulation. Generalized transmission parameters are introduced. The fact is proved that within a certain range of the ratio signal/noise, frequency modulation provides the highest noise stability. (U.S.S.R.)

New Principles of Construction of Telemetering Systems with Time and Width-Pulse Modulation, V. A. Iljin and A. I. Novikov. "Avto. i Tel." Aug. 1958. 5 pp. The construction principles of single-channel and multichannel telemetering systems with the exponential transducers are considered. These principles enable to create the multichannel systems with time channel division without commutators. The paper contains some expressions for transducers and an example of a system. (U.S.S.R.)

COMPONENTS

The Use of Ferrites for Designing Coaxial Rectifier Systems, A. L. Mikaelian, M. M. Kozlova. "Radiotek." Apr. 1958. 6 pp. The paper studies the problem of using ferrites for designing coaxial rectifier systems. An experimental study is made of the non-reciprocal attenuations in a transverse-magnetized ferrite-dielectric plate located in a coaxial line, as functions of the size and permittivity (permeability) of the dielectric and the ferrite. Characteristics are given for the coaxial rectifier at a 10 cm wavelength. (U.S.S.R.)

Some Design Problems for an Asynchronous Clutch with a Monolithic Rotor, T. A. Glazenko. "Avto. i Tel." Aug. 1958. 9 pp. Electromagnetic field in the gap and in the rotor of an asynchronous clutch is analyzed. As a result of the analysis formulas for maximum torque and for maximum sliding are deduced. The effect of some design factors on the torque and on mechanical characteristic shape is found out. (U.S.S.R.)

Influence of the Dimensions of Toroidal Cores on Their Static Magnetic Properties, M. A. Rosenblatt. "Avto. i Tel." Aug. 1958. 12 pp. The influence of the OD/ID ratio of toroidal cores on their magnetization curves and hysteresis loops is considered. Formulae for the determination of these characteristics are given. It is shown that the influence of the OD/ID ratio is the most for magnetic materials with a rectangular hysteresis loop or with a sharp knee on the magnetization curve. (U.S.S.R.)

Single Pair Self-Supporting Coaxial Cables, R. Relus. "Cab. & Trans.," Vol. 12, No. 1. Jan. 1958. 7 pp. The self-supporting cable described in this paper has been designed for two purposes: to establish quickly a long distance sixty-channel link, and to replace temporarily a faulty underground coaxial pair. Tests are described for determining mechanical strength, elasticity, lightness, and reliability. This is followed by a more detailed discussion of protection means against external electromechanical fields. (France.)

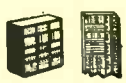
Life Expectancy of Paper Condensers, J. P. Mayeur. "Cab. & Trans.," Vol. 12, No. 2. Apr. 1958. 8 pp. The paper deals with the statistical laws of probable life duration of paper condensors. The influence of temperature and applied voltages is examined, and a test method is proposed for determining the proper service conditions of condensers. The experimental results are in good agreement with the theory. (France.)

International ELECTRONIC SOURCES

Coils for Magnetic Fields, Part 1: Thermal Aspects, G. M. Clarke. "E. & R. Eng." Aug. 1958. 9 pp. The introduction of the foil-wound solenoid for microwave valve applications makes desirable a comparison with the usual wire-wound solenoid. It is found that the internal temperature-rise limitation virtually disappears with foil winding until very high powers are applied. (England.)

Experimental Wide-Band Thermistor Mounts, J. Swift. "Proc. AIRE." June 1958. 4 pp. Several simple thermistor mounts are described which consist basically of a coaxial line terminated by two thermistors placed across an untuned cavity. When capsuled thermistors are used a VSWR of less than 1.1 is obtained over frequency bands centered at 900 MC, 2000 MC, and 4000 MC. With uncapsuled thermistors, a mount has been constructed which covers the band 450-5000 Mc/s with a maximum VSWR of 1.3. (Australia.)

The Spherical Coil as an Inductor, Shield, or Antenna, Harold A. Wheeler. "Proc. IRE." Sept. 1958. 8 pp. The spherical coil is an idealized form of inductor having, on a spherical surface, a single-layer winding of constant axial pitch. Its agneticm field inside is uniform and outside is that of a small coil or magnetic dipole. Its properties exemplify exactly some of the rules that are approximately applicable to practical inductors. Simple formulas are given for self-inductance, mutual inductance, coupling coefficient, effect of iron core, and radiation power factor in free space or sea water. (U.S.A.)



COMPUTERS

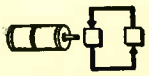
The Method of Solving a Certain Class of Integral Equations By Casing Computers, U. S. Valdenberg. "Avto. i Tel." Aug. 1958. 6 pp. Zeidel's itterative method of approximate solution of Friedgolm's and Voltterra's 1st and 2nd type linear integral equations is worked. The use of computers to solve special types of these equations is indicated. The results of practical application of this method to the automatic control system synthesis problems are considered. (U.S.S.R.)

An Analog Computer Realizing Conformal Mapping for N-Order Polynomial, V. A. Brick and S. A. Ginsburg. "Avto. i Tel." July 1958. 10 pp. An analog computer is described that makes it possible to analyze n-order polynominals (n=1,...,10) with real and imaginary coefficients. The main destination of the computer is to determine characteristic equations roots and to plot Michaelov locus. (U.S.S.R.)

Ternary Logic, E. Muehldorf. "Arc El. Uber.," Vol. 12, No. 4. Apr. 1958. 7 pp. The paper considers the possible application of a ternary switching algebra for electrical systems. A system of semiconductor circuits is developed whose basic circuits correspond to the functions and relationships of switching algebra. In determining a circuit, the author starts out with a switching function that expresses in mathematical terms the properties demanded for the circuit. The construction of a ternary adder is described using transistors. (Germany.)

A Load-Sharing Matrix Switch, G. Constantine, Jr. "IBM J." July 1958. 8 pp. A matrix-switch winding pattern has been developed which allows the power from several pulse generators to be combined into a single high-power pulse to drive a computer core memory. This pulse may be directed into one of a group of outputs. The method of operation, including the logical basis for changes in number of outputs, is described. (U.S.A.)

Computation of Arcsin N for $0<N<1$ Using an Electronic Computer, E. G. Kogbetliantz. "IBM J." July 1958. 5 pp. All known subroutines for Arcsin are based on the relation Arcsin N = Arctan $(N/(1-N^2)^{1/2})$. Therefore, Arcsine is not computated as such but as an Arctangent. (U.S.A.)



CONTROLS

Electric Control of Stable RC-Generator Frequency, V. P. Demeshin. "Avto. i Tel." July 1958. 13 pp. Electric control of stable RC-generator frequency is considered. This new way of control enables to regulate frequency within wide range. The dependence of frequency on control voltage and on transient process is analyzed, inertial and inertialess nonlinearity being taken into consideration. The circuits of RC-generators in question are given. (U.S.S.R.)

Plotting of Root Loci of Automatic Control Systems, N. N. Michaelov. "Avto. i Tel." July 1958. 13 pp. The paper deals with analytical graphical and semigraphical plotting of root loci of automatic control systems. The use of root-finders is suggested to simplify the plotting of root loci. The possibility of the plotting with the help of automatic devices is proved and block-diagrams of these devices are given. (U.S.S.R.)

On the Speediest Transient in Servosystems with Power, Torque and Rate Limitations of the Power Unit, E. A. Rozenman. "Avto. i Tel." July 1958. 21 pp and 2 pp of formulae. The problem of the speediest transient process in servosystems with power, torque and rate limitations of the power unit is analyzed. The phase plane of states of the system is divided according to the form of optimum transient at the said limitations. The solution of the variation problem results in the shape of the speediest transient process. (U.S.S.R.)

Structure of High-Speed Automatic Control Systems, M. V. Meerov. "Avto. i Tel." July 1958. 12 pp. The paper deals with the synthesis of automatic control systems structure. The structure under consideration permits in principle reproduction of any accuracy. It is shown how to take into account some limitations due to nonlinear characteristics of some units. (U.S.S.R.)

Conversion of Output Initial Conditions in a Linear System with Variable Parameters Into an Input Signal, A. V. Solodov. "Avto. i Tel." July 1958. 7 pp. Formulas to convert output initial conditions into an input signal are deduced. The input signal is a combination of various order—functions. The obtained formulas are used to determine the output transient process when pulse transient function is known (the output process is caused by the initial conditions mentioned above). (U.S.S.R.)

A Voltage Regulator with Switched Transistor Operation, R. L. Piper. "El. Energy." Aug. 1958. 7 pp. This article describes a voltage regulator using a power transistor in a switched operation to give increased power handling capacity. (England.)

GENERAL

Recordings of Sputnik II at 40,002 kc/s, H. A. Hess. "Nach. Z." July 1958. 2 pp. The ionospheric Institute Breisach has been successful in obtaining film recordings of CRT pictures of CW signals at 40,002 kc/s from nineteen circulations of Sputnik II during five days between 07.00 h and 17.00 h TU. The duration of reception and the field strength have been recorded. (Germany.)

Molecular Microwave Amplifiers (Maser), H. H. Klinger. "El. Rund." July 1958. 3 pp. The article gives a survey on the electronics of molecular microwave amplifiers known as "Maser" the operation of which is based on the quantum of radiation. After several basic statements on the physical principles of this procedure, the molecular radiation, negative temperature, light quantum and crystal type Maser are discussed. (Germany.)

Vanguard and Explorer. "Toute R.," No. 225. May 1958. 2 pp. This article provides a block diagram of the electronic devices in the Vanguard satellite. In addition, the article describes the systems used in the Explorer III, for transmitting radiation, erosion, and temperatures. (France.)

The Georgi System—The Esperanto to Science, A. Beny. "Toute R.," No. 225. May 1958. 5 pp. The Georgi System is not new. However, a treatise by the author describes the simplifications which can be accomplished by making use of this theory for complex calculations. The Georgi System may mean for physics what the Mendeleev table is to chemistry. (France.)

The Computer and Control for the Telescope at Jodrell Bank. "El. Eng." Aug. 1958. 7 pp. In use the radio telescope is required to carry out relatively complex motions. In this article the method of computing and controlling these movements is described. (England.)

Radio Studies During the International Geophysical Year 1957-58, W. J. G. Beynon. "J. BIRE." July 1958. 16 pp. The knowledge gained in the previous International Polar Years is briefly reviewed and some of the plans for radio measurements in the present I.G.Y. are described. (England.)

INDUSTRIAL ELECTRONICS

Automatic Optimizer, A. A. Feldbaum. "Avto. i Tel." Aug. 1958. 13 pp. The paper deals with the problem of constructing a machine minimizing the function of several variables when additional limitations take place. Some ways of solving the problem are considered and a circuit of the machine is proposed. (U.S.S.R.)

A High Power Vibrator Convertor, R. Stewart Nunn. "El. Energy." Aug. 1958. 6 pp. A new design of vibrator convertor mechanism incorporating many more power contacts than have hitherto been found practicable, achieves a considerable increase in power rating. (England.)

INFORMATION

Certain Problems Involved in Magnetic Pulse Recording. R. G. Ofengenden. "Radiotek." July 1958. 5 pp. The paper cites a new method for shaping playback pulses. The method makes it possible to achieve reliable operation for memory units when there is appreciable superposition of pulses. A study is made of the dependence of playback pulses on the duration of the recording pulses. (U.S.S.R.)

The Transmission Capacity of a Binary Pulse-Code System Which Has Nonidentical Symbol-Distortion Probabilities, L. Z. Kliachkin. "Radiotek." Apr. 1958. 4 pp. The paper treats the transmission of information in a pulse code system with a binary code having nonidentical distortion probabilities for the recention of the symbols 0 and 1. The paper analyzes the effect of fluctuating noise on the system from the point of view of its transmission capacity. (U.S.S.R.)

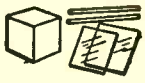
Linear-Transformations of Binary Codes, N. Ja. Matvukhin. "Avto. i Tel." Aug. 1958. 12 pp. Linear transformations of binary codes with a fixed number of elements per code symbol, when for each possible symbol there is

a reciprocally single valued relation, are considered. (U.S.S.R.)

The Application of Information Theory to Amplitude Compression, J. A. Ville. "Cab. & Trans.," Vol. 12, No. 2. Apr. 1958. 4 pp. When a signal of instantaneous amplitudes is transmitted through a channel in which the amplitude variation range is limited to two extreme values (—A, +A) it is generally suitable to effect an amplitude compression with a distribution of uniform density. From the point of view of information theory, a rigorous solution to this problem encounters extreme difficulties. (France.)

IRE Standard on Definitions of Terms on Information Theory. "Proc. IRE." Sept. 1958. 3 pp. (U.S.A.)

A Direct-Reading Printed-Circuit Commutator for Analog-to-Digital Data Conversion, C. A. Walton. "IBM J." July 1958. 15 pp. A novel direct-readout printed-circuit commutator has been incorporated in the design of a shaft-to-digital converter system for analog-to-digital data conversion. The design avoids the use of supplementary coding or additional translation circuitry required to operate other shaft-to-digital converters. Methods are described for ensuring logical progressions of numerical data despite gearing errors and the analog nature of the input-shaft position. Some applications of the commutator are discussed. (U.S.A.)



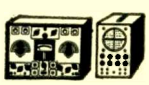
MATERIALS

On High-Coercive Tapes, G. S. Veksler, P. S. Tomashevskii. "Radiotek." June 1958. 4 pp. An analysis is made of the practicality of using high-coercive tapes; the results of experimental tests on the magnetic and electro-acoustic properties of various types of Soviet tapes are cited. (U.S.S.R.)

