ELECT

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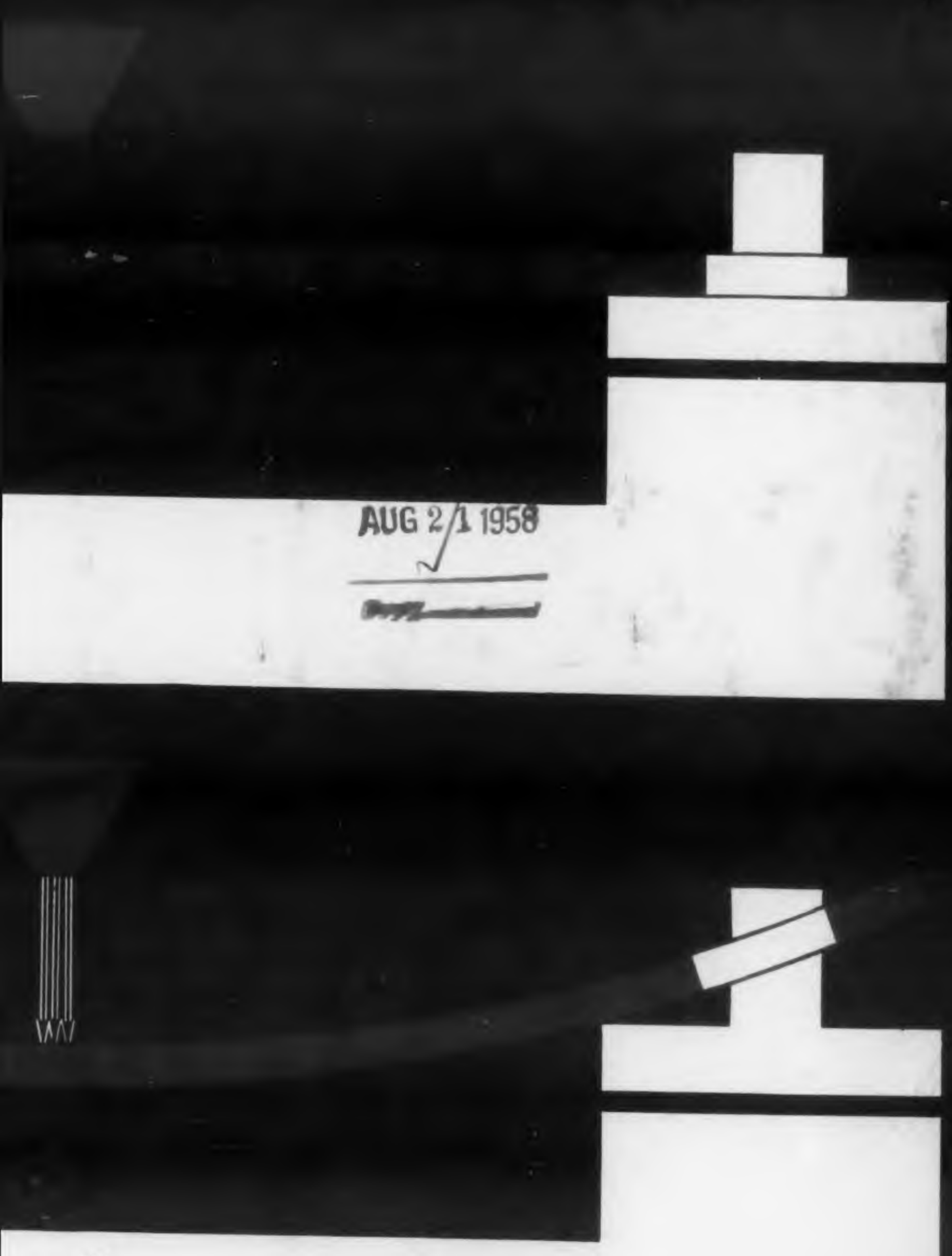
Air-Operated Rotating Switch . . . .

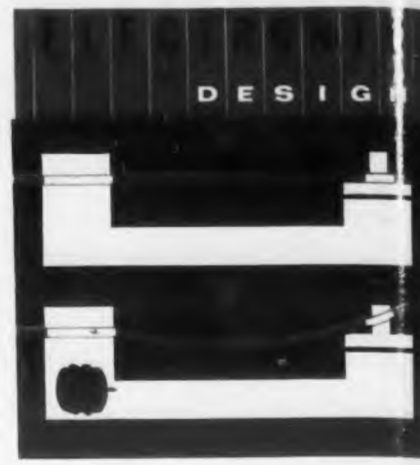
RONIC
ESIGN

AUGUST 20,

(Nos. 550-599)



HIGHLIGHTS OF ISSUE



A jet of air, rotating at speeds of up to 20 cps inside this sampling switch, strikes contacts and closes them in rapid succession. As described on the cover, the jet of air tends to deflect the reed-like movable contact, drawing it into contact with the pin, which acts as the fixed contact.

With just two basic equations and some characteristics of magnetic material, you can design magnetic amplifiers for pulse work. Mr. White's lucid presentation shows how to go through the design and what the important design considerations are. Here, in the first of a two-part article he provides a step-by-step design procedure and a sample design.

Forty-seven commercially available oscilloscopes having high frequency responses and fast rise times are listed along with the thirteen manufacturers producing these standard models.

Using Plastics in Electronics
Look for this Special Report
in our next issue
September 3, 1958

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August 20, 1958 Vol. 6

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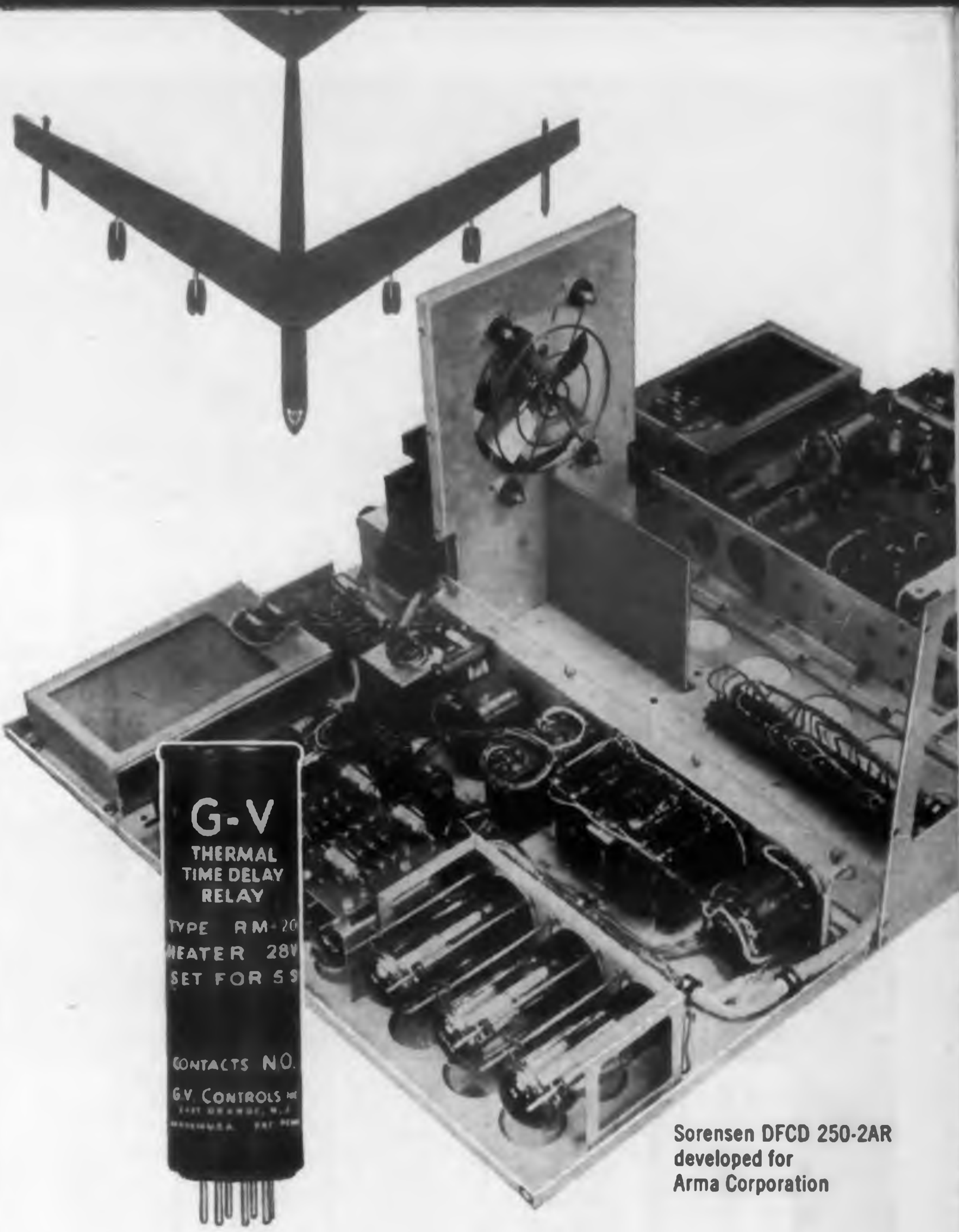

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developed for
Arma Corporation

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"...to enhance reliability..."

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

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ENGINEERING REVIEW

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

Ceramic-in-Glass Tubes May Improve Missile Performance

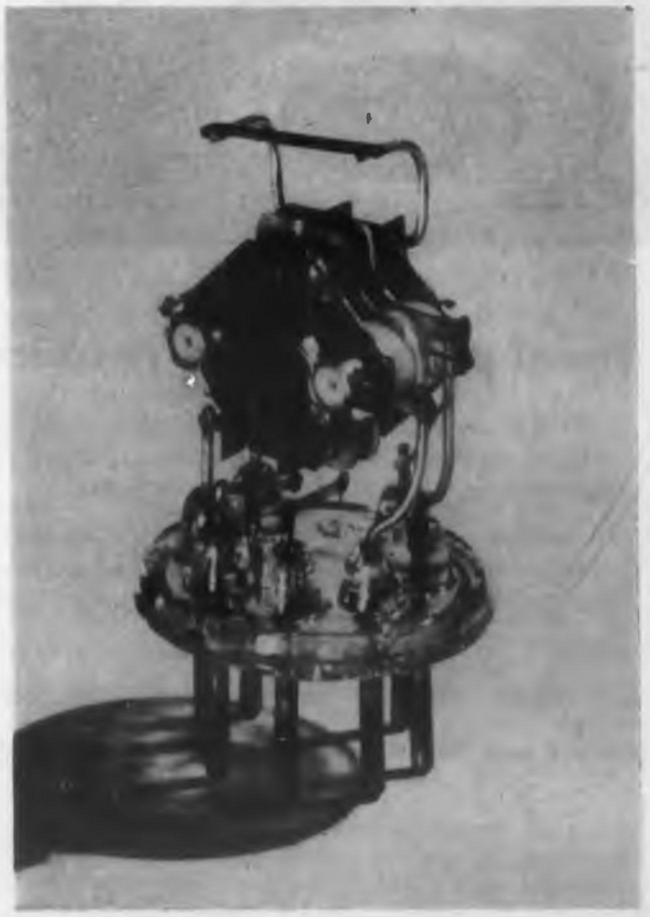
Development of a new "ceramic-in-glass" electron tube which puts a stacked tube into a conventional glass envelope, is expected to improve performance of guided missiles and satellites. As announced by Sylvania Electric Products Inc., Emporium, Pa., this new device is capable of withstanding extreme conditions of vibration, shock, and fatigue.

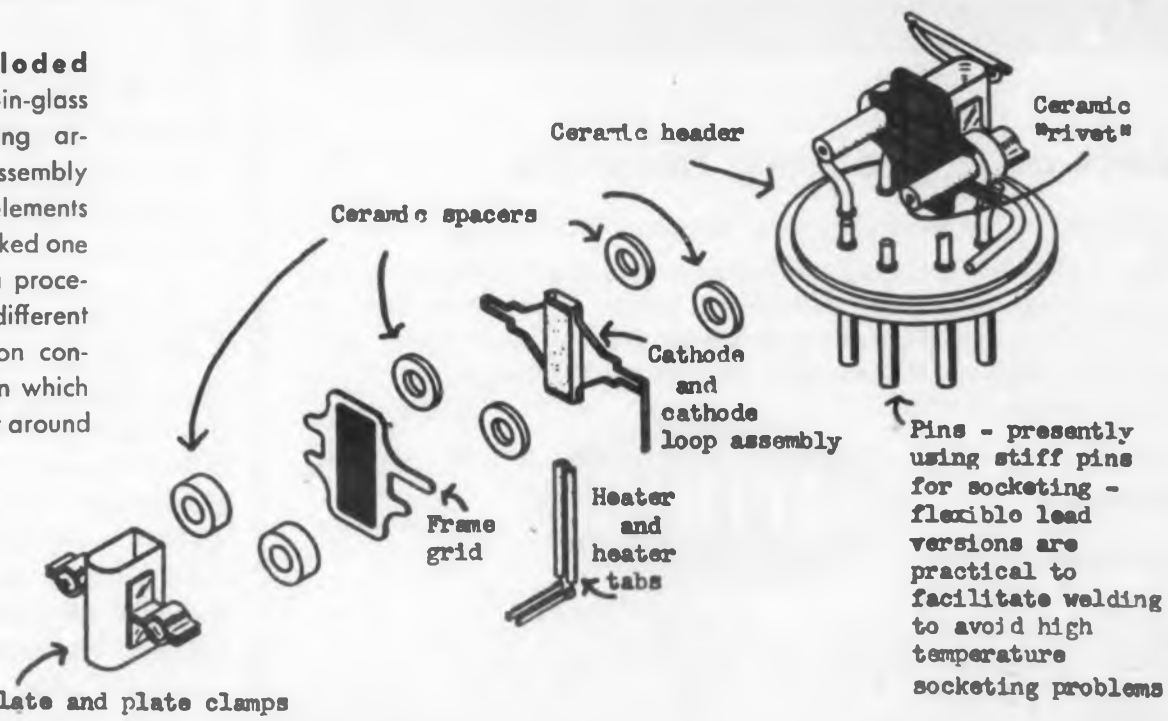
The tubes employ a planar structure in which tube parts and ceramic spacers are aligned on a ceramic post. The whole assembly is secured under compression by means of metal anchors around the supports. According to Sylvania officials, the tubes are immediately adaptable to present automatic production techniques and equipment. There is no need for additional equipment tooling or circuit redesign. In addition, the stacked-mount-in-glass tubes will functionally replace existing tube types.

Two types for use in radar and ultra-high frequency communications, are presently available. Type 7244 is a dual triode, whose conventional counter-part is the 6J6WA, a medium-mu double

(continued on following page)

Combining a glass envelope with the planar structure of the ceramic stacked tube, the ceramic-in-glass tubes are capable of surviving extreme conditions of shock, vibration, and fatigue. The new structure (below) is shown with standard (T5½) 6J6 mount (above) with which it is directly interchangeable.





Partially exploded view of ceramic-in-glass tube of mounting arrangement. In assembly process various elements of mount are stacked one atop the other, a procedure radically different from that used on conventional tubes in which elements are built around a common axis.

triode for use in an oscillator, amplifier or mixer up to vhf. Type 7245 is a single triode, whose conventional counter-part is Type 6J4WA, a high-mu triode for use as a grounded grid amplifier in vhf applications. Additional types are reported under development with an audio beam power pentode and an RF pentode scheduled to be introduced later this year.

May Eliminate Interference Problems

Communication interference problems may be partially relieved by a new power control device under development at General Electric, Syracuse, N.Y. Successful pilot tests in a two-way radio system operated by Niagara-Mohawk Power Corp. were reported by GE. Transmitted power of a base station is automatically adjusted to match the incoming power of a mobile radio. The outgoing power becomes inversely proportional to the signal received from a mobile transmitter.

Although initial tests were made with a 250 w station, the power control may be designed for operation with lower power base or mobile transmitters as needed.

It is hoped that the device will result in less co-channel interference and more effective utilization of the radio spectrum.

Computer Aids Missile Sub Construction

Construction of the new Polaris missile-launching submarine will be speeded by the IBM 705 computer at Mare Island Naval Shipyard, Vallejo, Calif.

The computer will be put to work immediately on such problems as pipe stress analysis for the nuclear power plant of the submarine project. This job requires some 35,000 computations and would take an engineer some 20 days to complete manually. The 705 can do the job in 20 minutes. The 705 will lso provide a current picture of the vork assigned to each area of production so that employment and material needs can be predicted and scheduled in proper sequence. Officials will also obtain a daily progress report on all construction under way from which potential trouble areas can be spotted and steps taken to avert costly delays.

Russian Electronic "Arrow" Uses Beam Memory Tubes

The Russians are now producing a new digital computer, Strela (Arrow), for mathematical work at industrial and scientific research institutions throughout the USSR. No information is available on how many Strelas have been made, but the machine has a performance rating as high as BESM, the high speed electronic computer developed by the Russian Academy of Sciences.

Strela was developed at the Design Bureau of the Russian Ministry of Instrument Building and Means of Automation, over the course of a few years. Details on the design and logic have only recently been reported in the Ministry organ, *Proborostroyeniye* (Instrument Building).

Strela has an internal core memory which uses 43 electron beam memory tubes. The memory can store 2047 numerical characters or instructions in the form of spot electrostatic charges on the plates of the 43 tubes.

The external memory uses two magnetic tape units with 5 in. wide tape, 328 feet long. Each tape can store 253 zones of information groups with up to 200,000 numerical characters. Reading and writing speed is 1000 characters a second.

The computer's 16 standard programs, with up to 256 instructions, and constants to 256 numerical characters are stored in diode memory units with provision for manual dialing and switching of plug-in cells. Strela uses a floating decimal in both its storage and in its nu- perations.

ENGINEERING REVIEW

Six Digit Voltmeter Aids Research

The first six-digit digital voltmeter ever produced has been delivered to the National Bureau of Standards. Developed by Non-Linear Systems, Inc., which was selected by NBS to undertake the project, the instrument is not slated for production according to NLS officials.

Voltages from one ten thousandth of a volt to one hundred volts may be measured automatically, at approximately four readings per min. These precise measurements are instantly displayed in numerical form in a readout window on the front panel of the instrument. The illuminated readout numerals are one in. high and appear with the appropriate plus or minus sign and correctly positioned decimal point.

Instrument calibration is automatic. Provision is also made for a control device and connections to operate an IBM Summary Punch machine which automatically punches the voltmeter readings on cards that can be fed into a computer or stored for later use.

NBS will use this instrument in a research program involving the precise measurements of minute voltages that must be taken during basic research being conducted on extremely pure forms of rare substances.

World's Worst Weather Duplicated

The candy-striped bubble in the foreground is the radome of a Navy jet bomber's automatic armament system undergoing severe weather condition testing. The massive weather chambers that simulate the altitude of 90,000 feet, are capable of temperature ranges from —105 deg to 500 deg and humidity approaching 100 per cent, even with salt spray. The $400,000 apparatus resembles a two-car garage 10 feet high, 18 feet wide and 16 feet deep. The tunnel is installed at the Westinghouse Friendship Airport plant, Baltimore, Maryland.

CIRCLE 102 ON READER-SERVICE CARD ➤

Recording Optical Tracking Instrument which sequentially photographed Sputnik II.

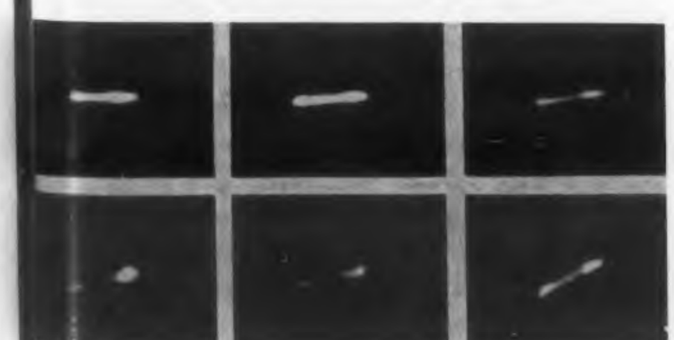
How Long The "Moon"

The entire Soviet Satellite, Sputnik II, containing the dog "Laika", instrumentation, propellent tank, and motor, was from 74 to 84 ft long. This measurement was calculated from photographic evidence taken with the missile tracking camera, designed and built by the Perkin-Elmer Corp., Norwalk, Conn., for the Air Force Missile Test Center.

Trained on Sputnik II as it passed over Patrick Air Force Base, Fla. on December 21, 1957, the Recording Optical Tracking Instrument took the sequence of photographs necessary to determine the length.

Russian Satellite Beta (Sputnik II) passed within 200 statute miles of the Missile Test Center. Approximately 400 ft of 70 mm film was used by the tracking telescope. The telescope has a 24 in. aperture and focal length up to 500 in. Maximum focal length was used for this series.

The accompanying series of enlargements shows typical frames from the best or middle part of the photographic series at intervals of two seconds of time. All enlargements have been magnified 27.7 times from the original film. This magnification was determined from similarly enlarged photographs of the sprocket holes of the film and their known dimensions and spacing. Image size was measured on the enlargements to one-hundredth of an inch. These values divided by the magnification of 27.7 gave the size of the image on the original film. Further corrections were then made for angle distortions.



Two-second sequence shots of "Laika" aloft.

◄ CIRCLE 102 ON READER-SERVICE CARD

Silicon—Thin Sliced Loaves

Using a new diamond wheel Audio Devices' Rectifier Division, Santa Ana, Calif. recently revealed its silicon-sawdust loss has been reduced 45 per cent.

At $5,000 a pound, crystal silicon is not a material to be wasted. Conventional diamond wheels cut away 65 per cent or more of the substance during production of silicon wafers. The Diatronic wheel, manufactured as a standard product by Navan, Inc., Santa Monica, Calif., has cutting edge widths ranging from 0.006 in. with a tolerance of +0.005 in., −0 in.

The new wheels cut satisfactorily for 30 days or more. This compares with four hours to two days for conventional wheels. Silicon crystals cut by Audio are usually 0.10 in. sq and 0.13 in. thick. Clearly a diamond wheel with a maximum edge width of 0.0065 in. instead of the former 0.007 in. ±0.001 results in substantial production savings.

Unconventional Sources of Electrical Power Surveyed

Most practical unconventional power sources for converting solar, thermal, chemical, and mechanical energies into electricity, appear to be the oscillating electromagnetic generator, thermopile generator, ion exchange membrane, fuel cell, and photovoltaic battery. This was the conclusion of an Air Force-sponsored survey which has just been released to industry. The study involved the theoretical and practical limitations and capabilities of power generation by means other than rotating machinery, conventional batteries, or radio activity. The data, drawn from the literature and limited laboratory work, was intended to determine where emphasis should be placed in a possible development program. A. L. Betts and P. A. McCollum of Oklahoma A & M College conducted the survey for Wright Air Development Center, U. S. Air Force. The report is *Unconventional Power Sources* divided into two parts (PB 131411 and PB 131218) each selling for two dollars from OTS, Dept. of Commerce, Washington 25, D.C.