Square Loop Ferrites and Tests of Their Storage Properties, C. Heck and H. Reiner. "Nach. Z." July 1958. 10 pp. The requirements for storage cores are discussed with the aid of designs for storage matrices. This leads to specifications as to properties of the material and shape of the storage cores. (Germany.)

Ferrites for High-Power R-F Tuning, Pietro P. Lombardini and Richard F. Schwartz. "El. Mfg." Aug. 1958. 12 pp. Incomplete manufacturers' data forced the designers of the Penn-Princeton Proton Synchrotron to undertake an elaborate program of ferrite evaluation for the 2.5—to 30—megacycle range. Here are the results for a variety of commercially available materials. (U.S.A.)

How Magnetic Tape Characteristics Affect System Performance, Clarence B. Stanley. "Auto. Con." July 1958. 4 pp. An analysis of tape's function as a component of various types of recording systems. (U.S.A.)



MEASURE & TESTING

***Quartz Crystals Require Testing for Spurious Response,** A. N. Silverstein. "El. Ind." Oct. 1958. 4 pp. Increasing selectivity of quartz crystal oscillator circuits prompts detection of spurious response. Described here is a complete development program — tester design, reference selection, and test requirement determination. (U.S.A.)

On Measuring Impedances Using A Feeder Reflectometer, S. A. Vakin, I. F. Poletaev. "Radiotek." July 1958. 4 pp. The paper analyzes a method for measuring impedances which is based on using a feeder reflectometer of the type developed by A. A. Pistol'kors and M. S. Neiman (modernized by G. P. Strauss). The impedance is determined on the basis of two measurements of the modulus for the coefficient of reflection from the impedance under study when it is shunted by a certain standard resistance, and when the shunt is removed. (U.S.S.R.)

A Wide-Band Decimeter-Wave Noise Generator, A. D. Kuz'min, A. N. Khvoshchev. "Radiotek." July 1958. 7 pp. The paper describes a noise generator designed for measuring the noise coefficient of radio receivers in the decimeter band; the noise generator covers the frequency range 300-3000 Mc without any retuning. In this band the noise temperature of the generator is constant and equal to 15900 deg K ±7%. The standing-wave coefficient of the generator in the indicated band is less than 1.5. (U.S.S.R.)

Fluctuation Action in the Simplest Parametric Systems, V. I. Tichonov. "Avto. i Tel." Aug. 1958. 8 pp. Statistical characteristics of the output random signal of a parametric system are obtained when outer action and variable element are correlated stationary normal random functions. The system under consideration is described by the first-order linear differential equation. (U.S.S.R.)

Measurements of Noise Peaks in a Noise Spectrum and Their Influence on the Volume Tolerance, H. Niese and J. Koehler. "Hochfreq." Vol. 66, No. 5, Mar. 1958. 11 pp. A study is made of the volume tolerance of broad band noise and its dependence on the pass-band in the range from 5 to 1,000 cycles. The center frequency is used as parameter. (Germany.)

A Differential Bridge for Impedance and Impedance Variation Measurements Between 10 kc and 10 mc, I. Eyraud. "Cab. & Trans." Vol. 12, No. 2, Apr. 1958. 14 pp. Direct reading impedance bridges are described which permit the determination of the real and imaginary components of an impedance with an accuracy of 0.1 ohm. (France.)

The Negative Impedance in General and Two and Four Terminal Negative Impedance Repeaters, J. Dezoteux. "Cab. & Trans." Vol. 12, No. 2, Apr. 1958. 15 pp. First the paper gives a definition of negative impedances and classifies them with respect to their stability into short and open circuits and specifies their general design by means of high-gain amplifiers and a balancing network. Applications to impedance converters and transistor oscillating devices are indicated. Finally, four terminal repeaters are described. (France.)

Improvement of Pulse Fault Location by Intercorrelation, G. Comte. "Cab & Trans." Vol. 12, No. 2, Apr. 1958. 8 pp. Fault locations by means of echo meters is hindered by background noise when the pulse echo amplification must be increased to obtain a longer range. Intercorrelation devices allow a substantial reduction of the relative level of the noise with respect to that of the main signal. (France.)

A Sample Inspection Method Based Upon a Percentage Criteria, H. Pech. "Cab. & Trans." Vol. 12, No. 2, Apr. 1958. 7 pp. A new method is given for computing the efficiency of an inspection procedure by assuming an a priori known distribution of the faulty samples. (France.)

Testing the Linearity of Modulators and Demodulators in Multi-Channel F.M. Transmitters and Receivers, G. C. Davey. "El. Eng." Aug. 1958. 3 pp. This article describes a newly engineered technique for rapid adjustment of the linearity of f.m. modulators and demodulators, where the linearity must be of a high order. A cathode-ray tube display clearly discriminating changes in slope as little as 1% is used. (England.)

Planned Reliability, K. L. Wong and W. C. Gray. "El. Eq." Aug. 1958. 4 pp. Component failure statistics and analysis for a specific miniaturized digital computer. A guide to component specification and selection for electronic equipment design. (U.S.A.)

RADAR, NAVIGATION

Computing the Range of a Pulse Radar According to its Parameters and the Specified Probability of Target Detection, M. M. Gerdov. "Radiotek." July 1958. 8 pp. The paper derives formulas which make it possible to compute the range of a pulse radar. The formulas are derived while taking into account the effect of intrinsic receiver noise and reflected signal fluctuations caused by the motion of the target. The appearances of the useful signal and the noise at the output of the receiver are treated as joint events. The proposed formulas do not take into account the effect of reflection from the earth on the formation of the radiation pattern for the radar antenna, or the attenuation of the radiowaves in the atmosphere. (U.S.S.R.)

A New Highly Efficient Pulse Power Amplifier at Audio Frequencies, D. V. Ageev, V. V. Malanov, K. P. Polov. "Radiotek." June 1958. 4 pp. The paper analyzes a new high-efficiency audio-frequency pulse power amplifier. Detailed results are given for preliminary operational tests. A new pulse amplifier circuit is used. (U.S.S.R.)

Two Short Low-Power Ferrite Duplexers, R. S. Cole and W. N. Honeyman. "E. & R. Eng." Aug. 1958. 5 pp. Two short ferrite duplexers which are suitable for low-power Doppler navigational systems in X-band are described, and their performances given. (England.)

Factors in the Design of Airborne Doppler Navigation Equipment, E. G. Walker. "J. BIRE." July 1958. 20 pp. The paper describes the use of a Doppler-sensor of aircraft component-velocities as an input for self-contained dead-reckoning navigation. (England.)

Refraction Anomalies in Airborne Propagation, Ming S. Wong. "Proc. IRE." Sep. 1958. 11 pp. Ray tracing techniques are used to explain the irregularities of radio wave propagation caused by various refractive index patterns of the atmosphere, determined from airborne measurements. (U.S.A.)

Light Modulator Records Airborne Radar Displays, Leo Levi, "El." Aug. 1, 1958. 4 pp. Light modulation using an ultrasonic cell achieves resolution and dynamic ranges previously unattainable. (U.S.A.)

Logical Design of SAGE Radar Input Monitor, Byron L. Bair. "El." Aug. 15, 1958. 6 pp. Speed and clarity of information are prime requisites of any effective radar system such as SAGE. The monitor described accomplishes these objectives and eliminates other unnecessary data simultaneously. (U.S.A.)

SEMICONDUCTORS

***Design Nomographs for Transistor Narrow Band Amplifiers,** L. M. Krugman. "El Ind." Oct. 1958. 4 pp. Nomographs are given which permit quick determination of the realizable performance of a transistor as a narrow band amplifier in terms of its available or measurable operating parameters and a desired skew factor. (U.S.A.)

***A Transistor DC-AC Beta Tester,** T. P. Sylvan. "El. Ind." Oct. 1958. 3 pp. (U.S.A.)

***Applications for Zener Diodes,** G. Porter. "El. Ind." Oct. 1958. 2 pp. One of the newest of the electronic components, the zener diode offers high current handling capabilities in a small package, useful in design of lightweight, compact equipment. (U.S.A.)

International ELECTRONIC SOURCES

The Analysis of Transistor Circuits, E. N. Garmash. "Radiotek." July 1958. 8 pp. The paper studies a special method developed by V. P. Sigorskii for the analysis of transistor circuits without the preliminary use of equivalent transistor circuits. The use of this method is illustrated by the example of a two-stage amplifier. (U.S.S.R.)

Determining the Limiting Frequency for the Current Transfer Coefficient of a Transistor, T. M. Agakhanian, L. N. Patrikeev. "Radiotek." Apr. 1958. 8 pp. The paper presents experimental data which verify the possibility of using theoretical derivations for determining the boundary frequency for the current transfer coefficient of ordinary transistors and high-frequency drift transistors; this can be done by using the phase-frequency characteristics of the current gain determined for a common-emitter circuit. (U.S.S.R.)

Experimental and Theoretical Analysis of Newer Types High Frequency Transistors, Especially the Drift Transistors, W. Guggenbuehl and W. Wunderlin. "Arc. El. Uber." Vol. 12, No. 5, May 1958. 10 pp. The transport factor of the base of a drift transistor is compared with experimental results. The high frequency behavior of a transistor with uniform base layer resistivity is considered for high level injections. Methods to evaluate the transit time through the base layer are given. (Germany.)

Shot Noise in Semiconductors, Particularly in Germanium Point Diodes at 1 kc/s to 10 Mc/s, H. Bley. "Nach. Z." July 1958. 11 pp. Idealized noise regions in the reverse and forward directions are superimposed with shot noise regions which can be described by simple equations with constant frequency and current exponents. (Germany.)

Phase Equilibria in the Ferrite Region of the System Manganese-Iron-Oxygen, M. W. Shafer. "IBM J." July 1958. 7 pp. An important factor in growing crystals from the melt is an understanding of the phase-relationships for systems involving the necessary elements. This investigation deals with the determination and interpretation of these relationships in the ferrite region of the system Mn-Fe-O and points out the conditions necessary to grow crystals along the Mn_3O_4-Fe_3O_4 join. (U.S.A.)

Transistor Circuits Alter Magnetic Amplifier Frequency Response, James C. Taylor and Charles L. Wyman. "El. Mfg." Aug. 1958. 4 pp. Some solutions to the problem posed by the long and sometimes variable time-constants of full-wave magnetic amplifiers are posed. (U.S.A.)

How to Regulate D-C Power with Transistors, R. T. Bayne and J. M. Buchanan. "Auto. Con." July 1958. 4 pp. A method for increasing the amount of d-c power which may be regulated by typical power transistors. (U.S.A.)

Transistorized Analog-Digital Converter, William B. Towles. "El." Aug. 1, 1958. 4 pp. (U.S.A.)

TELEVISION

***Automatic Light Control for Vidicon Film Cameras, Part 1, W. L. Hurford.** "El. Ind. Ops. Sect." Oct. 1958. 3 pp. Unattended operation of vidicon film chains—black-and-white and color—is now feasible. A neutral density filter interposed between source and camera is responsible. The complete system is detailed here. (U.S.A.)

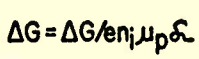
The Transmission of the Coordinates of Television Picture Elements, I. I. Tsukkerman. "Radiotek." Apr. 1958. 3 pp. The excess of television information can in certain cases be reduced if the brightness and coordinate signals for only the "new" elements of the decorrelated picture are transmitted. It is demonstrated that, depending on the statistics of the television picture, it may be expedient to transmit directly either both coordinates of the elements or only the line coordinate and the signal for line termination. (U.S.S.R.)

On the Average Component of a Television Signal and Methods for Obtaining It, V. A. Novik. "Radiotek." July 1958. 5 pp. The paper studies the problem involved in obtaining and introducing the average component of a television signal when cathode-ray television transmitter tubes with charge storage are used. (U.S.S.R.)

Signal Conversion with Video Cameras, W. Dillenburger. "Arc. El. Uber." Vol. 12, No. 5, May 1958. 16 pp. The suitability of Vidicon tubes for converting the standard TV picture signals is investigated. The picture tube must meet particular demands. Results with respect to definition, gamma, and signal-to-noise ratio are investigated. (Germany.)

Contrast Filter for TV Sets, R. Suhrmann. "El. Rund." July 1958. 6 pp. The attainable contrast may be improved by the use of a colored protection disc in front of the screen of TV sets. Grey filter and selective filter can be distinguished according to spectral transparency. (Germany.)

The Maintenance of Television Studio Equipment, V. G. Perry. "Brit. C. & E." Aug. 1958. 6 pp. The organization required to maintain the equipment used in the television studios of the B.B.C. is described: an outline is given of the maintenance work involved, and a brief mention is made of possible future trends. (England.)



THEORY

The Fourier-Series Method Applied to Linear Systems, A. N. Zaezdnyi. "Radiotek." Apr. 1958. 12 pp. The paper shows that when harmonic synthesis tables are available for the study of linear systems which are subjected to a periodic input, it is expedient to use the Fourier-series method to a considerably greater extent than is done at the present time. The paper proposes a new method of harmonic synthesis based on the direct utilization of operational calculus tables. Rules are given which make it possible to find the sums of series from known sums of other series. Two examples are given of the analysis of linear systems based on the operations of harmonic synthesis. (U.S.S.R.)

The Theory of the Gradient Receiver of First and Second Order, C. Smetana. "Hochfreq," Vol. 66, No. 5. Mar. 1958. 8 pp. The properties of gradient microphones of first and second order are discussed. This is followed by a discussion of the gradient theory. Finally, the practical design of a gradient microphone of the first order is described. (Germany.)

Probability Density and Spectrum of Stationary Time Processes, P. Frey. "Hochfreq.," Vol. 66, No. 5. Mar. 1958. 2 pp. The explanations are given for limited resolutions which are achieved by measuring the spectrum and the probability density. The relationship between the calculated and the measured values are given by differential equations, and solutions are provided. Simple examples explain the relationship. (Germany.)

Noise of Space Charged Diodes Deduced in the Transit Time Region with Consideration of the Maxwell Velocity Distribution of the Electrons, K. Loecherer. "Arc. El. Uber.," Part I, Vol. 12, No. 5. May 1958. 12 pp., and Part II, No. 61. June 1958. 7 pp. The fundamental equations of a planar space charge diode are pursued, and a numerical solution of an example are given. From the numerical results, the quadripole noise parameters of the ideal triode are calculated. (Germany.)

The Reactance Theorems, H. Wolter. "Arc. El. Uber.," Vol. 12, No. 4. Apr. 1958. 5 pp. Since the proofs of the reactance theorems by means of conversion between star configuration and n-corners polygon are not fully valid, the paper outlines a successful inductive mode. It shows that short circuit and open circuit impedances of a passive four-terminal network are of "foster" type. Every polygon with n-corners consisting of "foster" type two-terminal network acts as a "foster" type two terminal network if any two corners are elected as terminals. (Germany.)

TRANSMISSION

The Properties of Lossy Inhomogeneous Transmission Lines Under Matched Conditions, H. Meinke. "Nach. Z." July 1958. 7 pp. The paper contains a summary of the possible technical applications of inhomogeneous lossy lines. The behaviour of a line with only series losses is based on the known behaviour of an equivalent lossless line. (Germany.)

The Homogeneous Rectangular Wave Guide with a Damping Foil, H. Buseck and G. Klages. "Arc. El. Uber.," Vol. 12, No. 4. Apr. 1958. 6 pp. The influence of an axial damping foil on the transmission properties of rectangular wave guides is analyzed theoretically under the assumption that the foil is connected to the walls of the guides. A detailed discussion is given of the field distribution and the lanar waves that establish the wave pattern in the quasi optical condition. (Germany.)

Properties and Evaluations of the Long Slot Directional Coupler, E. Schuon. "Arc. El. Uber.," Vol. 12, No. 5. May 1958. 7 pp. Considering the long slot directional coupler as a single wave guide in which two field distributions exist, the boundary conditions at the input of the directional coupler can be satisfied by the two types of field. Coupling factor and directivity can be reduced to the difference of the cut-off wave length and eigenvalues respectively. Quantitative measurements confirm these conditions. (Germany.)

TUBES

Commercial Gas-Discharge Counter Tube (Decatrons), I. Ia. Breido, G. M. Iankin. "Radiotek." July 1958. 7 pp. The basic parameters and construction data are given for various types of cold-cathode gas-discharge counter tubes manufactured in the USSR. Circuits for control units are analyzed and applications of the decatrons under study are cited. (U.S.S.R.)

A High Frequency Mass Spectrometer and its Use for the Vacuum Tube Technique, V. F. Varadi et al. "Vak. Tech.," Vol. 7, No. 213. Apr. 1958. 6 pp. A light weight mass spectrometer designed for high frequency operation is described. It is used in the tube industry for leak detection. The device also provides indication of the total pressure. A second instrument with a resolution of 25 is designed for the quantitative gas analysis. The accuracy is 10%. (Germany.)

Grid Control Methods of Thyratrons, H. Dornheim. "El. Rund." July 1958. 4 pp. The most important grid control methods of thyratrons and their properties are discussed. Whereas horizontal and vertical controls will in many cases suffice for simple control units, only pulse controls can be used for high demands on precision and reversion time. (Germany.)

U. S. GOVERNMENT

Research reports designated (LC) after the PB number are available from the Library of Congress. They are photostat (ph) or microfilm (mi), as indicated by the notation preceding the price. Prepayment is required. Use complete title and PB number of each report ordered. Make check or money order payable to "Chief, Photoduplication Service, Library of Congress," and address to Library of Congress, Photoduplication Service, Publication 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.

Miniaturized Pulse Connectors, J. H. Gesell, Federal Telecommunications Laboratories for Wright ADC. Dec. 1956. 49 pages. (PB 131048, OTS) $1.25. Miniaturized pulse connectors able to withstand the severest climatic and environmental conditions yet operate satisfactorily at working voltages of 7500 volts peak were developed. The connectors, which are said to be the smallest developed to the date of the research, were intended to replace larger pulse connectors then used in airborne electronic equipment. The connectors met or exceeded all electrical and mechanical requirements of the associated cable and were capable of operation over the temperature range minus 65 to 150 C at altitudes up to 70,000 feet. They measured approximately one inch in diameter and three inches in length, or five inches for plug and mated recepticle. Development of semiconducting silicone rubber for high temperature operation is discussed in the report. Tests for performance characteristics of connector assemblies and components are reviewed in detail.

A Miniature, High Altitude, Constant Cooling Capacity Blower for Electronic Equipment, L. Cromwell, Gray and Huleguard, Inc., for Wright ADC. Apr. 1957. 45 pages. (PB 131184 OTS) $1.25. This design study showed a 400 cycle motor-driven fan controlled by a temperature sensitive bridge circuit to be an effective means of maintaining constant ambient temperature in a chamber containing electronic equipment. The blower system operates through an axial flow impeller driven by a high-slip three-phase 400-cycle AC motor with a speed range from 3000 to 22,000 rpm, a wide range necessary for constant cooling effect at both sea level and high altitude. A three-phase magnetic amplifier, with one bias and one signal winding, serves as a variable voltage source for the motor. The winding is connected directly to the output of a bridge circuit, one leg of which is a thermistor or temperature transducer. A small change in the resistance of the thermistor, which is affected by changes in temperature, causes a change in the bridge output or signal winding input, which in turn regulates the output voltage of the magnetic amplifier and the speed of the motor. The transducer is placed in the outlet airstream of the electronic equipment.

The Fault Diverter—A Protective Device for High-Power Electron Tubes, B. H. Smith, Radiation Laboratory, Univ. of Calif. for U. S. Atomic Energy Commission. Aug. 1957. 21 pages. (UCRL-3701 (revised) OTS) 75 cents. Fault diverters, or crowbars, have proven very effective in protecting against transient-induced power arcs in oscillator tubes used at the University's Radiation Laboratory. The protective device short circuits the oscillator-plate power supply in the event of an over-current, thus removing the power flow from the fault within a few microseconds. Ignitrons, thyratrons, and triggered spark gaps are used for short circuiting. The power supply is protected from the short circuit either by a current-limiting device or a high-speed contactor which removes the system from the power lines.

An Analytical Method for Correcting the Magnetic Field of a Cyclotron, J. A. Baker and W. F. Stubbins, Radiation Laboratory, Univ. of Calif. for U. S. Atomic Energy Commission. Aug. 1957. 22 pages. (UCRL-3907, OTS) 75 cents. Studies of particle trajectories in high energy accelerators have indicated that for circular machines efficient acceleration is achieved by creation of a uniform, well-tailored magnetic field. This volume describes a computational procedure which gives the iron shim element changes required to correct the magnetic field of the 184-inch cyclotron, thus avoiding the empirical shimming previously used. Two hundred and forty simultaneous equations are solved by an iterative process to find the necessary changes.

The Feasibility of Using Magnetic Amplifiers with 2 Vanadium Permendur Cores at Temperatures np to 500 C, W. H. Raskin, U. S. Naval Ordnance Laboratory. Oct. 1956. 9 pages. (PB 131050, OTS) 50 cents. Saturable reactor amplifiers which operated successfully at temperatures from —68 C to 500 C were constructed as part of a Navy study of high-temperature components for missiles. Since no high-temperature diodes were available, the standard two-core saturable reactor circuit was used. The core material, known as 2 Vanadium Permendur, had a composition of 2 percent vanadium, 49 percent cobalt, and 49 percent iron. Windings were made from glass insulated copper wire. Although some gain was lost because of increased copper resistance at high temperatures, it was concluded that the amplifiers were operable in the —65 C-500 C range. It was further concluded that the use of high temperature diodes would permit the use of almost any standard magnetic amplifier circuitry.

Variable, Wire-Wound, Precision Resistors, J. D. Roehm, L. H. Stember, Jr., and P. G. Perry, Battelle Memorial Institute for Signal Corps, U. S. Army. July 1954. 67 pages. (PB 131216, OTS) $1.75. Final data are presented on precision wire-wound variable resistors (potentiometers) investigated prior to preparation of Signal Corps specifications. Thirty commercial resistors were examined, most of them wire-wound. All were of the linear type. Information was accumulated on how linearity accuracy and total resistance were affected by rotational life, load life, temperature cycling, low-temperature operation and storage, and moisture-resistance cycling. Dielectric-strength, noise, and temperature-coefficient data were also collected. The most destructive test was moisture resistance, and only eight units remained operative. Rotational and load-life operations greatly affected specimens, while temperature tests had little effect. Except for smaller units, all specimens passed the dielectric-breakdown-voltage requirements. Detailed results are presented in summaries and tables.

Powering Transistorized Electronic Devices with Radiated Energy (U), L. R. Crump, Diamond Ordnance Fuze Laboratories, Ordnance Corps, U. S. Army. Feb. 1956. 13 pages. (PB 131264, OTS) 50 cents. This report describes the principle and circuitry for powering electronic devices entirely from electromagnetic energy radiated from distant sources. The energy sources may be transmitters operated specially for powering the devices, or ordinary commercial radio or television stations in urban areas. In most applications of the system, dc power derived from received rf energy is used to power transistors in various circuits. The report emphasizes the use of a transistor amplifier in the system to provide remote switching of power to a load. Complete instructions are given for construction of a standard broadcast radio receiver operating on this principle. Circuit arrangements are described for storing dc power, withdrawing the stored power at selected rates and amplitudes, changing dc power to ac power, and applying the required power to various devices.

Applications of Transistors to Amplification of Barium Titanate Accelerometer Signals (U), R. C. Carter, Diamond Ordnance Fuze Laboratories, Ordnance Corps, U. S. Army. Mar. 1956. 39 pages. (PB 131277, OTS) $1. Transistor amplifier circuits are proposed to reduce microphonism, a serious problem when vacuum tube amplifiers are used in telemetering shock and vibration data with barium titanate accelerometers. The microphonic noise output caused by vibration of elements in the vacuum tube amplifier may, under some conditions, be as large as the output of the accelerometer. Reduction of microphonism was attempted through use of 2N77 transistors in the amplifier. Of three configurations analyzed, a grounded emitter with added emitter resistance appeared to give the best signal-to-noise ratio. The circuit did not meet specifications, however, because of low frequency noise (excess noise below one kilocycle). The collector noise generator was the main noise source. Other circuits studied were a grounded emitter with added base resistance and a grounded collector stage.

Streamlined Lens-Radomes, A. F. Kay, Wright ADC. Dec. 1956. 49 pages. (PB 131041, OTS) $1.25. Feasibility of unifying the design of a lens focussing element with a radome for streamlined nose applications was investigated. A design technique was developed for variable refractive index lens-radomes with streamlining which satisfied the requirements of perfect axial focussing and the Abbe sine condition. The resulting lens-radomes were analyzed for weight, dielectric losses, fabrication techniques, and methods of feeding. Beam shaping ability off-axis was studied by means of a ripple tank hydrodynamic analogue in two special cases. It was concluded that scanning range in these cases was about 30°. The range could be substantially increased, it was believed, by redesign. The lens-radome was very similar to a conventional Luneberg lens capped by a thin wall dielectric radome, with the region between filled with foam. It differed in that small deviations from the Luneberg index variation compensated for the additional dielectric in the foam and radome.

Materials Developments and Fabrication Processes in Radomes for USAF Ground Electronic Equipment, S. C. Nilo, Rome Air Development Center. Feb. 1956. 35 pages. (PB 121272, OTS) $1. Radomes in use by the Air Force permit operation of radar antennas under adverse conditions and wind velocities higher than those for which the antennas were designed. They also allow reduction of weight in radar design. This report reviews the fabrication of air supported and rigid radomes and the development of lightweight fabric materials. Properties of the new Dacralon fabric are given, and the material is compared to fabrics used in earlier stages of radome development. Formulation of weather coating compounds and their uses are discussed, and results of service life tests are given. Development and fabrication characteristics of the rigid reinforced plastic radome are described, and the advantages of such radomes are listed.

Simple Conversion of an Analytical Balance for Automatically Recording Weight Changes, C. Campbell and S. Gordon, Picatinny Arsenal, U. S. Army Ordnance Corps. Oct. 1956. 15 pages. (PB 131285, OTS) 50 cents. An automatic analytical balance which records electronically was developed for use in a thermobalance for thermogravimetric studies of pyrotechnic ingredients and compositions. The device provides for continuous automatic recording of weight changes after a simple conversion of an analytical balance which requires no balance alterations. It is based on the hydrostatic principle that changes in the amount of a liquid displaced by a rod suspended into it from one end of a balance beam are proportional to the change in weight of a sample suspended from the other end. A linear variable differential transformer is used to electronically measure and record beam deflections, reflecting the changes in weight. By using rods of various diameters and liquids of various densities, the sensitivity can be varied over ranges of micrograms to grams.