Largest Radio Multi-Channel Link Opened

The largest radio telecommunications system capable of providing an ultimate capacity of over 50,000 channel miles has recently been opened in Nigeria. Constructed by Marconi's Wireless Telegraph Co., the system uses Marconi vhf multi-channel equipment at all the 14 terminal and 25 repeater stations.

Utilize Body Heat in Cold Weather Operation

Development of a battery vest, utilizing human body heat to keep dry cells warm and active for radio operators in extremely cold weather, was announced by the Department of the Army.

Developed by the U. S. Army Signal Research and Development Laboratory, Fort Monmouth, N. J., the idea is to place dry cell batteries in a vestlike garment worn beneath parkas to capture body heat. A cord is used to plug in standard Army radios. With the vest batteries developed for low-temperature use are expected to stay in service ten times longer in 40-degree-below-zero weather. Test models were built by Burgess Battery Co., Freeport, N.Y.

CIRCLE 9 ON READER-SERVICE CARD ➤

Gevic computer, for a typical fighter bomber application, will weigh only 45 pounds and occupy 0.8 cu ft. Arithmetic module is being inserted in package.

Lightweight Digital Computer Designed for Airborne Use

Weighing 45 pounds and occupying 0.8 cu ft. of space, a new airborne digital computer has sufficient speed and capacity to handle all computations required by an advance fighter-bomber. Developed by the Light Military Electronic Equipment Department of the General Electric Company, Utica, N.Y., the computer, called GEVIC, has been designed with high solution and iteration rates, so that it can be incorporated directly into control system loops.

Design engineers stated that the same technique could be applied to airborne multi-threat evaluation, pre-launch missile computation, or in-flight missile inertial guidance.

The GEVIC computer is based on a newly-developed variable increment type of variable difference mathematics. This special mechanization permits very fast slew operation, yet provides high accuracy digital resolution during normal operation. The computer can select any one of numerous increment values to accommodate rapidly changing parameters.

GEVIC uses magnetic logic and subminiature techniques throughout. The magnetic core-diode circuits are driven in parallel from a single sine-wave clock supply. The parallel connection enables the core units to operate over wide ranges of voltage and diode impedance values. Clock supply wave-shape is of minor importance. Components are mounted on only one side of the printed circuit boards to facilitate dip soldering techniques.

High-Purity Tantalum Produced Commercially

Achievement of commercial production of very high purity tantalum metal was announced by the Research Corp., Cambridge, Mass.

The new tantalum product is very low in oxygen, carbon and other impurities which adversely affect melting and fabrication. High purity gives the NRC tantalum ingot unusual ductility and low hardness (60-65 Brinell), permitting size reduction from 3-in. diam ingot to 0.0005-in. foil without intermediate annealing.

Attack Simulator Trains Anti-aircraft Crews

Nike missile-men and other anti-aircraft crews are being trained in enemy interception and destruction by a new attack simulator. The device is housed in a 20-foot trailer since it is designed to be moved from one weapons site to another. It will be used at Nike guided missile centers and at 90-millimeter and 120-millimeter artillery sites both in the United States and overseas, for the continual training of fire-control and missile-guidance radar operators.

The device, developed by IT&T, New York, N.Y., can inject six synthetic aircraft targets into the control radars, with each of the simulated targets having the characteristics of extremely fast, maneuverable planes. As each of the planes is detected and appears on the radar scope, the instructor can order into the system "jamming" by the "enemy" to simulate various types of interference. The speed with which the operators can solve each of the problems is indicated by a time scoreboard.

Target speeds up to 2300 miles an hour, with a maximum target range of more than 100 miles can be simulated. It also can simulate target altitudes up to 80,000 feet; maneuvers, including climb rates, up to 40,000 ft a min and dive rates up to 80,000 ft a min.

CIRCLE 11 ON READER-SERVICE CARD ➤

WASHINGTON REPORT

Herbert H. Rosen

SAGE Becomes Operational

A new era opened on electronic automation recently with the dedication of the first operational SAGE center at McGuire Air Force Base, New Jersey. While technologically not representative of the most advanced electronics, SAGE does function as the foundation of another area of specialization in the electronics industry. One that will revolve around the air defense of the nation with some application to civilian air traffic control.

SAGE has also provided eight organizations with a solid entry into this new field—an entry that leaves little room for other companies. Western Electric acted as the prime contractor for SAGE—gathering all the loose ends together to form this giant complex. Burroughs provided radar data links with its AN/FST-2 units. The Lincoln Lab of MIT was concerned with the overall design of the system. IBM's AN/FSQ-7 computer is the heart of SAGE. Bendix Radio supplied the FPS-20 long range radar, the gap filler radar FPS-14, and parts of the computer inputs. General Electric's power supplies feed the computers and other units. Lewyt has developed a transistorized display and read-out printer for SAGE. And a newcomer to the team, Systems Development Corps—a Rand Inc. spin-off organization—worked on the programming of the data.

SAGE continues to be a very expensive and complex experiment. Its complexity dictated the selection of only large, deeply organized, well-financed principal contractors. Cost of SAGE has been reported to be between $2.4 billion and $7.2 billion. The latter figure includes everything in the Air Defense System associated with SAGE—radars, missiles, missile sites, control centers, observations posts, power, communications, etc. The $2.4 billion represents the cost of bringing the radar link and the sample center to the point of dedication—as at McGuire.

Even spread over the six years spent in developing SAGE, the finances of this program are staggering. The huge black house—and everything in and around it—cost about $132 million. A cost the Air Force anticipates will not be repeated at other centers. For the moment, however, about $27 million bought the computer, about $10 million the brick and mortar in the building, and the rest for power, air conditioning, land lines, data links, radar link, office space, etc.

McGuire is the first of 29 major SAGE Direction Centers. Nine of these will have duplicate SAGE installations and will act as central control for regions consisting of four or more SAGE Centers. That brings the total up to 36 more—nearly another billion dollars of equipment.

By the time the tenth or so center is built, the Air Force expects the average cost of each one to be reduced considerably. Engineers on the project also predict that the newest electronic techniques will be more generally used—notably semiconductor technology.

Even then, the Air Force estimates that operations and maintenance costs of the 36 centers will be about $489 million a year. Those costs should start in 1963, when all of the SAGE Centers are supposed to be operational.

An official estimate of the total bill the U.S. must pay annually for all of its air defense is $4-1/2 billion. Of course, that includes both the manned and unmanned defensive forces being coordinated by NORAD—the North American Air Defense Command—at Colorado Springs.

Early next year, it is hoped, the first BOMARC squadron will be operational at McGuire. Part of the SAGE computer will be used to control and guide this medium range missile.

Meanwhile, a small-scale controversy rages over the relative roles of SAGE and Missile Master. The Air Force is more concerned with the long range intercept as typified by DEWline and the F-105. Missile Master and its 50-mile Nike-Hercules are considered the last ditch stands.

Still, the two systems must be linked together. Within the next two years the differences between the two systems must be resolved. SAGE is digital. Missile Master is analog. And the data link connecting them cannot be as large as either installation.

Still others comment on the number of missions SAGE can control—in the 40's. As an air control system for civilian traffic, this is an intolerably small rate. Moreover, SAGE requires people—it is semiautomatic.

As SAGE now stands it fits into the National Defense Plan against manned airplanes and air-breathing missiles—the subsonic kind. This is a condition the military planners expect to continue for a few years. After that what?

SAGE can be connected to BMEWS—the ballistic missile early warning system—just as it is now connected to the DEWline. And as it will be eventually to Missile Master. But there are grave doubts that unless there are some improvements, its ability to cope with supersonic ballistic missiles is weak.

MEETINGS

Sept. 3-5: 1st National Conference on the Application of Insulation

Cleveland, Ohio. Sponsored by AIEE and National Electrical Manufacturers Association. Sessions will be divided according to equipment category, as follows: rotating equipment, transformers, controls and instrumentation, and electronics. Morning sessions will consist of papers delivered by representatives of electrical insulating materials manufacturers; afternoon sessions presentations will be made by electrical equipment manufacturers. For information write George Bamberg, Cleveland Publicity Committee, c/o The Glastic Corp., 4321 Glenridge Road, Cleveland 21, Ohio.

Sept. 12: Regional Technical Conference, Society of Plastics Engineers

St. Clair Inn, St. Clair, Mich. Sponsored by Detroit Section of SPE. Arrangements have been made for papers on injection molding, compression molding, thermoforming, reinforced plastics, automotive lighting, and vacuum metallizing. For information write J. D. Young, E. I. du Pont de Nemours & Co., 13119 W. Seven Mile Rd., Detroit 35, Mich.

Sept. 12-14: 7th Annual High Fidelity Show

Palmer House, Chicago, Ill. Write to International Sight and Sound Exposition, Inc., 1 N. La Salle St., Chicago 2, Ill., for further details.

Sept. 15-19: 13th Annual Instrument-Automation Conference and Exhibit

Philadelphia Convention Hall, Philadelphia, Pa. Sponsored by ISA. Two technical sessions on the use of instruments in the nuclear field will highlight the 5-day conference. Ask Fred J. Tabery, Conference and Exhibit Manager, 3443 S. Hill St., Los Angeles, Calif., for further information.

Sept. 22-24: National Symposium on Telemetering

Americana Hotel, Miami Beach, Fla. Sponsored by PGTRC of IRE. Ken West, 1345 Indian River Dr., Eau Gallie, Fla., has additional information about the symposium.

Sept. 24-25: 7th Annual Symposium on Industrial Electronics

Rackham Memorial Auditorium, Detroit, Mich. Sponsored by PGIE and AIEE. Address queries to William R. Thurston, General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.

Sept. 29-Oct. 3: ASTE Semi-Annual Meeting and Western Tool Show

Shine Exposition Hall, Los Angeles, Calif. Sponsored by American Society of Tool Engineers. Theme will be "Tooling for the Space Age." For more information write ASTE, 10700 Puritan Ave., Detroit, Mich.

Oct. 1-2: 2nd Annual Symposium on Engineering Writing and Speech

New York City. Sponsored by the IRE PGEW.

Oct. 13-15: National Electronics Conference

Hotel Sherman, Chicago, Ill. Tentative program includes sessions on transistors, servomechanisms, antennas, audio, filter design, solid state, microwaves, instrumentation, network theory, engineering writing and speech, computers, radar and radio navigation, magnetic amplifiers, engineering management, industrial electronics, television and communications. More information can be obtained from National Electronics Conference, Inc., 84 East Randolph St., Chicago 1, Ill.

Oct. 20-21: 4th National Aero-Com Symposium

Hotel Utica, Utica, N.Y. Sponsored by the IRE Professional Group on Communications Systems. It will stress the requirements, progress and challenge of communications in all its phases.

Oct. 20-22: URSI Fall Meeting

Pennsylvania State University, University Park, Pa. Co-sponsors are IRE professional groups on information theory and antennas and propagation. Write U.S.A. National Committee, URSI, 2101 Constitution Ave., N. W., Washington 25, D. C., for more information.

Oct. 22-24: Fifth National Symposium on Vacuum Technology

Sir Francis Drake Hotel, San Francisco, Calif. Sponsored by American Vacuum Society. For more information write American Vacuum Society, Box 1282, Boston, Mass.