International ELECTRONIC SOURCES

PATENTS

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

High Frequency Power Dividing Networks, #2,820,202. Inv. S. E. Miller. Assigned Bell Telephone Laboratories, Inc. Issued Jan. 14, 1958. A predetermined fraction of electromagnetic wave energy is abstracted from a main transmission line, the fraction being substantially independent of frequency over a broad band. An auxiliary transmission line is coupled to the main transmission line over a length depending on the phase velocity constants of both lines and the predetermined fraction to be abstracted. The frequency selectivity of the coupling is minimized by making the two phase velocity constants substantially different from each other.

Flame Turbulence Analyzer, #2,820,945. Inv. R. S. Marsden. Assigned Philips Petroleum Co. Issued Jan. 21, 1958. Two pairs of closely spaced electrodes are arranged in a turbulent flame a known distance apart. Current and flame noise are measured. A computor for squaring, rectifying and averaging received signals is provided. The result is applied to an indicator.

Color Television System, #2,822,419. Inv. H. R. Lubcke. Issued Feb. 4, 1958. The different color images are scanned at different speeds and the signal amplitude for the different colors is also changed. In the reproducer the scanning speed is controlled to conform to the color signal scanning at the transmitter and the amplitude is adjusted as required.

Transistor Amplifier Circuit, #2,822,430. Inv. H. C. Lin. Assigned Radio Corporation of America. Issued Feb. 4, 1958. The output of a transducer, having an essentially capacitive internal impedance is applied between the base and emitter electrodes of a transistor. A resistor is connected to the emitter electrode and a capacitive impedance is connected in parallel with the transducer to provide a load circuit for the transducer having a time constant of a high value to compensate for frequency response variations of the transducer output current.

Slow-Wave Guide for Traveling Wave Tubes, #2,822,501. Inv. H. C. Poulter. Assigned Research Corporation. Issued Feb. 4, 1958. The helix of the tube is surrounded and supported by a tube of insulating material. The tube wall has a single internal generally longitudinal groove formed therein to interrupt its contact with the helix for regularly spaced and substantially uniform intervals along the length thereof.

Stabilized TV System, #2,822,503. Inv. E. J. Campbell. Assigned Allen B. Du Mont Laboratories, Inc. Issued Feb. 4, 1958. The deflection signal is fed to a first winding on a transformer. A second transformer winding is connected to the accelerating electrode of the display tube forming a current carrying loop with this electrode. The control grid of an amplifier tube is connected to this current loop and receives current in a direction opposite to that drawn by the accelerating anode. The plate of the amplifier tube supplies a third winding on the transformer.

Magnetron Amplifier, #2,822,504. Inv. Chas. V. Litton. Assigned Litton Industries, Inc. Issued Feb. 4, 1958. A coupling for introducing energy into a magnetron comprising a plurality of inwardly extending radial partition walls forming resonators, extends from the inner end of one partition wall to the external anode surface. The coupling wall is formed by the one partition wall and traverses its total radial extension, whereby the only energy transfer opening into the magnetron is at the inner end of the one partition wall.

Electric Pulse Time Modulators, #2,822,520. Inv. K. W. Cattermole. Assigned International Standard Electric Corp. Issued Feb. 4, 1958. A train of short regularly repeated amplitude modulated sample pulses, respectively representing samples of the signal waves of one or more communication channels is stored in a reactive device. The stored energy controls the time of generation of an output position-modulated pulse, whose time position with respect to one of a series of regularly spaced time instants corresponds to the amplitude of the original signal wave samples.

Grid Network for Pulsed Oscillator, #2,822,521. Inv. F. T. Littell. Assigned International Telephone and Telegraph Corp. Issued Feb. 4, 1958. A grid-controlled pulse modulator tube drives the cathode of a grid-controlled oscillator tube. A substantial capacitance is produced across the modulator output which is in series with the oscillator and charged solely therethrough. A resistance-capacitance network is extended between the oscillator grid and ground for producing rapid charging of the capacitance upon termination of the modulating pulse to thereby produce rapid cut-off of the oscillator oscillations.

Semiconductor Angle Modulator Circuit, #2,822,523. Inv. P. L. Bargellini. Assigned Radio Corporation of America. Issued Feb. 4, 1958. A plurality of ohmic base contacts are symmetrically located equi-distant on a semiconductor about an emitter electrode. Equal frequency carrier signals are applied to the base contacts in relative phases to establish a rotating electric field within the semiconductor. Modulating signals are also applied to the base contacts. An angle-modulated output is obtained from the collector electrode, having a center frequency equal to the carrier frequency.

Aircraft Instrument Landing System, #2,822,540. Inv. J. L. Butler. Assigned Sanders Associates, Inc. Issued Feb. 4, 1958. A plurality of radiating members radiate sequentially at least three plane-polarized beams of h.f., the directions of polarization being so oriented as to provide a static reference coordinate system having at least one preselected control path. A receiver contains a polarization discriminator to develop an error signal having an amplitude varying with the resultant beam polarization.

Subscriber Line Ringing in an Electronic Telephone System, #2,823,266. Inv. R. B. Trousdale. Assigned General Dynamics Corp. Issued Feb. 11, 1958. An electron tube connects, when conducting current, a series-connected capacitor and a ringer to a source of cyclic ringing current. The operating signal is applied to the tube grid, rendering the tube conductive during a portion of each ringing cycle. A rectifier inserted between the plate and cathode of the tube discharges the capacitor during another portion of the ringing cycle.

Transistor Amplifier Having a Variable Impedance, #2,823,269. Inv. H. H. van Abbe and L. J. Cock. Assigned North American Philips Co., Inc. Issued Feb. 11, 1958. The emitter electrode of a transistor and one terminal of the signal source are grounded. The other signal source terminal is connected to the base electrode over a first resistor. A negative feedback resistor, large compared to the first resistor, extends between the second signal source terminal and the collector electrode. Setting of a variable on the feedback resistor, which tap connects to the base electrode, controls the amplification factor without an excessive drop in the input impedance presented to the signal source.

Adjustable Sweep Circuit, #2,823,274. Inv. R. F. Casey. Assigned Allen B. Du Mont Laboratories, Inc. Issued Feb. 11, 1958. A charging current across a series connected capacitance and resistance results in a wave pulse across the resistance and a sawtooth wave across the capacitance. A quasi-exponential wave is also produced and the three waveforms are combined.

Detector Circuit, #2,823,306. Inv. L. Malter. Assigned Radio Corporation of America. Issued Feb. 11, 1958. A gas-filled diode has a voltage applied thereto and in series with its load impedance to operate the tube in a mode having the major portion of the space between the equipotential cathode and the cylindrical anode which surrounds the cathode filled with a dark plasma. R.F. energy is applied to the dark space by a coaxial line, the outer conductor of which connects to the anode and the inner conductor of which connects to the cathode.

Semiconductor Network, #2,823,312. Inv. E. Keonjian. Assigned General Electric Corporation. Issued Feb. 11, 1958. The frequency-stabilization circuit of a transistor oscillator comprises an ambient-temperature sensitive voltage divider having an intermediate terminal connected to the transistor base electrode. The temperature-sensitive element is arranged to control the energization of the transistor to reduce ambient-temperature induced changes in the oscillator frequency.

Oscillator Circuit, #2,823,314. Inv. F. V. Topping. Assigned F. V. Topping, Electronics Ltd. Issued Feb. 11, 1958. A crystal controlled oscillator in which the oscillation amplitude is limited by the voltage between the control grid and cathode comprises a cathode bias resistor and a grid leak resistor in parallel with a crystal diode rectifier. The rectifier is poled to conduct when the grid is positive with respect to ground. A capacitor is connected between each of the crystal terminals and ground.

Distance Measuring Systems with Compressed Returned Pulses, #2,823,375. Inv. G. D. Camp. Assigned Melpar, Inc. Issued Feb. 11, 1958. Substantially rectangular pulses of predetermined duration are transmitted and returned from a remote target. On reception, each pulse generates pulse of a duration, less than the predetermined duration of the emitted pulses, and indicative of the distance of the remote target.

Semi-Conductor Signal Processing Circuits, #2,824,170. Inv. H. C. Goodrich. Assigned Radio Corporation of America. Issued Feb. 18, 1958. A transistor receives the output of an amplifier tube and is connected to separate the synchronizing signal. For this purpose a signal conductive path, such as a capacitor, extends between the base electrode of the transistor and the power supply for the amplifier plate, whereby undesired a.c. components are suppressed.

Sampling Apparatus, #2,824,172. Inv. Wm. H. Cherry. Assigned Radio Corporation of America. Issued Feb. 18, 1958. The received color television signal which has a given phase relative to the phase of a reference wave and is modulated by an a.c. and a d.c. signal is modulated in the receiver by a wave of carrier frequency and predetermined phase. The modulated output will provide the a.c. signal component, while the d.c. component is derived from the non-modulated portion of the composite signal.

Television Synchronizing Circuit, #2,824,224. Inv. N. C. Fulmer. Assigned Allen B. Du Mont Laboratories, Inc. Issued Feb. 18, 1958. The composite noisy signal is applied to the input grid of a tube in a predetermined polarity. An integrating circuit is connected between the signal source and the gating grid of this tube for applying the integrated signal to the gating grid in the same predetermined polarity.

Variable Delay System, #2,824,227. Inv. D. Richman. Assigned Hazeltine Research, Inc. Issued Feb. 18, 1958. The instantaneous frequency of a carrier wave is controlled by a signal determining the time delay; the signal is then modulated onto the frequency-controlled carrier. This signal-modulated frequency-controlled carrier is delayed by an amount determined by the instantaneous carrier frequency.

ALLEN-BRADLEY PRESENTS...

NEW METAL GRID

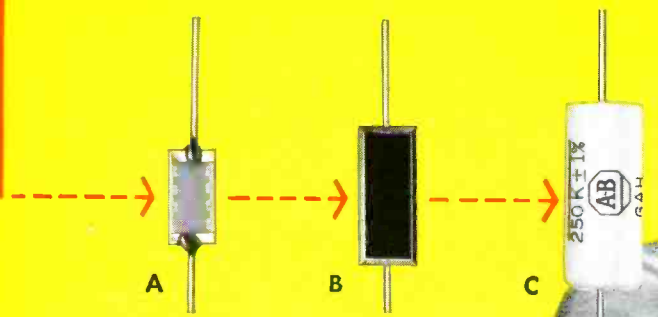
¼, ½, and 1-WATT

PRECISION RESISTORS

A-B QUALITY

Far exceed MIL Specs for film and wire-wound resistors

Allen-Bradley's new, truly accurate, metal grid resistors are now available in ¼, ½, and 1-watt ratings, producing test results that are a substantial improvement over the MIL Specifications for wire-wound and film type precision resistors. They combine remarkable stability, under load and on the shelf, with an exceptionally low temperature coefficient. The metal alloy grid is noninductive, providing excellent high frequency characteristics. They also have an exceptionally low noise level . . . comparable to that of wire-wound units. Each unit is individually calibrated and marked with nominal resistance value, tolerance (± 0.1 to 1%), and temperature coefficient. Provided with gold plated leads for flawless soldering. Considering their superior characteristics, these new resistors justly qualify under the Allen-Bradley trademark of *Quality*.



Type GAH
1 Watt at 100°C
± 0.1 to 1 %

5-58-E

The construction of the ¼, ½, and 1-watt resistors is identical. At the upper left is an enlarged view of the metal alloy grid, mounted on glass, which forms the resistance element. (A) Actual size of 1-watt element, (B) encapsulating epoxy resin body, (C) finished unit hermetically sealed in ceramic tube.