Oct. 22-25: National Society of Professional Engineers Fall Meeting

St. Francis Hotel, San Francisco, Calif. Sessions will be devoted to hearing committee reports on such issues as the effect of the accelerated activity in space travel on the future of the engineering profession; effective utilization of present engineering manpower; encouraging capable high school students to consider careers in engineering; and the role of the Federal government in engineering education. J. A. Sontheimer,

CIRCLE 16 ON READER-SERVICE CARD

MEETINGS

Secretary, California Society of Professional Engineers, c/o St. Francis Hotel, San Francisco, Calif., has more information.

Oct. 27-28: East Coast Conference on Aeronautical and Navigational Electronics

Lord Baltimore Hotel, Baltimore, Md. Sponsored by IRE Professional Group on Aeronautical and Navigational Electronics and the Baltimore Section. Technical papers to be presented will concern such things as new techniques in air navigation, new systems for air traffic control and radar. There will also be exhibits of navigational systems and test equipment and components. For additional information contact Harry S. Rutstein, Publicity Chairman, Eastern Associates, Inc., Baltimore, Md.

Nov. 19-20: Northeast Electronics Research and Engineering Meeting

Mechanics Hall, Boston, Mass. Sponsored jointly by the Boston, Connecticut, and Western Massachusetts Sections of the IRE. R. R. Leonard, Datamatic Div., Minneapolis Honeywell Regulator Co., Newton Highlands, Mass., has more information.

Dec. 2-4: 3rd EIA Conference on Reliable Electrical Connections

Dallas, Tex. For information, write W. O. Richards, 224 Cedar St., Syracuse 3, N. Y.

Paper Deadline

Oct. 1: Deadline for papers to be presented at the **1959 Western Joint Computer Conference**, to be held at the Fairmont Hotel, San Francisco, Calif., **March 3-5, 1959.** Theme of this conference will be "New Horizons with Computer Technology." There is particular emphasis on factual papers dealing with the newer applications of computer techniques, such as information retrieval, operation control, pattern analysis, decision making, computer communications, learning concepts, as well as on papers dealing with advances in computer component and systems design. There will be two sessions of a speculative nature; one dealing with the extension of computer technology into areas not considered feasible at present, the other with the philosophis and/or social implications of the widespread application of automatic computer techniques. Papers should be prepared based on a 20-minute delivery time. There are no format requirements for submission drafts. Three copies of proposed paper should be submitted to *M. L. Lesser, IBM Research Laboratory, San Jose, Calif.*

EDITORIAL

DOD Must Linear Program

Previous comment on this space, June 25 and August 6, dealt with the possibility of standardizing some aspects of digital computer design for weapons systems. The Department of Defense asked for voluntary industry standardization. From a survey on this subject we learned that industry felt it was too premature to standardize such a fluid industry, but that some benefits could be gained if it were possible. The complexity of the problem points to the need for a summit view to see everything that is involved. This means that if the Department of Defense wants standardization they will have to say what the specific goals are. Since they control funds for weapons systems work they can "put up" accordingly. Ignoring the 50 per cent who were unsympathetic to any idea of standardization as being premature, here are some constructive ideas leading to standardization advanced by respondents to our survey.

Overall Authority and Coordination. Only the Department of Defense can provide these functions. John Brown of the U. of Michigan says ". . . [The DOD must make] available to a standardization group ALL of the detailed requirements of ALL the computer circuits and components to be included in the standardization." Brown feels promising circuits that might work into a flexible standardization program are dynamic flip-flops, half-adders, shift register units, delay units.

Assigning Weight-Factors. J. H. Bigelow of the Institute of Advanced Study, Princeton, says "contracts must clearly indicate the relative importance of various performance parameters and also the sort of interchangeability needed for that particular class." Bigelow illustrated examples of weight-factors: a high one—comparable to tires or ammunition; a low one—research to see if the complicated solution could be done within specified constraints. Mr. Bigelow called this concept of assigning weight factors a linear programming technique. A team within the procurement department specifies the relative importance of weight factors and follows up by evaluating the results.

Start with Land-Based Computers. Airborne and shipboard requirements impose severe unusual shape and size limitations. Any start at standardization should be aimed at land-based computers.

Evaluation First. We choose to list this item last as a closing thought. Study and evaluation of what is desirable and what can be done comes first. This is a Department of Defense job. They must show the way.

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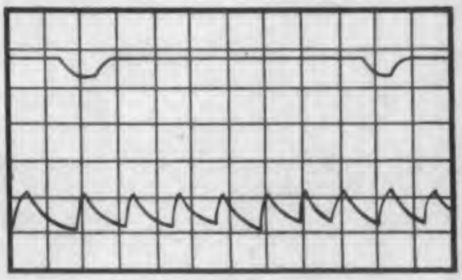
Plot of voltage ratio error versus rotation illustrates linearity to better than ± 0.3%.



ACEPOT RESOLUTION TEST

Section of oscillograph trace of electrical resolution shows voltage change for each turn of wire.

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CIRCLE 17 ON READER-SERVICE CARD

How To Design Pulse Magnetic Amplifiers

Part 1—Design

Richard L. White
Hoffman Semiconductor Div.
Evanston, Ill.

Richard White has years of experience developing commercial and military electronic equipment. He feels the application of magnetic core logic will help the instrumentation field go more and more to digital techniques.

Here, in the first part of a two part series, he gives a direct approach to designing pulse magnetic amplifiers. He winds up with a practical design procedure and a sample problem.

The second part of his article discusses logic.

YOU CAN design pulse magnetic amplifiers with two basic equations and some characteristics of the magnetic material. The equations are here. The characteristics are supplied by manufacturers.

Bobbin Cores

Pulse magnetic amplifier design centers around what is called a bobbin core. Physically, it resembles a small thread spool with an enlarged center hole. Several layers of ultra-thin magnetic material are wrapped where the thread would normally be. The bobbin, made of a ceramic material or stainless steel, gives rigid support to the fragile magnetic material.

Core Material

Fig. 1 shows the hysteresis loop of a 4-79 Mo-Permalloy 1/8 mil bobbin core with important design parameters labelled. Three factors dictate the choice of material.

- High squareness ratio (B_r/B_m ratio approaches unity).
- Low coercive force NI_m (involves power loss per core, hence, power requirements of the high frequency driving circuit).

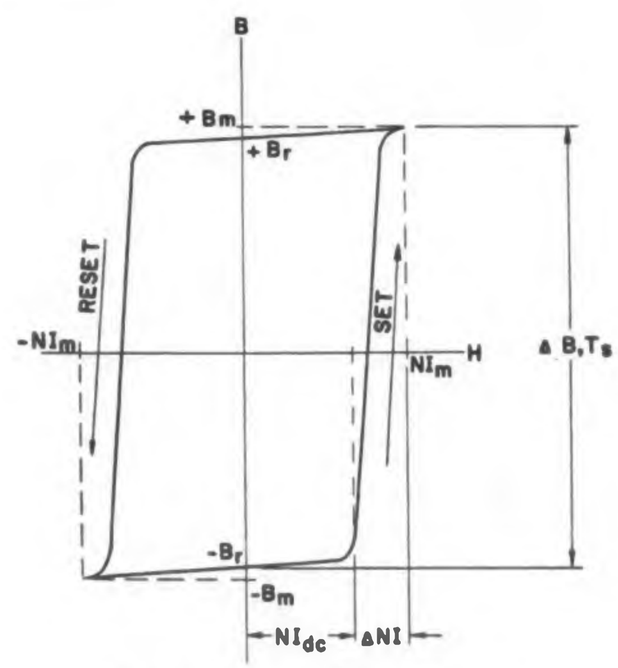


Fig. 1. A typical hysteresis loop.

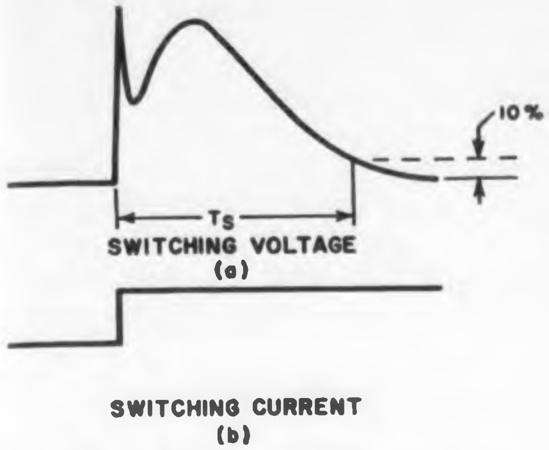


Fig. 2. A typical switching signal.

- High flux change (ΔB is large for a given cross-sectional area).

For these quantities, 4-79 Mo-Permally has the following approximate values: squareness ratio—0.98, coercive force (NI_{dc})—0.24 ampere-turns, flux change (ΔB)—10^5 lines per square inch.

Switching Time vs Coercive Force

Fig. 2 shows a typical switching signal. Switching time and coercive force are related by

$$NI_t = NI_{dc} + K_t/T_s \qquad (1)$$

where NI_t has the units of ampere-turns per inch of mean length. The mean length L, is calculated from manufacturer's data on bobbin size. ($L = \pi D$ where D is the average diameter of the magnetic material wrapped on the bobbin). K_t is a constant depending on the magnetic material. (For 4-79 Mo-Permalloy, $K_t = 1$). T_s is the switching time in microseconds.

For 4-79 Mo-Permalloy, eq (1) becomes

$$NI_t = 0.24 + 1/T_s$$

A comparison of the data using this equation and experimental data using the circuit of Fig. 3 is plotted in Fig. 4. The curves agree closely.

Equivalent Resistance Concept

A saturable magnetic core presents a predominantly resistive impedance to an applied

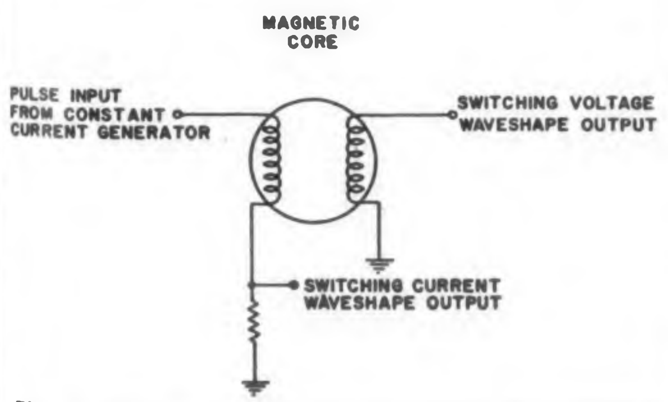


Fig. 3. This circuit was used to provide the switching data plotted in Fig. 4.

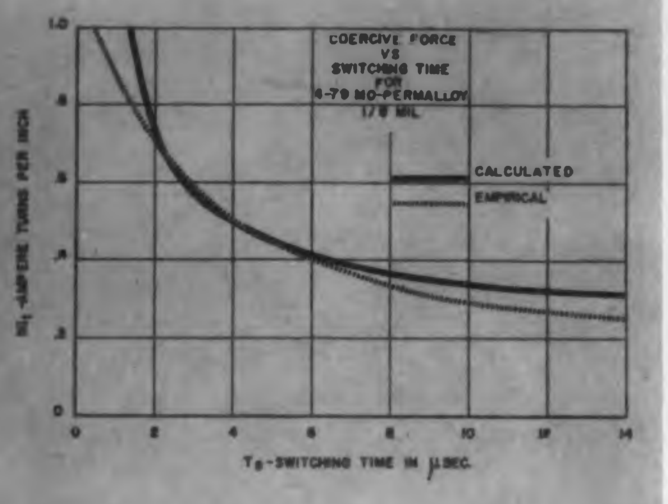


Fig. 4. Switching data for 1/8 mil 4-79 Mo-Permalloy.

voltage or current pulse. The equation relating the various physical and electrical parameters to this resistance is

$$\overline{R}_o = \frac{\Delta B\ A\ 10^{-2}}{NI_t\ L\ T_s} \text{ ohms/turn}^2 \qquad (2)$$

where ΔB is the number of lines per square inch, A is in inches of cross-sectional area, NI_t is in ampere-turns per inch, T_s is switching time in microseconds, and L is the mean length of the magnetic path in inches. This equation determines the power loss in the core and the voltage drop across the windings.