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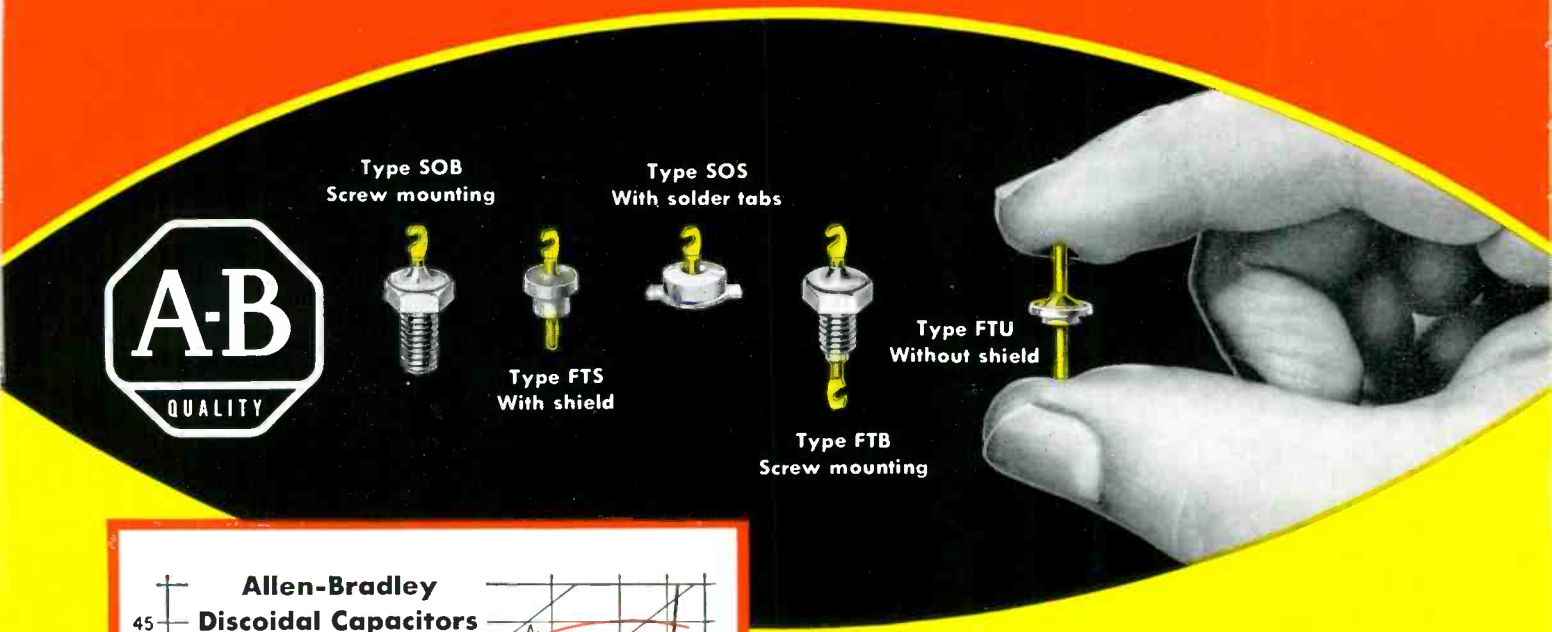
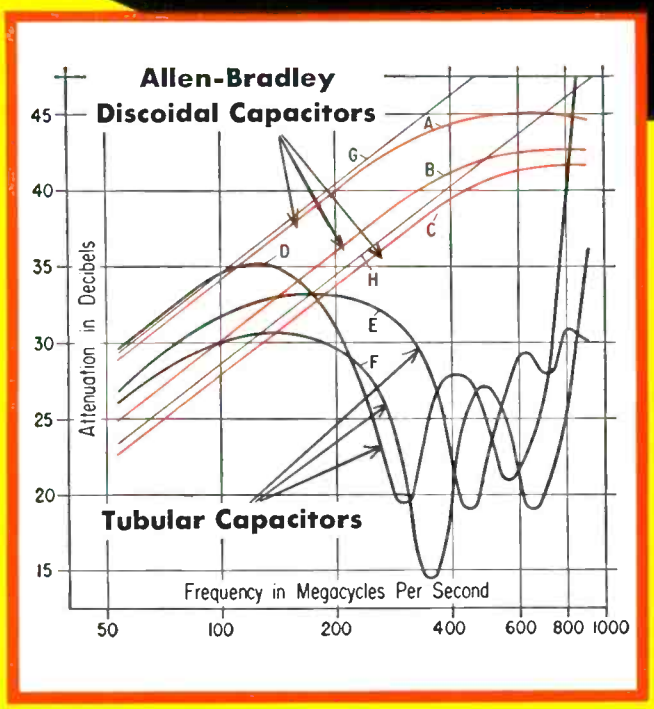
QUALITY
ELECTRONIC COMPONENTS

NO PARALLEL RESONANCE

(UP TO 1000 MEGACYCLES)

WITH ALLEN-BRADLEY DISCOIDAL FEED-THRU AND STAND-OFF CAPACITORS





Discoidal vs. Tubular Feed-Thru Ceramic Capacitors

Allen-Bradley Discoidal Type	Curve A—1800 MMF at 1 KC Actual Curve B—1150 MMF at 1 KC Actual Curve C— 800 MMF at 1 KC Actual
Representative Tubular Type	Curve D—2000 MMF at 1 KC Actual Curve E—1500 MMF at 1 KC Actual Curve F—1400 MMF at 1 KC Actual
The "Ideal" Capacitor	Curve G—2000 MMF Curve H—1000 MMF

AVOID RADIATION INTERFERENCE FOR VHF AND UHF RECEIVERS

Their unique discoidal design eliminates ALL parallel resonance effects which are normally encountered with tubular type capacitors in the VHF and UHF frequency ranges. With this complete absence of self-resonance, as shown in the graph at left, you can use far greater nominal capacitance values to obtain lower coupling impedances . . . and superior filtering.

The rugged construction of Allen-Bradley discoidal capacitors minimizes breakage during assembly or from thermal shock incurred during soldering. And, these capacitors have *gold plated* terminals to insure faultless soldering every time . . . even after long periods in storage.

Both feed-thru and stand-off capacitors are available in standard nominal capacitance values from 5 mmf to 1,000 mmf.

For suppression of stray radiation at frequencies to 1,000 megacycles, you cannot equal Allen-Bradley discoidal capacitors. Send for Technical Bulletin 5409.

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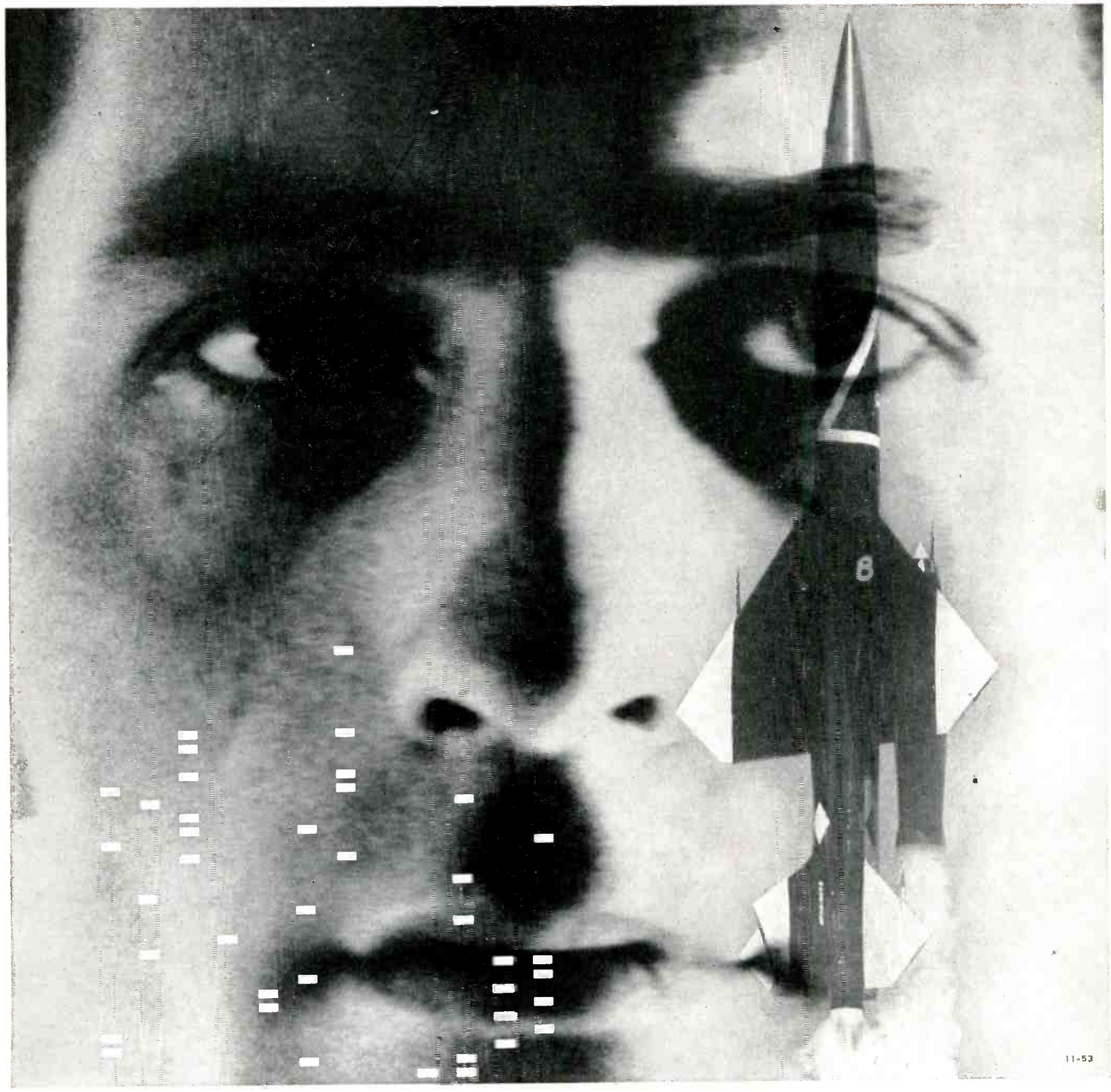
QUALITY

5-58-E

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



Man-Machine Relationships: A New Field for Scientists and Engineers

A new field for Operations Research Specialists, Engineers, Computer Programmers and Behavioral Scientists has arisen from System Development Corporation's work on relationship of men and machine systems.

It involves two major projects: 1 *creating and conducting large-scale training programs in present and planned air defense systems; and* 2 *operational computer programming for SAGE.*

Attaining the most effective interaction between men and machines is of prime importance. It requires intensive effort in an unusual combination of technical and scientific areas; it is a new field of endeavor.

Both activities also have these elements in common: they are constantly changing • they are long-range in nature • they are essential to the welfare of the United States.

The close interrelationship of these two major projects, the widely diversified specialties involved in them, and the dominating influence of man-machine relationships make SDC's work unique. Operations Research Specialists, Engineers, Computer Programmers, Behavioral Scientists—all find their assignments reflect the unique qualities of this new field.

The expanding scope of SDC's work has created a number of positions in these fields. Inquiries are invited. Address: R. W. Frost, 2428 Colorado Ave., Santa Monica, California, or phone collect at EXbrook 3-9411 in Santa Monica.

SDC

SYSTEM DEVELOPMENT CORPORATION
Santa Monica, California

11-53A

An independent non-profit organization.

PROFESSIONAL OPPORTUNITIES

Reporting late developments affecting the employment picture in the Electronic Industries

Design Engineers • Development Engineers • Administrative Engineers • Engineering Writers
Physicists • Mathematicians • Electronic Instructors • Field Engineers • Production Engineers

Electronic Engineers Needed in Alaska

Life for electronic engineers in the new state of Alaska has several new attractions, one of them higher pay, says the Civil Aeronautics Administration, U. S. Dept. of Commerce.

With the recent 10% increase in federal pay, and the 25% added cost of living allowance to federal workers in Alaska, starting pay for engineers is very attractive. Under Civil Service rules, engineers may be started at work at pay steps higher than other employees, because of the need for experienced employees in the electronics field.

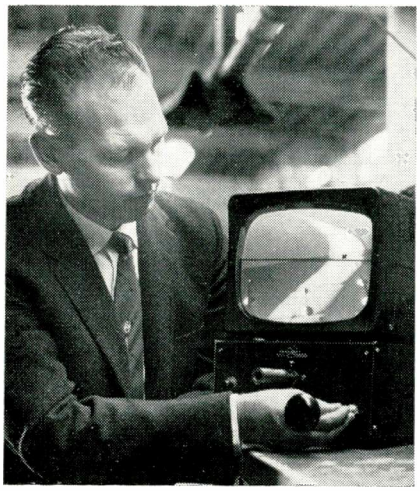
Today, an engineering graduate is eligible for a GS-5 grade with a salary of $4,490, to which is added $1,125 as the territorial cost of living allowance. His cost of living allowance is tax free for Federal Income Tax purposes, and his prospects for promotion are excellent. Each additional year of professional experience qualifies him for promotion to the next higher grade with an increase in salary of $1,000, again with the cost of living allowance added.

San Antonio Woos Electronics Firms

San Antonio, Texas, is the latest bidder for new electronic industries. A brochure of the Greater San Antonio Development Committee describes in detail the advantages of locating an electronics firm in the area.

Even, mild climate and numerous cultural activities are stressed as inducements to qualified personnel to locate in the area. To the industries are offered equitable taxes, abundant natural and human resources, and planned industrial sites. A detailed study of facilities, tailored to individual industrial needs, can be obtained from the committee by writing to P.O. Box 1682, San Antonio, Tex.

"PATHWAY IN THE SKY"



Kaiser Electronic Contact Analog Display System is demonstrated by its inventor, Geo. H. Balding. Kaiser was awarded a prime contract for the unit which provides the aircraft pilot with an analog of outside conditions.

College Trains Own Teachers

A fresh approach to the problem of finding qualified teachers is being used by the Newark College of Engineering. The college has instituted an instructor training program for graduates who indicate a teaching potential during their undergraduate years.

The graduates have a limited number of classes to teach and are paid well besides receiving free tuition toward their master's degree. The faculty work with the student during the training program. Upon completion of the program the graduate is free to enter industry or to remain at the college, usually with an increase in rank. Although it is too early to fully evaluate the program, the college feels it is significant that of the first seven to complete the program all have elected to continue their teaching careers.

Most Engineers Look to Sales, Administration

Engineers would rather do engineering work, but feel there are more rewards in moving into jobs outside their technical specialization. This is one of the findings of a national survey by Deutsch and Shea, Inc., New York City, technical manpower consultants.

The survey also concerned motivating factors in job choice, the wife's influence on the engineer's decision to change jobs, and engineer preferences in areas to live and work.

More than 80% of the engineers felt that the greatest opportunities were outside of technical specialization. Sixty-five per cent believed that administrative work offered greater advancement, and 17% felt that more opportunities were available in sales. But only 42% of these engineers would be interested in leaving technical work if the salaries and opportunities were equal.

Why did engineers choose their present jobs? The six most influential factors were:

1. Type of work 45%
2. Salary 34%
3. Location 31%
4. Advancement opportunities 30%
5. Challenge to abilities 17%
6. Reputation and prestige of company 14%

Of 894 married engineers, 82% consulted their wives about accepting jobs. Only 16% said their wives' opinions had little to do with the final decision.

More than half of the respondents living in the Middle Atlantic and Eastern States—except Florida — would prefer to work elsewhere. The Mountain and Pacific states were most favored. San Francisco and Denver were the most preferred cities.

FOR MORE INFORMATION . . . on positions described in this section fill out the convenient inquiry card, page 123.

"The Corporate Personality"

In what order do electronic firms rank in the opinions of the public-at-large? How are they rated as prospective employers? As investment risks?

Based on the report, "A Study of the Corporate Personality," published June 1958, by the Research Department, "Nation's Business."

THE subject of "public relations" is one that is foremost in the minds of management today. Most successful firms realize that future growth no longer depends exclusively on the company's ability to operate at a profit, but that the firm must give careful consideration to the attitudes of the many groups of people or "publics" with which it comes in contact. These include, among others, the relationships of the company with its customers and prospects, its stockholders, employees and suppliers.

It is, of course, primarily by the sale of goods and services that a corporation can grow and prosper, and therefore, the relationship a firm enjoys with its customers and prospects is at the top of any list of considerations when planning a public relations program.

Secondly, it is obvious that without the support and cooperation of its employees no firm can produce the goods or services necessary to secure profits for future growth.

There is, in addition, a third area of major interest to management—the stockholders, those who own the company.

In today's complex economy, there are other "publics" whose favorable attitudes are important to the success of corporations. High on the list are the people who live in the plant communities. A company's activities in striving for civic improvements, better municipal government, public welfare projects and the like—all are reflected in the firm's public relations . . . and in its future success.

The attitude of the business community as a whole is extremely important to a company's standing. Whether the businessmen are engaged in finance, insurance, commercial banking or investment banking —or in distribution of the firm's products (or prod-

TITLES AND TYPES OF BUSINESS OF RESPONDENTS

Titles	Number	Percent
Presidents	20	12.7
Owners and Partners	4	2.5
Vice Presidents	28	17.9
Secretaries and Treasurers	12	7.6
General Managers	5	3.2
Managers	70	44.6
Assistant Managers	8	5.1
Other Titles	10	6.4
Total	157	100.0

Types of Business	Number	Percent
Manufacturing and Processing	106	72.6
Agriculture and Natural Resources	7	4.8
Public Utilities and Transportation	5	3.4
Finance, Insurance, Real Estate	14	9.6
Distribution	9	6.2
Services—Business and Consumer	5	3.4
Total	146	100.0

ucts containing components made by the firm), a favorable impression is essential.

Realizing, therefore, that there are many ways to determine a given company's public relations quotient, in any of the above areas, it was decided that specific, practical questions, put to a group of leading business executives, might provide an over-all answer.

The first question: "Assuming that you were approached by a young man who seeks employment in the electronics division of one of the leading companies in the industry, which one of the following firms would you recommend he consider for future employment?"

The serious, considered recommendation of a firm to young men for future employment is a reflection of the mature business executive's impression of the corporation's prospects for the future . . . but, more than that, the recommendation is bound to spring from his feelings about the company as "a place to work," implying knowledge and approval of the firm's personnel practices and policies and general standing in the community. The recommendation of a company for employment is evidence that the firm has a favorable "corporate personality."

The second question asked concerned a more practical view: "If you were to make a personal investment of $5,000 in electronics securities, which three of the following firms would you consider?"

The investment of dollars in a corporation is a significant act of faith in the company's future growth and success. It implies satisfaction with the company's role in the economy . . . reflects confidence in the firm's management, its policies and its products. It is further evidence that the firm enjoys a favorable "corporate image" in the minds of businessmen.

To test this theory, a pilot study was conducted during June, 1958, among a representative group of Nation's Business readers to determine their attitudes toward leading electronic instruments manufacturers. The sample selected had the following characteristics:

(1) All 500 persons who received the questionnaire are subscribers to Nation's Business.

(2) Because each of these 500 subscribers had recently purchased reprints of Nation's Business articles, it is safe to assume that they are readers of the magazine.

(3) The sample was made up of men with varying executive titles, drawn from a broad cross-section of business and industry. (See table: "Titles and Types of Business of Respondents.") 43.9% of the respondents were men with administrative management titles, including presidents, owners, partners, vice presidents, secretaries, treasurers, and major department heads.

(4) Eighty and eight-tenths per cent of the replies were from executives in industry, of which 72.6% are engaged in manufacturing or processing.

"Assuming that you were approached by a young man who seeks employment in the electronics division of one of the leading companies in the industry, which one of the following firms would you recommend he consider for future employment?"

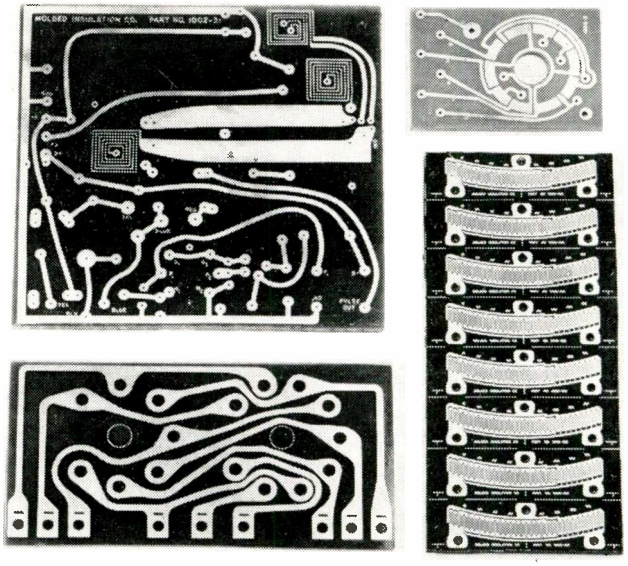
No. of replies—161.
No. answering question—156 = 100%.

Company	Number	Percent
General Electric Company	69	44.2
General Dynamics Corp.	39	25.0
Minneapolis-Honeywell Regulator Company	27	17.3
Sperry-Rand Corporation	25	16.0
Radio Corporation of America	23	14.7
Westinghouse Electric Corp.	23	14.7
International Tel. & Tel. Corp.	15	9.6
Sylvania Electric Products, Inc.	14	9.0
Aerojet-General Corp.	13	8.3
Bendix Aviation Corp.	13	8.3
Beckman Instruments, Inc.	10	6.4
Electro-Data Division, Burroughs Corporation	9	5.8
Litton Industries, Inc.	8	5.1
Raytheon Manufacturing Co.	7	4.5
Avco Manufacturing Corp.	6	3.8
Consolidated Electrodynamics	3	1.9
AiResearch Mfg. Co., Div. The Garrett Corporation	2	1.3
American Bosch Arma Corp.	2	1.3
General Precision Equipment	2	1.3
Philco Corporation	1	0.6
Other (written in):		
American Tel. & Tel. Co.	2	1.3
Collins Radio Company	1	0.6
International Business Mach.	1	0.6
Lewyt Corporation	1	0.6
P. R. Mallory & Co., Inc.	1	0.6
Motorola, Inc.	1	0.6
Texas Instruments, Inc.	1	0.6

"If you were to make a personal investment of $5,000 in electronics securities, which three of the following firms would you consider?"

No. of replies—161.
No. answering question—149 = 100%.

Company	Number	Percent
General Electric Company	91	61.1
General Dynamics Corporation	49	32.9
Radio Corporation of America	37	24.8
Westinghouse Electric Corp.	34	22.8
Minneapolis-Honeywell Regulator Company	33	22.1
Sperry-Rand Corporation	31	20.8
International Tel. & Tel. Corp.	25	16.8
Sylvania Electric Products, Inc.	19	12.8
Aerojet-General Corporation	18	12.1
Electro-Data Division, Burroughs Corporation	13	8.7
Beckman Instruments, Inc.	10	6.7
Avco Manufacturing Corporation	9	6.0
Litton Industries, Inc.	9	6.0
Raytheon Manufacturing Co.	9	6.0
Bendix Aviation Corporation	8	5.4
American Bosch Arma Corp.	5	3.4
Consolidated Electrodynamics	5	3.4
AiResearch Mfg. Co., Div. The Garrett Corp.	2	1.3
Philco Corporation	2	1.3
General Precision Equipment	1	0.7
Other (written in):		
International Business Mach.	2	1.3
American Tel. & Tel. Co.	1	0.7
Hewlett-Packard Company	1	0.7
Motorola, Inc.	1	0.7
Taylor Instrument Co.	1	0.7



Examples of flushed circuits. Flushing etched panels minimizes arc draw and edge wear if the circuit is part of a sliding contact.

Etched Panels

(*Continued from page* 92)

Flushing equipment consists of a hydraulic press with platens that can be heated to 450° F and then rapidly cooled. The press must be properly aligned. Also needed are 2 hardened plates, no less than 3/16-in. thick, of the same size as the press platen. The plates must be smoothly ground with top and bottom surfaces parallel.

Even though the press is perfectly aligned, cushions are necessary to compensate for the slight irregularities in thickness of the laminate and the copper. The amount of cushioning depends upon the extent of the irregularities in the etched circuit. Asbestos paper or mats may be used; however, hard kraft paper seems the most satisfactory cushioning material.

Typical Lay Up

A typical lay up or assembly of material to insert in the press, is:

1. Four or five sheets of 11 mil kraft paper.
2. A flat ground steel plate.
3. The etched circuit which is to be flushed.
4. The second flat ground steel plate.
5. Four or five sheets of 11 mil kraft paper.

It is advisable to apply a releasing agent, such as stearic acid or one of the silicone greases, to the steel plates before assembly to prevent the laminate from sticking to them when hot pressed.

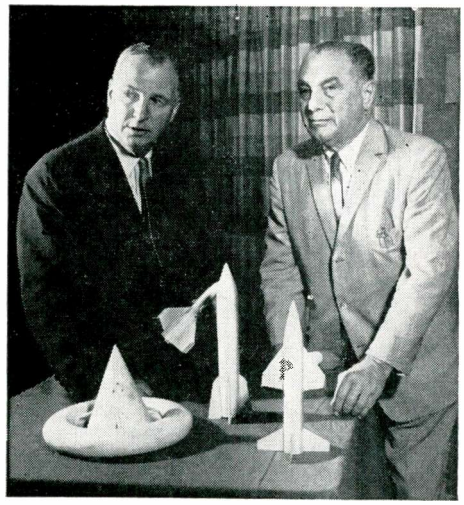
Excessive amounts of release agent can be as disastrous as not enough. Enough should be applied to put a thin film all over the contact area and then rubbed off with a paper towel.

Suggested Flushing Procedure

1. Raise platen temperature to 400° F.

(*Continued on page* 174)

An invitation to senior scientists and engineers



A $14,000,000 R & D Center, housing 9 new laboratories, was revealed as core of Republic's $35,000,000 Research and Development Program at recent announcement by Mundy I. Peale, President, and Alexander Kartveli, Vice-President for Research and Development.

.... To join Republic Aviation's new $35 million Research and Development Program for spacecraft, missiles and advanced aircraft

In announcing Republic's $35 million research and development program, designed to arrive at major breakthroughs in the aviation industry's transition to astronautics, Mundy I. Peale, President, set the following objectives:

> "...ACCELERATION OF PROJECTS ALREADY UNDER WAY AT REPUBLIC ON LUNAR PROGRAM FOR MANNED SPACE VEHICLES, AND MISSILES TO DESTROY ORBITING WEAPONS, AND INITIATION OF INVESTIGATIONS LEADING TO NEW CONCEPTS FOR INTERPLANETARY TRAVEL."
>
> "...RADICAL NEW FAMILIES OF LONG-RANGE AIR-TO-AIR MISSILES AND AIR-TO-SURFACE BALLISTIC MISSILES FOR STRATEGIC AND TACTICAL AIRCRAFT."
>
> "...VERTICAL TAKE-OFF FIGHTER-BOMBERS, HIGH-MACH FIGHTER-BOMBERS, AND SUPERSONIC TRANSPORTS."

Alexander Kartveli, Vice-President for Research and Development, emphasized that Republic's program "will not duplicate in any way investigatory work currently in progress elsewhere, but will stress novel concepts and new approaches to basic problems of missiles and space technology."

The program includes construction of a $14 million R & D center to house 9 new laboratories, and anticipates doubling the present research staff.

Senior men interested in the new possibilities created by a simultaneous exploration of all aspects of Flight Technology are invited to study the functions of the new laboratories for more detailed information:

SPACE ENVIRONMENTAL DEVELOPMENT LABORATORY
To simulate space flight conditions and test missile, satellite and spacecraft systems and components; investigate human engineering problems.

RE-ENTRY SIMULATION & AERODYNAMIC LABORATORY
To study hypersonic shock dynamics, real gas effects, heat transfer phenomena and magnetohydrodynamics.

MATERIALS DEVELOPMENT LABORATORY
Study effects of high velocity, temperature, and space environment on materials for spacecraft, missiles and advanced weapons.

GUIDANCE & CONTROL SYSTEM DEVELOPMENT LABORATORY
To develop and test guidance and control systems for spacecraft, missiles and aircraft.

ELECTRONICS DEVELOPMENT LABORATORY
Study and explore all problems connected with highly specialized, complex electronic systems required for advanced forms of spacecraft, missiles and aircraft.

ADVANCED FLUID SYSTEMS DEVELOPMENT LABORATORY
To develop and test fluid power systems for spacecraft and missiles capable of operation under extremely high temperature, high pressure conditions.