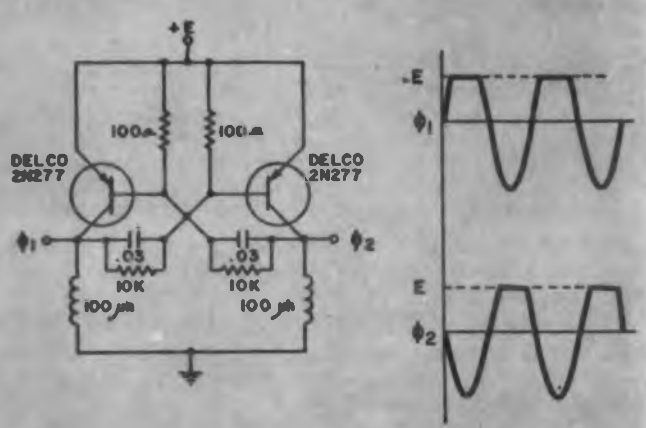


Fig. 5. The circuit and output waveshapes of a 100 kc transistor oscillator. It can drive approximately 50 pulse magnetic amplifiers.

Pulse Magnetic Amplifier Operation

Fig. 6 shows a basic complementing pulse magnetic amplifier. The power connection at Φ_2 is taken from the power oscillator in Fig. 5.

This amplifier is a binary device, capable of only two output conditions. The presence of a voltage pulse is called a "1" and the absence of a pulse is called "0." If the core is in the set condition, at $+B_r$ in Fig. 1 when Φ_2 is applied, a "1" appears at the output. The total voltage appears across the load resistor R_L. No voltage appears across winding N_2 because the core is saturated.

If the core is in the reset condition, at $-B_r$ with Φ_2 applied, a "0" appears at the output. The total voltage appears across winding N_2. This condition exists because the core is being set. The hysteresis loop is being traced from $-B_r$ to $+B_m$.

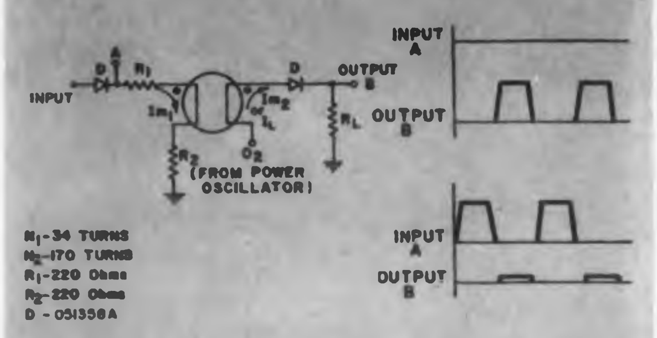


Fig. 6. The design procedure for this basic complementing pulse magnetic amplifier is given in the text.

A small voltage does appear across the load resistor R_L of the amplifier (Fig. 6) due to the magnetizing current I_{m2}.

The desired output is determined by the binary signal fed to the input. This input signal has a 180 deg phase relationship to the output signal. The input signal is in phase Φ_1, while the output is in phase Φ_2. Hence, the input places the core in a state that determines what the output will be one half cycle later. If there is no input during Φ_1 positive, one half cycle later an output occurs during the positive excursion of Φ_2. An input during Φ_1 positive resets the magnetic core so no output is present in the following positive Φ_2 period.

This illustrates three important characteristics of the pulse magnetic amplifier.

- The amplifier is complimentary. When the input is a "1" the next output is a "0," and vice versa.
- The amplifier has intrinsic time delay. The output dictated by a given input occurs 180 degrees later.
- Power is not transferred through the core by transformer action. It is gated by controlled saturation. When the core is saturated, winding N_2 offers only the resistance of the wire to Φ_2. When the core is not saturated, N_2 offers the impedance determined by eq (2).

Design Considerations

Three factors must be determined first:

1. Switching time;
2. Pulse voltage amplitude;
3. Zero to one ratio.

Switching time is determined by the desired operating frequency.

Maximum pulse voltage is determined by the physical limitation of the number of wraps of magnetic material on the bobbin and the maximum turns of wire that can be wound on the bobbin. The amplifier is designed to have its output connected to the input of at least one identical amplifier. Also, the ampere-turn requirement for complete saturation is constant (for a given switching time) regardless of the number of turns on a given winding. Hence, $N_1 I_{m1} = N_2 I_{m2}$.

Zero to one ratio is the ratio of the voltage pulses at the output for a "1" and a "0". Since the output is a constant resistance, this voltage ratio can be expressed as a current ratio, and the ampere-turn relationship can be re-written

$$I_{m1}/I_{m2} = N_2/N_1.$$

Thus the minimum zero to one ratio can be expressed in terms of the windings on the bobbin core.

When the switching time, pulse voltage amplitude, and minimum zero to one ratio have been established, the design can proceed.

Design Procedure

Step 1. Select a bobbin size and number of wraps of 1/8 mil 4-79 Mo-Permalloy. The maximum number of wraps for a given bobbin is given in the manufacturer's data sheet.

Step 2. Calculate NI_t using eq (1). Multiply this figure by L to obtain the ampere-turns for the selected bobbin.

Step 3. Calculate the equivalent winding resistance using eq (2).

Step 4. Select a desired magnetizing current I_{m2}, keeping in mind that I_{m1} will be at least the zero to one ratio times as great as I_{m2}.

Step 5. Calculate N_2 (using Ohm's law) and N_1. Select a wire size compatible with the window area of the bobbin and the output current requirements.

Step 6. Calculate the series resistance $(R_1 + R_2)$. Use a current value of 1.5 I_{m1} to assure complete resetting of the core during the switching time regardless of slight variations in manufacture.

Step 7. Calculate the power loss in the core and its associated components for a complete power cycle.

Sample Design

Given data:

Operating frequency = 100 kc

Switching time = 5 μsec (selected primarily because of the frequency limitations on the power transistors in the power oscillator).

Pulse voltage amplitude = 9 v

Zero to one ratio = 5 (A compromise. A larger ratio requires a higher I_{m1}. A smaller ratio might enter an ambiguous area where partial setting of the following core could take place).

Step 1. Pick the bobbin size on the basis of the pulse voltage, wire size, number of wraps of magnetic material, and hole area to accommodate the wire. Good choice is Arnold Engineering #17 with ID = .210 in., OD = .312 in.
Number of wraps = 15
Mean length of magnetic path (L) = .79 in.
Cross-sectional area $(A) = 2.34\,(10)^{-4}$ sq in.

Step 2. $NI_t = .24 + 1/5 = .44$ ampere-turns/in.
$NI_tL = (.44)\,(.79) = .35$ ampere-turns

Step 3. $\overline{R}_o = \dfrac{2.34 \times 10}{(.35)\,5} = .134$ ohms/turn²

Step 4. Let $I_{m2} = 2$ ma
$I_{m1} = 5\,I_{m2} = 10$ ma

Step 5. $E = \dfrac{NI_tL}{N_2}\overline{R}_oN_2^2 = NI_tL\overline{R}_oN_2$

and $N_2 = \dfrac{E}{NI_tL\overline{R}_o} = \dfrac{8}{(.35)\,(.134)} = 170$ turns

$N_1 = N_2/5 = 34$ turns
$N_1^2\overline{R}_o = 150$ ohms
$N_2^2\overline{R}_o = 4000$ ohms

Wire size = #36 heavy Soldereze

Step 6. $R_s + N_1^2\overline{R}_o = \dfrac{E}{1.5\,I_{m1}} = \dfrac{9}{15}\,10^3 = 600$ ohms

$R_s = 600 - 150 - 450$ ohms
$\overline{R}_1 = R_2 = 220$ ohms

Step 7.

$$
\begin{aligned}
2.25\,I_{m1}^2N_1^2R_o &= 34 \text{ mw}\\
2.25\,I_{m1}^2\overline{R}_s &= 100 \text{ mw}\\
I_{m2}^2N_2^2\overline{R}_o &= \underline{16 \text{ mw}}\\
\text{Power loss per stage} &= 150 \text{ mw}
\end{aligned}
$$

Results of this design are summarized in Fig. 6.

High Speed Sampling Switch

"blows" contacts closed

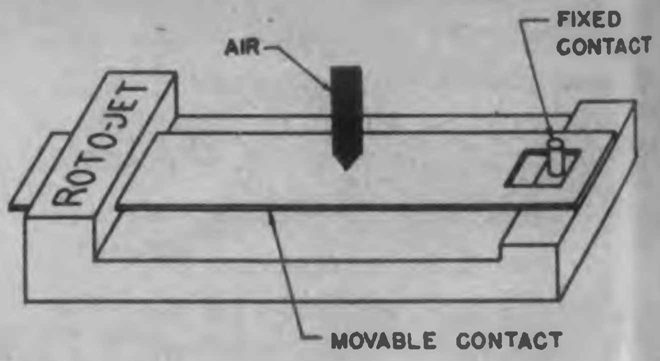
A RAPIDLY ROTATING jet of air provides gentle but firm contact closure in this sampling switch. Forty-five isolated pairs of contacts are arranged barrel-stave fashion around the body of the switch. The air jet, rotating at speeds up to 20 rps, strikes each individual pair of contacts in quick succession.

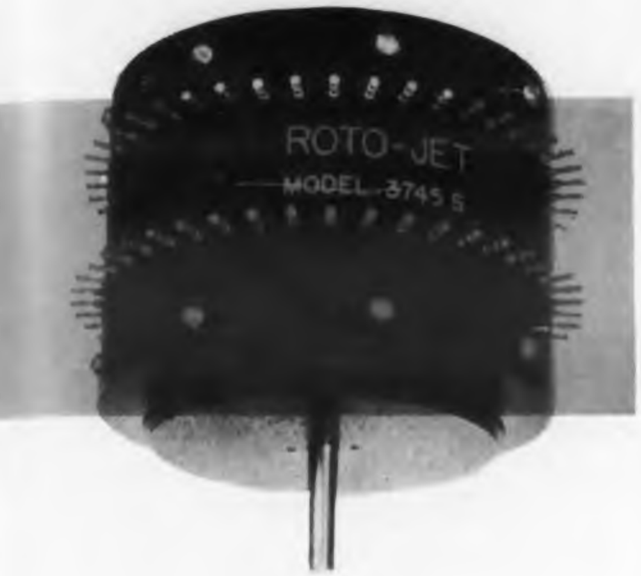
Contact wear is a minimum, resulting in a service free life of 2000 hours at 20 rps. Noise is practically eliminated; at least, none can be observed on a scope with 1 mv/cm sensitivity using an input signal of 10 mv at 50 μa.

The sampling switch, called the Roto-Jet, is being made available by Norman Hardy Assoc., P.O. Box 97, Wyncote, Pa. The standard arrangement of 45 contact pairs can be easily adapted to other configurations. For instance, by tying all the output terminals together, the switch becomes single pole, 45 contacts per pole.