MANUFACTURING RESEARCH & DEVELOPMENT LABORATORIES
To develop advanced manufacturing processes and techniques for materials used in missiles and spacecraft. Laboratories for each of the following areas: *Non-Metallics, Metallics, Welding.*

Qualified men are invited to write directly to:
A. Kartveli, Vice President, Research and Development

REPUBLIC AVIATION
FARMINGDALE, LONG ISLAND, NEW YORK

Circle 505 on "Opportunities" Inquiry Card, page 123

(*Continued from page* 172)

2. Insert lay up.

3. Close press to a pre-set pressure of approximately 500-1000 psi for phenolic resin, paper-base laminate and 2000-3000 psi for epoxy resin, glass-fabric laminate, as calculated over the total area of the base panel.

4. Maintain pressure for approximately 10 minutes for the phenolic resin, paper-base laminate and approx. 20 min. for the epoxy resin, glass-fabric laminate.

5. While the etched circuit is still under pressure, rapidly cool the platens to room temperature. This prevents the copper from creeping above the surface of the laminate after pressure is removed.

There is no set standard procedure for the flushing of etched circuits because of the varying amounts of copper required by the circuit. However, an operator can readily develop the necessary skill and adjust his technique to compensate for these variations.

West Coast Real Estate Opportunities

"Los Angeles"

Editor, ELECTRONIC INDUSTRIES:

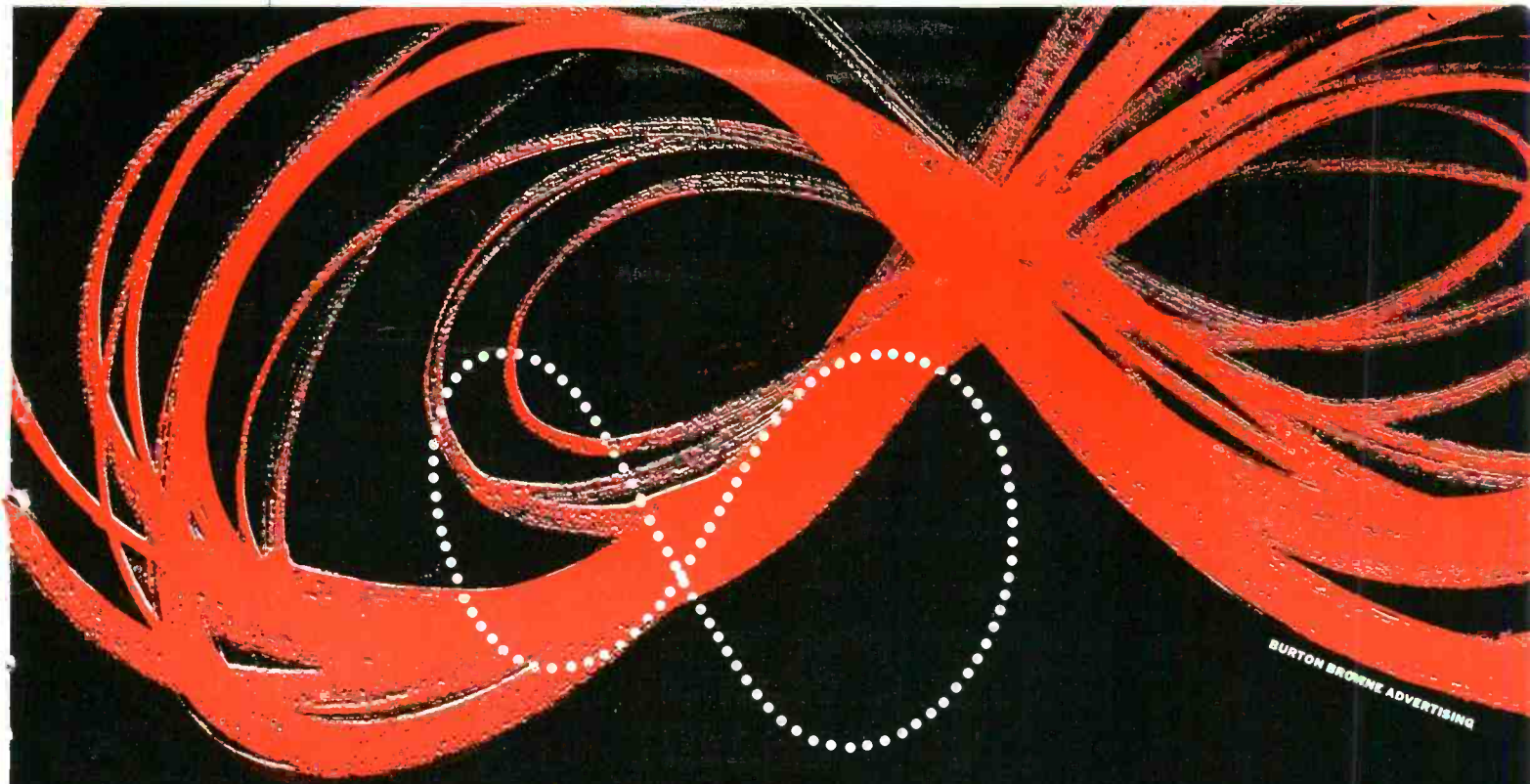
Recently the City of Los Angeles adopted an ordinance changing our zoning regulations to make it possible for research and development projects to locate in areas other than those now zoned for industry.

This action has resulted in many favorable comments from a number of large national organizations. They indicate that this is a forward step and that it furnishes the opportunity for scientific personnel to live and work under as nearly ideal conditions as can be provided through municipal legislation.

Since the passage of this permissible legislation, the Industrial Development Unit of the Department of Water & Power, City of Los Angeles, has carefully surveyed the many additional sites now available and is now ready to present complete and interesting data to firms planning an R & D project on the West Coast.

Also, we have available upon request two brochures, "F.O.B. Los Angeles" and "How to Pick a Site," both of which we believe will be of value for your Los Angeles file.

K. H. Bennett
Industrial Consultant
Business Agent's Division



EINSTEIN, INFINITY and the IONOSPHERE

Creative imagination took Einstein into a new widening concept of the nature of the physical universe.

At the National Co. creative imagination is continuing to broaden our mastery of the physical universe through the realization of such means of communication as Ionospheric Scatter systems.

The implications of these new means of communication are manifold and the applications multitudinous.

You, who enjoy such creative challenges to scientific and technical development, should talk to *National.*

National Co. *right now* affords engineers and physicists the opportunity to grow and establish prestige in such advanced fields as atomic frequency standards, multipath transmission, noise reduction and correlation techniques, Tropospheric scatter systems, Ionospheric scatter systems, molecular beam techniques for signal processing, and long range microwave transmission.

At National Co. in the heart of New England electronics, you can associate with a company in which creativity is required, recognized and rewarded.

Write or phone

tuned to tomorrow **National** NC®

National Company, Inc. Malden, Massachusetts

N. E. C.—1958

(*Continued from page* 101)

Telephone Company. The papers, given by men from 16 states and three foreign countries, will include such topics as: antennas, audio, communications, computers, engineering management, industrial electronics, instrumentation, amplifiers, microwaves, radar and radio navigation, television and transistors.

More than 10,000 scientists, engineers and educators are expected to attend. The technical sessions will provide up-to-the-minute coverage on research, development and application in the broad field of electronics. A record number of commercial exhibits, highlighted by displays of new electronic developments and devices, is scheduled. There will be social events and programs for wives of men attending.

The technical sessions on the opening day will be concerned with transistors I, servomechanisms I, antennas, audio, tutorial session on automatic navigation, filter design, solid state and microwaves I.

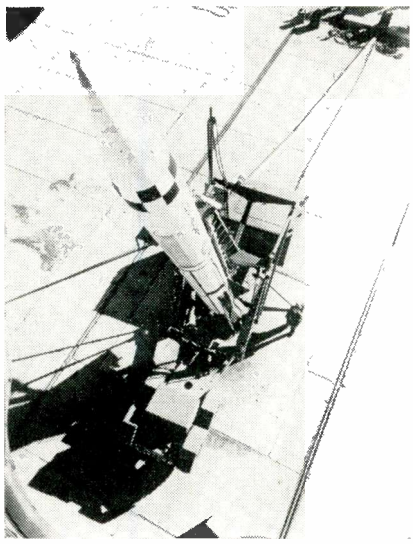
Topics at the October 14 technical sessions will include the International Geophysical Year, transistors II, servomechanisms II, instrumentation, panel discussion —Role of the Laboratory Program in Engineering Education, network theory, microwaves II, and noise and data smoothing.

The final day's sessions on October 15 will cover engineering writing and speech, computers, radar and radio navigation, magnetic amplifiers, engineering management, industrial electronics, television, and communications.

Math-Science Teaching

The President's Committee on Scientists and Engineers has prepared a "Local Action Kit," a compilation of case histories of practical community programs on math and science instruction. The kit also includes a book, "United Local Action," and selected literature related to math and science. The kit and a monthly newsletter are being distributed to interested groups.

NEW TACTICAL MISSILE



The Army's new 30-ft. "Sergeant," tactical ballistic guided missile, has a solid-propellant rocket motor. It was developed by Cal Tech's Jet Propulsion Lab and will be produced by the Sperry Gyroscope Company.

Snap-In Connection

(*Continued from page* 88)

dielectric separation with no voids; seal before electrical contact and lock; and positive lock without safety wiring. These connectors are visually inspectable for locking.

Contacts are finished in gold plate over silver plate; other metal parts are finished in cadmium plate and clear iridite. All shells are stamped with a part number, manufacturer's symbol and code.

Voltage rating is 2000 v. 60 cps, 2500 vdc (rated at sea level), which exceeds "A" ratings of MIL-C-5015. Other specifications for the snap-in connectors include:

Current: 10 amps @ 2 volts dc.

Resistance of contacts: 6.0 mv at 10 a. or equal to 1.6 mv per amp.

Insulation resistance: 25,000 meg-ohms minimum.

Temperature: operative at temperatures in excess of 300°F.

Usable wire sizes: Contacts receive conductors up to .052 inch O.C. Rear will seal on wire from .070 to .100 inch O.D. Other seals are available.

General Radio Brochures

The General Radio Co., Cambridge, Mass., has prepared two multi-color brochures describing the organization, aims, and the benefits of employment at that firm.

Copies may be obtained by writing directly to General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.

News of Reps

REPS WANTED

A manufacturer of **filters, toroids, magnetic amplifiers and high temperature transformers** desires representation in the New England states and Northwest area. (R10-1, Editor, ELECTRONIC INDUSTRIES.)

Wayne Kerr, Ltd., British designer and producer of **electronic measurement Instruments,** is seeking reps in the Pacific Northwest and in the Southwest. Contact Wayne Kerr Corp., P. O. Box 801, Philadelphia 5, Pa.

Stevens-Capell Co., Los Angeles, Calif., is now exclusive sales rep in Southern California and Arizona area for Burnell & Co.

T. J. Ray Co., Tulsa, Okla.; **L. F. Florence Co.,** Kansas City, Mo.; and **Nortel Engineering Service Co.,** Montreal, P. Q., Canada, have been named reps for the Penta Laboratories, Inc. lines.

Engineering Associates, Inc., is now manufacturers reps for Computer Engineering Associates, Inc., for Texas, Oklahoma, Arkansas and Louisiana.

Maury Farber Associates, Buffalo 2, N. Y., is rep for American Microphone Mfg. Co. in the upstate New York territory.

The James S. Heaton Co., San Mateo, Calif., has been appointed rep for Hi-Spec Electronics Corp. in Northern Calif. and Northern Nevada.

Michael Scott Co., Wellesley Hills, Mass., is now rep in the New England territory for the National Co., Inc. and **Metrorep,** Teaneck, N. J., are their reps in Metropolitan New York and New Jersey.

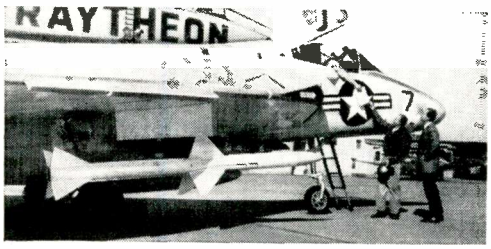
Jack Geartner Co., Miami Beach, Fla., has been named rep for Electro Tec Corp. in the state of Florida.

Michael S. Coldwell, Inc., Hartford, Conn., is now rep in Maine, Vermont, New Hampshire, Massachusetts, Rhode Island and Connecticut for Computer Engineering Associates, Inc.

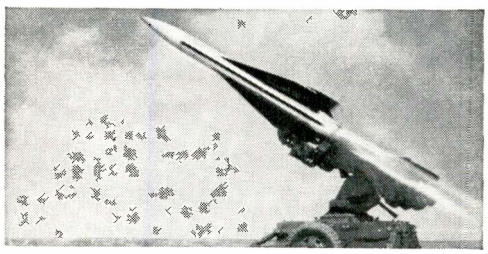
Gordon V. Peck Co. of Dallas, Tex., is rep in the southwest for the Sealectro Corp.'s lines.

The Industrial Test Equipment Co. has appointed **Broger Instrument Sales Co.** as rep for their electronic test equipment line in the entire New England area.

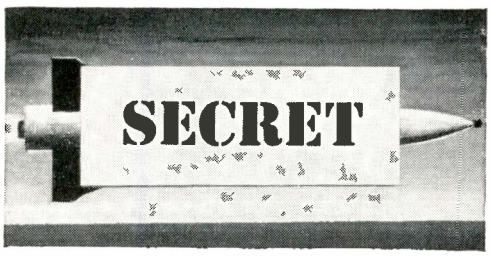
Raytheon Missile Projects



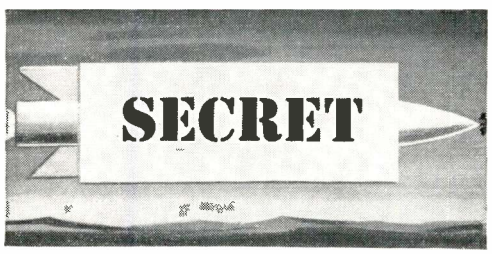
SPARROW III—the Navy's tenacious, lightning-fast, air-to-air missile—is intended for extensive use by Navy fighter aircraft in fleet air defense. Sparrow III is a Raytheon prime contract.