The structure of one contact-pair module is illustrated. The impact of a high velocity air causes the reed-like movable contact to deflect, drawing the free end into contact with a fixed pin. The arrangement provides good mechanical advantage, permitting a tiny jet of air to hold the contacts together with

A jet of air strikes the movable contact, causing it to deflect and be drawn into contact with the fixed contact pin.





more than satisfactory force. Closure time is fast, being in the order of 40 µsec. Contact is broken in about 20 µsec. These times represent the leading and trailing edge duration of the typical square wave pattern. Duty cycle (ratio of closed contact time to total time between successive contacts) can be adjusted from 30 to 90 per cent.

The Roto-Jet sampling switch has a contact resistance of 0.5 ohm. An air supply of 2-1/2 cfm at 40 psi is needed for operation. Diameter of the switch is approximately 3-3/4 in.

For more information, turn to the Reader-Service card and circle **100**.

Individual contact module.

Resistor Noise Testing

Edmund Osterland
EO Electronics, Inc.
Mountain Lakes, N.J.

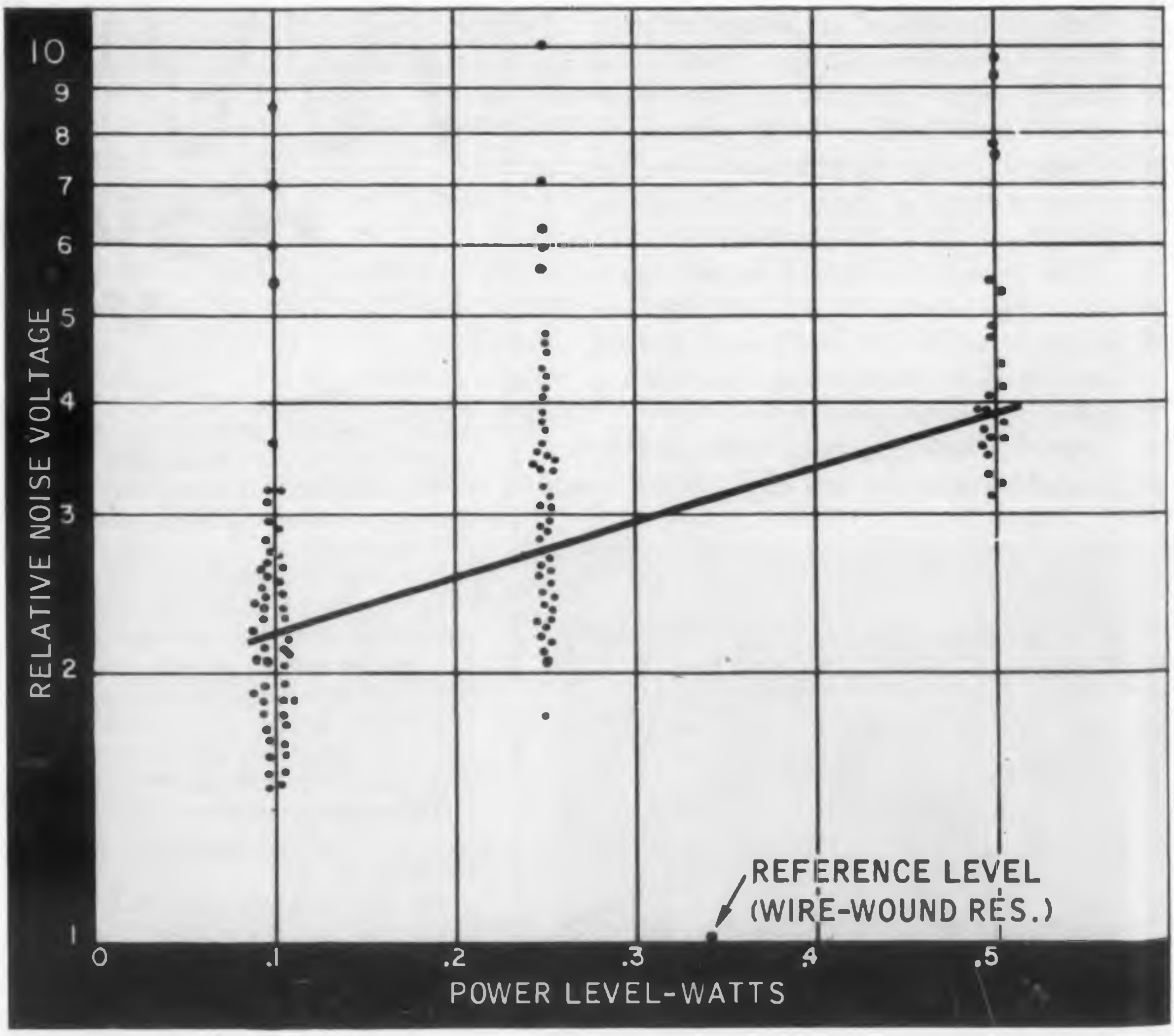


Fig. 2. Noise vs load characteristics for a typical lot of 80-1/2-watt 50 K deposited carbon resistors. Some samples too noisy to be shown on the graph.

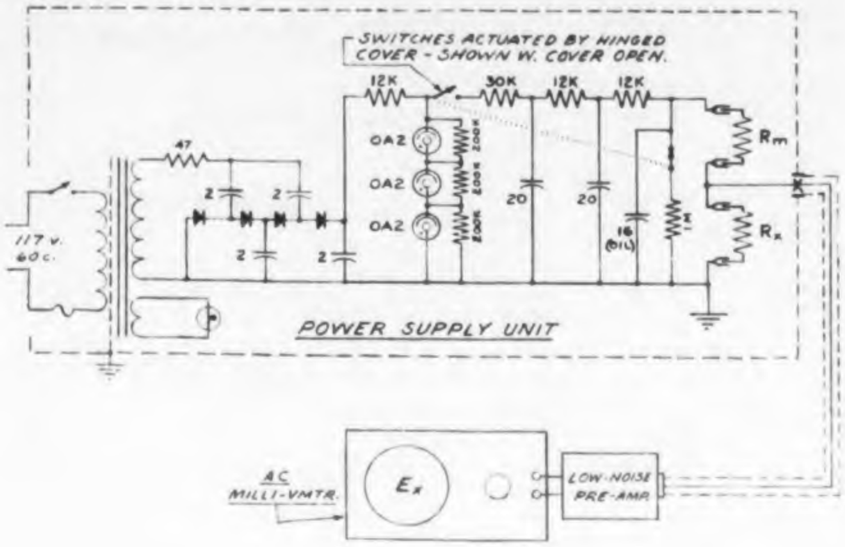


Fig. 1. (left) Circuit diagram of the system for measuring noise value.

Fig. 3. (right) Actual instruments used in the noise tests.

OBSERVATION of the wide variation of noise level in resistors from a given lot suggests that full incoming inspection is advisable. Described is a method which permits such inspection with minimum time and equipment.

Noise values for different types of resistors are detailed in Table 1. Note the high noise values found in groups which have a generally acceptable average noise figure.

The circuit diagram, Fig. 1, illustrates a system for measuring noise value. Direct current equal or near to the rated maximum for a particular resistor is passed through a matching resistor, R_m and the test resistor R_x. The matching resistor R_m should have approximately the same resistance as R_x for optimum sensitivity of measurement, and it must be a wirewound unit with welded or soldered end terminations so that it will not contribute measurable noise currents. The extent of current fluctuations in R_x is then directly noted by measuring the ac voltage from the junction of R_m and R_x to ground.

The variation of noise currents as a function of dc load is shown in Fig. 2. This also illustrates the irregularity of individual units in a representative lot taken from new stock supplies.

The combination of an instrument pre-amplifier and a sensitive rms voltmeter serves as indicator. The response of the indicator should be limited to the low audio range, since current noise predominates in this region. The Min-Amp pre-amplifier in Fig. 3 incorporates filter circuits which aid in the delineation of resistor noise against a background of extraneous noise.

The inherent noise voltage generated by the resistor is given as

$$E_n = E_x \times R_x \left[\frac{1}{R_x} + \frac{1}{R_m} + \frac{1}{R_g} \right]$$

Where:

E_x is the indicated noise voltage,
R_x is the resistance of the test resistor,
R_m is the resistance of the matching resistor,
R_g is the pre-amplifier input resistance.

Dividing E_n by the dc voltage across R_x yields the familiar figure of $\mu v/v$. Since for any group of resistors the test voltage and the circuit parameters remain constant, it is only necessary to choose acceptable values of E_x for production test limits.

For shielding purposes, the test resistor is clipped into a fixture recessed in the power supply unit and enclosed by a hinged lid. Closing the lid also closes switches in the dc supply circuit so that the apparatus is operative only when the resistor is properly enclosed in this shielding structure. Shielded connectors and connecting leads are also required for satisfactory results.

A laboratory-type regulated power supply of conventional design may be used as a dc source but will probably require additional filter sections to attain an adequately low hum level. The simple dc supply illustrated is useful for testing 1/4 to 1/2 watt resistors in the range of 10 K to about 75 K. Finally, the input noise level of the pre-amplifier must remain consistently low for accurate noise analysis. The unit pictured has a rated noise level of 2 μv for the restricted range of 200 to 2000 cps or 6 μv for a 5 to 500,000 cps response band. It provides a maximum gain of 100 which enables the measurement of signals down to 10 μv with the millivoltmeter shown.

Tabulation of Resistor Types and Associated Noise Levels.

Resistor Type	R ohms	Load Level	Inherent Noise in microvolts/volt			Remarks
			Low	High	Average	
½w. composition slug type	22K	⅓w.	0.31	0.37	0.34	10 samples
1w. composition slug type	22K	⅓w.	0.15	0.61	0.19	10 samples
½w. dep. carbon Mfr. (A)	20K	⅓w.	0.15	1.10	0.29	10 samples
½w. composition slug type	51K	⅓w.	0.20	2.30	0.56	10 samples
½w. composition film type	47K	⅓w.	0.46	0.90	0.62	10 samples
½w. dep. carbon Mfr. (A)	50K	⅓w.	0.09	9.20	0.30	80 samples
½w. dep. carbon Mfr. (B)	65K	½w.	0.11	3.80	0.51	20 samples
Wire-wound std. (1 sample)	50K	⅓w.	0.08	0.08	0.08	Nearly equiv. to thermal noise

Table 1. Noise values for different types of resistors are shown. Note how far the extreme values may differ from the average value for a given resistor type. Bandwidth of measurement is 5 to 250,000 cps.

References

JAN-R-11 Specification, May 31, 1944.
Noise in Composition Resistors, George T. Conrad, Jr., National Bureau of Standards.

Pulse Oscilloscope List

HERE IS a list of 47 scopes having high frequency responses, fast rise times, sweep generators calibrated in real time, and which are dc coupled to avoid low frequency distortion. All are commercially available standard models from among 13 manufacturers.

The oscilloscopes are arranged in ascending order of hf response (Column 3) from 1 mc up to 1 kmc. Within any group having the same upper frequency limit, the order is determined by the sensitivity (Column 5) with the most sensitive placed first. Within any such group where the sensitivities are the same, the order is determined by the sweep speed (Column 6) with the smallest minimum time placed first.

Sensitivities are peak-to-peak values. Figures separated by a dash show the range of sensitivity for the vertical channel. Where no dash appears, the second number is the sensitivity of the horizontal channel. Wherever specifications are given for the horizontal amplifier, this input is available externally. The scopes shown use 5-in. cathode ray tubes, unless otherwise noted. All may be used on commercial single phase 60 cps input power of 105-125 v.

List is abstracted from Volume 3, *Scalers*, of the *Directory of Technical Specifications, Electronic Test Instruments,®* published by Technical Information Corp., 41 Union Square, New York 3, N. Y.

A 30-page list of oscilloscopes covering 146 items by 39 manufacturers in 21 columns of specifications and including manufactures' names and addresses is available for a limited time at $10. A complete electronic test instrument service, which includes a four volume Directory, up-dating, and consultation on any instrument location problem, is available from the company for an annual subscription of $270. For more information about the Directory service and the oscilloscope list, turn to the Reader-Service card and circle **305**.

Manufacturer	Model	Amplifier 1	Frequency Min. cps 2	Frequency Max. mc 3	Rise Time µ sec 4	Sens. mv/in 5	Sweep Speed 6	Special Notes
SOLARTRON	AD557-A	b	dc	1	ina	3mv -100V /cm	* 1µs- 1sec /cm	6. Expansion 10X. CRT: 4 inch.
ELECTRONIC TUBE	H-23 a	Vert Horz	dc dc	1 250kc	ina ina	28 700	* 2µs- 0.1sec /in	6. Dual independent sweep generators.
RADIOMETER	OSG-42	Vert Horz	dc dc	1 1	ina ina	0.2mm 0.15mm /mv	*20mm /µs max	6. Expansion 3X. CRT: 3 inch.
RADIOMETER	OSG-41	Vert Horz	dc dc	3 800kc	ina ina	0.7mm 0.3mm /mv	*50mm /µs max	6. Expansion 3X.
TEKTRONIX	310	Vert Horz	dc ina	4 ina	.09 ina	10 1.2V /div	* 0.5µs -200ms /div	6. Expansion 5X. CRT: 3 inch, 4 div/in.
DU MONT	331	Vert Horz	dc dc	4 400kc	.08 ina	400mv 1V fs	* 0.5µs -500ms /div	6. Expansion 3X. CRT: 3 inch.
ADVANCED ELECTRONICS	200HP 200HR	Vert Horz	dc dc	4 500kc	0.1 5	50 30 /div	* 0.5µs -150ms /div	6. Expansion 5X. CRT: 3 inch, 5 div/in.
COSSOR	1058	Vert Horz	dc 20	4 200kc	.09 ina	250 500 /cm	* 25µs -250ms	6. Expansion 5X. CRT: 4 inch.
TEKTRONIX	532-53/54B c	Vert Horz	dc dc	5 300kc	.07 ina	* 5mv -20V /cm	* 1µs- 12sec /cm	5. AC 5-50 mv, AC/DC 50 mv 20V/cm, vernier to 50V/cm. 6. Expansion 5X.
TEKTRONIX	532-53/54L c	Vert Horz	dc dc	5 300kc	.07 ina	* 5mv -20V /cm	* 1µs- 12sec /cm	5. AC 5-50 mv, AC/DC 50 mv-20V/cm, vernier to 50V/cm. 6. Expansion 5X.
TEKTRONIX	532-53/54A c	Vert Horz	dc dc	5 300kc	.07 ina	* 50mv -20V /cm	* 1µs- 12sec /cm	5. Vernier to 50V/cm. 6. Expansion 5X.
DU MONT	327	Vert	dc	5	.07	500 fs	* 1µs- 1sec /in	6. Signal delay 0.4µs; expansion 2, 3, 4 or 5X.
THE SCOPES CO.	301	Vert	dc	6	.06	100 /cm	* 1µs- 0.5sec /cm	6. Expansion 10X. CRT: 3 inch.
SOLARTRON	CD523-A	Vert	dc	10	ina	1mv -10V /cm	* 0.1µs -1sec /cm	6. Expansion 5X. CRT: 4 inch.
TEKTRONIX	531-53/54B c	Vert Horz	dc dc	10 240kc	.035 ina	* 5mv -20V /cm	* 0.1µs -12sec /cm	5. AC 5-50 mv, AC/DC 50 mv-20 V/cm, vernier to 50V/cm. 6. Expansion 5X.
HEWLETT-PACKARD	150A-151A c	Vert Horz	dc dc	10 500kc	.035 ina	* 5mv -20V /cm	* 0.1µs -15sec /cm	5. Vernier to 50V/cm. 6. Expansion X5, 10, 50 and 100, max. .02µs/cm.
TEKTRONIX	536-53/54B c	b	dc	10	.035	* 5mv -20V /div	* 0.2µs -2sec /div	5. AC 5-50 mv, AC/DC 50 mv-20V/cm, vernier to 50V/cm. 6. With extra plug-in.
TEKTRONIX	524AD	Vert	dc	10	.035	* 15mv -50V /cm	* 0.1µs -10ms /cm	5. AC 15-150 mv, DC 150 mv-50V/cm. 6. 0-25 ms delay; exp. 3 or 10X.
TEKTRONIX	316 RM16	Vert Horz	dc dc	10 500kc	.035 ina	* 10 1.4V /div	* 0.2µs -2sec /div	5. AC 10-100 mv, AC/DC 100 mv-125V/div. 6. Exp. 5X. CRT: 3 inch, 4 div/in.
LABORATORY FOR ELECTRONICS	411A	Vert Horz	dc dc	10 400kc	.035 ina	20 4V /cm	0.1µs -100ms /cm	
DU MONT	329-A	Vert	dc	10	.035	*200mv -400V fs	* 0.1µs -1sec /div	5. 100 mv, 5 mc by switch. 6. Expansion by 50% notch, cal X10, uncal to X100.
DU MONT	323-A	Vert	dc	10	.035	200mv -400V fs	* 0.1µs -1sec /div	6. Expansion by 50% notch, cal X10, uncal to X100.
TEKTRONIX	531-53/54A c	Vert Horz	dc dc	10 240kc	.035 ina	* 50mv -20V /cm	* 0.1µs -12sec /cm	5. Vernier to 50V/cm. 6. Expansion 5X, delay available.
HEWLETT-PACKARD	150A-152A c a	Vert Horz	dc dc	10 500kc	.035 ina	* 50mv -20V /div	* 0.1µs -15sec /cm	5. Vernier to 50V/cm. 6. Expansion X5, 10, 50 and 100, max. .02µs/cm.

Manufacturer	Model	Amplifier 1	Frequency Min. cps 2	Frequency Max. mc 3	Rise Time µ sec 4	Sens. mv/in 5	Sweep Speed 6	Special Notes
TEKTRONIX	536–53/54A c	b	dc	10	.035	* 50mv –20V /div	* 0.2µs –2sec /div	5. Vernier to 50V/div. 6. With extra plug-in.
ELECTRONIC TUBE	H–25 a	Vert Horz	dc dc	10 500kc	.05 ina	* 300 4V	* 0.2µs –20ms /in	5. DC; .05V/in. AC. 6. Dual independent sweep generators; 2nd sweep delayed from 1st.
TEKTRONIX	531–53/54L c	Vert Horz	dc dc	11 240kc	.031 ina	* 5mv –20V /cm	* 0.1µs –12sec /cm	5. AC 5 mv–2V, DC 50 mv–20V, vernier to 4 or 40V/cm. 6. Expansion 5X, delay available.
TEKTRONIX	536–53/54L c	b	dc	11	.031	* 5mv –20V /div	* 0.2µs –2sec /div	5. AC 5 mv–2V, DC 50 mv–20V, vernier to 4 or 40V/cm. 6. With extra plug-in.
COSSOR	1065	Vert Horz	dc 50	11 300kc	.04 ina	250 /cm	10µs–250ms *	6. Expansion variable to 5X.
TEKTRONIX	551–53/54H a c	Vert Horz	dc dc	14 240kc	.025 ina	* 5mv –20V /cm	* 0.1µs –12sec /cm	5. Vernier to 50V/cm. 6. Expansion 5X.
LAVOIE	LA–260–S60 c	Vert Horz	dc 10	15 750kc	.02 ina	* 10 1V /cm	* 0.1µs –5sec /cm	5. Vert to 25V/cm. 6. Vernier to 15 sec/cm; exp. 10X. Dual trace plug-in available.
LAVOIE	LA–259D	Vert Horz	dc 10	15 750kc	.02 ina	* 10 2V /cm	* .07µs 100ms /cm	5. Vert to 25V/cm. 6. Expansion 10X; 0.2µs delay.
ELECTRONIC TUBE	K–215 a	Vert Horz	dc dc	15 2	.025 ina	* 50 1V /cm	* 0.1µs –1sec /cm	5. To 20V/cm vert. 6. Dual independent sweep generators.
TEKTRONIX	515A RM15	Vert Horz	dc dc	15 500kc	.023 ina	* 50 1.4V /cm	* 0.2µs –2sec /cm	5. Vernier to 50V/cm. 6. Vernier to 6 sec/cm; expansion 5X.
TEKTRONIX	551–53/54B a c	Vert Horz	dc dc	* 18 240kc	.02 ina	* 5mv –20V /cm	* 0.1µs –12sec /cm	3. AC 2cps–10mc, .035µs rise. 5. AC 5–50 mv, AC/DC 50 mv–20V /cm, vernier to 50V/cm. 6 Exp. 5X.
TEKTRONIX	551–53/54A a c	Vert Horz	dc dc	18 240kc	.02 ina	* 50mv –20V /cm	* 0.1µs –12sec /cm	5. Vernier to 50V/cm. 6. Expansion 5X.
DU MONT	336–A	Vert	dc	18	.02	2V– 500V fs	* 0.1µs –1sec /div	6. Delay 0.2µs; exp. by 50% notch, cal X10, uncal to X100.
TEKTRONIX	541–53/54B c	Vert Horz	dc dc	* 20 240kc	.018 ina	* 5mv –20V /cm	* 0.1µs –12sec /cm	3. AC 5 cps–12 mc, .03µs rise. 5. AC 5–50 mv, AC/DC 50 mv–20V /cm, vernier to 50V/cm. 6. Exp. 5X.
ROHDE & SCHWARZ	OMF BN 1912	Vert	dc	20	ina	250 mm/v	0.1µs –110ms /cm	
TEKTRONIX	541–53/54A c	Vert Horz	dc dc	20 240kc	.018 ina	* 50mv –20V /cm	* 0.1µs –12sec /cm	5. Vernier to 50V/cm. 6. Expansion 5X.
TEKTRONIX	551–53/54C a c	Vert Horz 4 chan	dc dc	22 240kc	.016 ina	* 50mv –20V /cm	* 0.1µs –12sec /cm	5. Vernier to 50V/cm. 6. Expansion 5X.
TEKTRONIX	551–53/54L a c	Vert Horz	dc dc	* 25 240kc	.014 ina	* 50mv –20V /cm	* 0.1µs –12sec /cm	3. AC 3cps–15 mc, .023 rise. 5. AC 5 mv–2V, DC 50 mv–20V, vernier to 4 or 40V/cm. 6. Exp. 5X.
TEKTRONIX	541–53/54L c	Vert Horz	dc dc	* 30 240kc	.012 ina	* 5mv –20V /cm	* 0.1µs –12sec /cm	3. AC 3cps–24 mc, .015 rise. 5. AC 5 mv–2V, DC 50 mv–20V, vernier to 4 or 40V/cm. 6. Exp. 5X.
TEKTRONIX	541–53/54K c	Vert Horz	dc dc	30 240kc	.012 ina	* 50mv –20V /cm	* 0.1µs –12sec /cm	5. Vernier to 40V/cm. 6. Expansion 5X.
DU MONT	410	Vert	dc	50	7mµs	200mv –200V fs	.01µs –20ms /cm	
TEKTRONIX	517A	Vert	dc	ina	7mµs	50 /cm	.01µs –20µs /cm	
EDGERTON, GERMESHAUSEN & GRIER	2236	Vert	200kc	1kmc	0.1 mµs	30V	25mµs –5µs	CRT: TW Tube, 0.4 in. vert by 0.6 in. horz. scan.