HAWK—the Army's defense against low-altitude attackers—carries out its destruction in the blind zone of conventional radars. Hawk development and production is under Raytheon prime contract.



TARTAR—A substantial contract for vital electronic controls for this Navy destroyer-launched missile is held by Raytheon. This equipment—a tracking radar and associated units—enables it to "lock on", cling to target's path, despite evasive tactics.



ADVANCED PROJECTS in aeronautical structures as well as missile guidance and control are now underway in Raytheon laboratories. New facilities are continually being added for this work.

PRELIMINARY NEW DESIGNS of tomorrow's missiles will result from the advanced work being done by today's missile engineers. Raytheon plays an important role in this area.

Circle 511 on "Opportunities" Inquiry Card, page 123

News of Reps

D. C. Quinlan Co., Ambler, Pa., has been named rep in Eastern Pennsylvania, Southern New Jersey, Delaware, Maryland, and the Washington, D. C. area for Electralab, Inc., and the Hippler Sales Co., Webster Groves, Mo., is their rep in Missouri.

A-F Associates, Pasadena, Calif., is now rep for the Electronics Div. of Iron Fireman Mfg. Co., in Southern California.

Chester Cable Corp. has named the Barnum Co. of Dallas, Tex. as rep in Oklahoma, Texas, Arkansas and Louisiana and R. W. Farris Co., Inc., Kansas City, Mo. to cover Iowa, Kansas, Missouri, Nebraska and a portion of Illinois.

Paul R. Posakony Co., Denver, Colo., is rep in Colorado, Utah, and Wyoming for General Precision Laboratory Inc. TV line.

The D. Dolin Sales Co. was appointed rep for the Windsor Motoren Co. They will handle their line of small fractional HP motors.

Barnhill Associates, Denver, Colo. and Ault Associates, Menlo Park, Calif., are now sales reps for Polytechnic Research & Development Co.

The M. W. Riedel & Co., has moved to new offices at 316 E. Valley Blvd., in Alhambra, Calif.

Paul Harper is now West Coast rep for Sel-Rex Corp.

Gudebrod Bros. has appointed J. P. McDonnough of Jermyn, Pa. and George Fedderson of Chicago, Ill. as reps for their line of color-coded electronic lacing tapes.

Frank Tye Sales Co., Chicago 14, Ill., is now exclusive sales rep in the Chicago area for Transistor Electronics Corp. of Minneapolis.

The following reps have been appointed by North Atlantic Industries to handle their line of instrumentation equipment: Dayton-Anderson Electronics Co., Dayton, Ohio, is rep in Ohio and Western Pennsylvania; Design & Sales Engineering Co., St. Louis 5, Mo., is rep in Missouri, Iowa, Kansas and Southern Illinois; and Carlson Electronic Sales, Chicago 31, Ill., is technical rep in the states of Indiana, Minnesota, Wisconsin and Northern Illinois.

ELECTRONIC INDUSTRIES Advertisers — October 1958

* In Operation Edition Only.

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

Facts You Can Use to Identify and Sell Your Electronic O.E.M. Market

WHAT'S THE DIFFERENCE BETWEEN ELECTRONIC O.E.M. AND ELECTRONIC END-USER MARKETS?

The end-user market is where electronic Original Equipment Manufacturers (O.E.M.'s) *sell* their military, industrial and commercial products. It is an "after market," entirely distinct from the original market where O.E.M.'s *buy* their materials, components, and subsystems.

End-users—commercial, industrial and government—buy finished electronic products like broadcast transmitters, industrial controlling equipment, radar systems, computers, and missile guidance systems. The original equipment (O.E.M.) market buys tubes, semiconductors, wire, solder, plastics, pre-assembled circuits and subsystems, power supplies, relays, etc.—in production quantities—for assembly and resale to end-users.

Although these "before" and "after" electronic markets are sometimes lumped into one, the people in them differ in buying motive, selling technique, and personal identity. *The O.E.M.'s are in the market for "producers goods"; the end-users are in the market for "capital goods."*

O.E.M. MARKET RESEARCH WITH THE NEW E.I.C. CODE

The government's Standard Industrial Classification (S.I.C.) fails to distinguish electrical from electronic manufacturers. For years this has forced manufacturers relying on S.I.C. market data to promote electronic components to electrical and electronic markets which cannot buy them in production quantities.

Now a new Electronic Industries Classification, the E.I.C. Code, has been developed to provide 101 major classifications for electronic products only. Data from an independent census of original equipment builders and suppliers are being punched on the IBM cards according to the E.I.C. Code.

Now you will be able to identify and measure your electronic O.E.M. market potentials using the E.I.C. Code, and ELECTRONIC INDUSTRIES IBM facilities. For more information contact your EI representative.

CAN ELECTRONIC O.E.M. MARKETS BE ECONOMICALLY REACHED THRU ROCKET AND MISSILE, AUTOMATION, AVIATION, AND OTHER END-USER PUBLICATIONS?

Electronic engineers working for aircraft, missile and industrial control manufacturers continue to submit most of their declassified theory and technique for publication in electronic—not end-user—magazines. Here, they know, is where fellow specialists working for other aircraft, missile, and control builders will be looking for electronic progress in these fields.

You will see over 80% of the contributed articles on missile electronics, electronic controls, and avionics in ELECTRONIC INDUSTRIES, Electronics engineering edition, Electronic Design, Electronic Equipment Engineering, and Proceedings of the IRE. Each one of these magazines alone reaches more electronic engineers in missile, industrial control, and aircraft activities than any TWO of the fourteen end-user publications aimed at these fields.

. . . . and ELECTRONIC INDUSTRIES delivers you more electronic O.E.M. subscribers in missile, aircraft, and control fields than any THREE end-user magazines.

ARE ELECTRONIC O.E.M. BUYING INFLUENCES REACHED BY "TECHNICAL MANAGEMENT" WEEKLIES, OR BY ENGINEERING MONTHLIES?

Original electronic manufacturers and end-users need to interweave both engineering and cost judgments in order to buy intelligently. These cost judgments involve management participation, obviously, when the product is purchased as capital equipment. Typical examples are the financial and labor-saving calculations necessary in the purchase of electronic automation equipment by industrial and commercial enterprises.

But with the exception of such capital goods as test instruments and light production equipment, the original electronic manufacturer buys only for assembly and resale to end-users. Here cost engineering is largely outside the scope of management decision. *Cost evaluation of alternate electronic subsystems and components is accepted as a problem only for working engineers—engineers conversant with the latest ideas in the monthly technical literature.*

For these reasons, electronic ads in missile, electronic and aircraft weeklies are sometimes logical for finished electronic systems sold to end-users as capital (or military) goods. But when selling "producers goods" to original electronic manufacturers for assembly, system incorporation, and resale, engineering monthlies are the only realistic, and economical, advertising media.

WHY ELECTRONIC INDUSTRIES IS — NOW — THE MOST IMPORTANT PUBLICATION SERVING THE ORIGINAL ELECTRONIC MARKET

FIRST—by thousands—in O.E.M. circulation (see S.R.D.S. listings)
FIRST in missile electronic and avionic circulation (see S.R.D.S. listings)
FIRST in number of letterhead requests for article reprints
FIRST with new ideas in a depth usable to engineers (send for details)
FIRST in market research services (send for details)

ELECTRONIC INDUSTRIES

Chilton Company Executive Offices:
56th & Chestnut Sts., Phila. 39, Pa.

AND, DEFYING INDUSTRY TRENDS, ELECTRONIC INDUSTRIES GAINED IN ADVERTISING IN THE FIRST HALF OF 1958

BPA NBP

A Viking Fable

When the terrible green monster suddenly appeared alongside the good ship Viking Queen, all hands save one promptly disappeared over the side into the chill waters of the North Atlantic. Only Lief Smorgasbord, radar operator, remained aboard to face the beast.

If we may take a trembling Lief from history, we will follow the conversation that ensued:

Lief (trembling): Why . . . why didn't you show up on my scope?

Monster (in a high, feminine voice): I'm enchanted, that's why! Oh, Mr. Viking, I'm just a poor princess who has been bewitched and transformed into a teen-age she-sea serpent! If you could answer the Mysterious Riddle, you could break the spell and marry me!

Lief (still trembling): The Mysterious Riddle?

Monster (hopefully): It goes like this.

Heart of that which has no ears, but hears;
No eyes, but sees; no nose, but knows . . .
Tube B or not Tube B, that is the question!

*Lief managed to answer the riddle, breaking the spell and instantly transforming the monster into a lovely princess. And so they were married and lived happily ever after.**

** The single word was "Bomac," of course. Lief knew "Tube B or not Tube B" must refer to Bomac tubes, heart of any radar system ("that which has no ears, but hears, etc.") Smart one, that Smorgasbord.*

No. 5 of a series . . . **BOMAC LOOKS AT RADAR THROUGH THE AGES**

* *Bomac makes the finest microwave tubes and components either side of the Atlantic*

WRITE FOR FREE SIX PAGE FOLDER

Bomac LABORATORIES, INC.
Salem Road, Beverly, Massachusetts

Leaders in the design, development and manufacture of TR, ATR, Pre-TR tubes; shutters; reference cavities; hydrogen thyratrons; silicon diodes; magnetrons; klystrons; duplexers; pressurizing windows; noise source tubes; high frequency triode oscillators; surge protectors.

Offices in major cities—Chicago • Kansas City • Los Angeles • Dallas • Dayton • Washington • Seattle • San Francisco • Canada: R-O-R Associates Limited, 1470 Don Mills Road, Don Mills, Ontario • Export: Maurice I. Parisier, 741-745 Washington St., N.Y.C. 14, N.Y.

Circle 2 on Inquiry Card, page 121

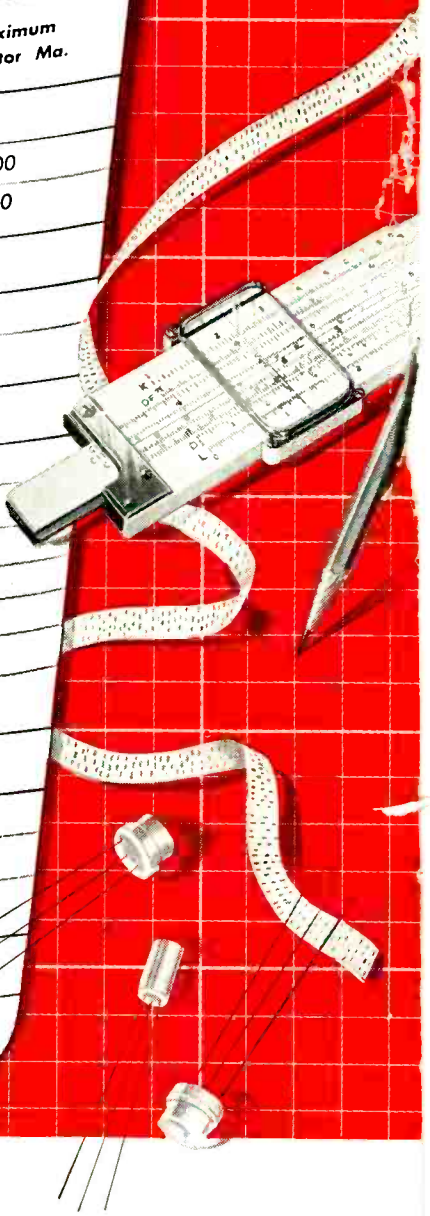
RCA TRANSISTORS

Specifically Designed for Switching Applications in ELECTRONIC COMPUTERS

RCA GERMANIUM ALLOY-JUNCTION TRANSISTORS FOR COMPUTER APPLICATIONS

Type	Typical Alpha-Cutoff Frequency-Mc	Typical DC-Current Transfer Ratio Value at Collector Ma.	Maximum Collector Ma.
n-p-n Types for Medium-Current Switching Applications			
2N356*	3	30 at +100	+500
2N585*	5	40 at +20	+200
n-p-n Types for High-Current Switching Applications			
2N357*	6	30 at +200	+500
2N358*	9	30 at +300	+500
p-n-p Types for Medium-Current Switching Applications			
2N581*	8	30 at −20	−100
2N404*	12	40 at −20	−100
2N582*	18	60 at −20	−100
2N583	8	30 at −20	−100
2N269	12	40 at −20	−100
2N584	18	60 at −20	−100
p-n-p Types for High-Current Switching Applications			
2N578*	5	15 at −400	−400
2N579*	8	30 at −400	−400
2N580*	15	45 at −400	−400
p-n-p-Type for High-Voltage (−105 Volts) Switching Applications			
2N398*	0.7	60 at −5	−100

*Jetec TO-9 Case



...a comprehensive line offering superior performance in computer designs

RCA's line now includes 14 types specifically designed to meet the demand from computer manufacturers for electrically *uniform and reliable* transistors. Your RCA Field Representative or your authorized RCA Semiconductor Products Distributor will be glad to discuss with you the many advances being made by RCA in this area of electronics. Specify *RCA* transistors for *your* computer designs. For technical data on specific types, write RCA Commercial Engineering, Section J-50-NN, Somerville, N. J.

RADIO CORPORATION OF AMERICA

Semiconductor and Materials Division

Somerville, N. J.

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