Taken from Scalers, Directory of Technical Specifications, Electronic Test Instruments.®

List of Pulse Oscilloscope Manufacturers

Advanced Electronics Mfg. Corp.,
2025 Pontius Ave.,
Los Angeles 25, Calif.

Cossor (Canada) Limited
301-303 Windsor St.,
Halifax, Nova Scotia

Allen B. DuMont Labs., Inc.,
760 Bloomfield Ave.,
Clifton, N. J.

Edgerton, Germeshausen & Grier, Inc.,
160 Brookline Ave.,
Boston 15, Mass.

Electronic Tube Corp.,
1200 East Mermaid Lane,
Philadelphia 18, Pa.

Hewlett-Packard Co.,
275 Page Mill Road,
Palo Alto, Calif.

Laboratory for Electronics, Inc.,
75 Pitts St.,
Boston 14, Mass.

Lavoie Laboratories, Inc.,
Matawan-Freehold Road,
Morganville, N. J.

Radiometer,
Welwyn International, Inc.,
3355 Edgecliff Terrace,
Cleveland 11, Ohio

Rohde & Schwarz,
Federal Instruments,
250 Garibaldi Ave.,
Lodi, N. J.

The Scopes Company, Inc.,
P. O. Box 56,
Monsey, N. Y.

Solartron, Inc.,
530-532 Cooper St.,
Camden 2, N. J.

Tektronix, Inc.,
P. O. Box 831,
Portland 7, Ore.

Footnotes

a. Dual channel scope.
b. Identical vertical and horizontal amplifiers.
c. Scope with plug-in amplifiers; model numbers are scope *dash* plug-in unit.

Abbreviations:
* —refers to Special Note following column number.
x —refers to lettered Footnote.
ina —information not available.
CRT —cathode ray tube.
exp —expansion.
cal —calibrated.
fs —full scale.
chan —channel

Concentrated Filter Passbands

Frederick A. Schaner
The Daven Company
Livingston, N. J.

Part 2 Crystal Filters

Crystal filters have been used commercially for about 25 years. Here, in the second part of Mr. Schaner's article, he describes their important properties.

In the first part, he discussed Mechanical Filters. In the concluding part, he will discuss the important qualities and applications of the Electrical or LC Filter.

THE NARROW passband characteristics of crystal filters make them ideal for telephone work and for data converter circuits in data link receivers. The reasonably wide passband characteristics which can be achieved with careful design also make them useful for single side band and am/fm communication receivers. One can sometimes simplify communication receiver circuitry from double to single conversion by using a crystal filter ahead of the i-f amplifier if image and spurious rejection requirements are not too rigorous.

Crystal filters have been used commercially for about 25 years. They are manufactured with center frequencies ranging from 1.0 kc to 30 mc, and with passbands from 0.01 to 10 per cent of the center frequency. They are said to have excellent phase linearity across the passband.

Crystal filters are essentially electro-mechanical devices. Consequently, in airborne and mobile applications, care must be taken in design and fabrication so externally induced mechanical vibrations will not affect the electrically transduced vibrations and thereby degrade the com-

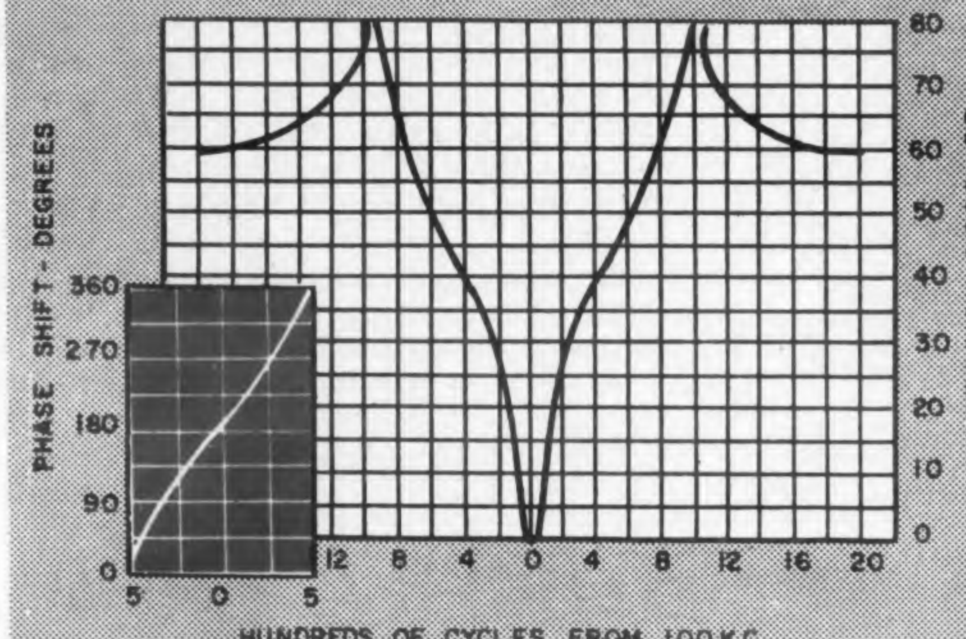


Fig. 1. Characteristics of the "needle nose" narrow band crystal filter.

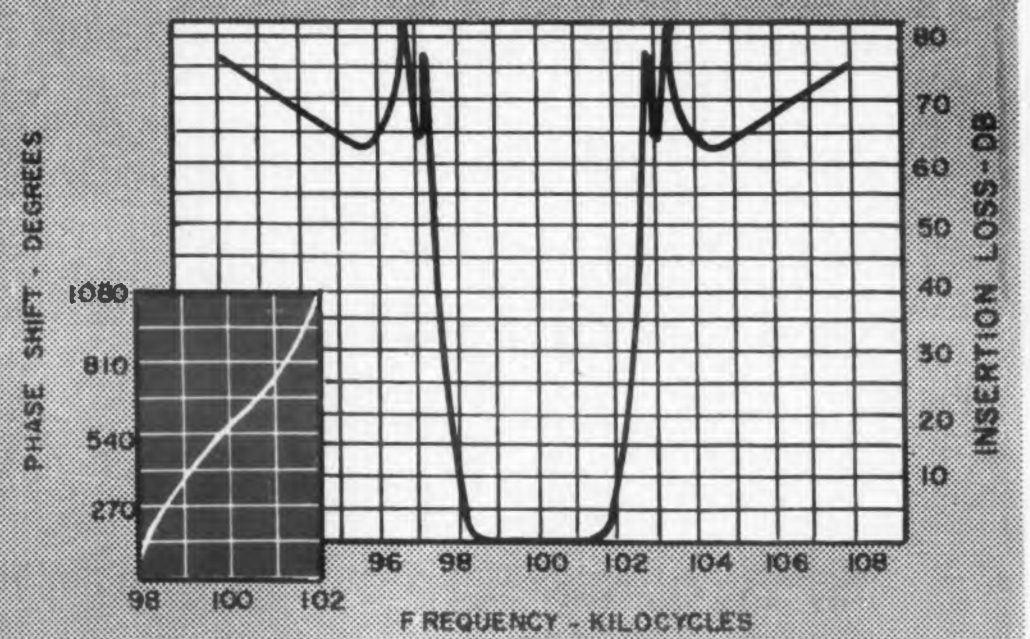


Fig. 2. Medium bandpass crystal filter characteristics.

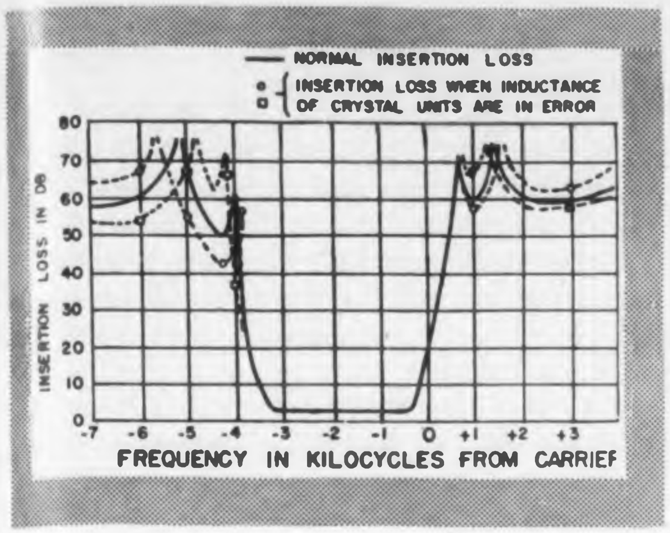


Fig. 3. Insertion loss of a crystal bandpass filter. The dotted curves show the effects of a one per cent change of the inductance of one of the crystal units in either lattice branch.

paratively low frequency intelligence in the received signal.

Crystal Properties

A crystal filter usually consists of a lattice network of carefully selected piezoelectric crystals. These crystals have a mechanical resonant frequency which depends on certain physical dimensions. Because of their very high equivalent Q (10,000 to 30,000 unloaded), one can make very narrow band filters and filters in which the attenuation rises very rapidly at cutoff. Curves for two bandpass filters are shown in Figs. 1 and 2.

While filter crystal units are like oscillator crystal units, in that they must have low internal dissipation and a close control of resonant frequency, they are different in that many additional characteristics of the filter crystal units must also be accurately controlled.

Characteristics Affect Performance

Impedance. Two typical illustrations show how characteristics other than resonant frequency and Q may react on filter performance. One of the major characteristics is the slope of the reactance vs frequency curve near series resonance. This slope is sometimes referred to as the impedance level of the crystal unit.

A convenient measure is the inductance of the equivalent electrical circuit. When this inductance departs from its nominal value, filter performance may undergo appreciable change. This is particularly true of filters in which the circuit has a lattice with crystal units in all bridge arms.

For example, in Fig. 3, the solid curve shows the transmission characteristic obtained with a lattice type filter in which both the series and diagonal branches have two balanced crystal units. A close impedance balance between the lattice branches provides high attenuation.

When the inductance of any of the units departs from its nominal value, the bridge balance is disturbed and the filter's transmission characteristic is changed. The two dotted curves of Fig. 3 show the characteristics that result when the inductance of the crystal units in either branch depart from their nominal values by about one per cent.

A negative departure in one branch has about the same effect on performance as a positive departure in the other branch. The two dotted curves differ in that one assumes a positive departure and the other a negative departure for the inductance of one branch.

Resonant Frequency. A typical lattice filter has two double plated crystals. One crystal is used in the two series branches, while the other is used in the two diagonal branches. Due to the close balance required, the effect of small departures from resonant frequency produce large variations in the transmission characteristic. For example, departures of about 10 cps in the crystal units of either branch can vary the discrimination as do departures of inductance, to about the same extent.

On the other hand, if the units of both branches exhibit equal departures, the entire transmission characteristic is shifted by the frequency departure of the crystals and there is no loss in discrimination.

Resistance. Another way deviations in crystal properties can react on filter performance is shown in Fig. 4. Here, the schematic is the equivalent electrical circuit of a narrow band filter using two balanced quartz crystal units. This filter provides a passband of about 10 cps with distortion less than 0.2 db. The insertion loss characteristic show that the desired transmission can be obtained for various magnitudes of effec-

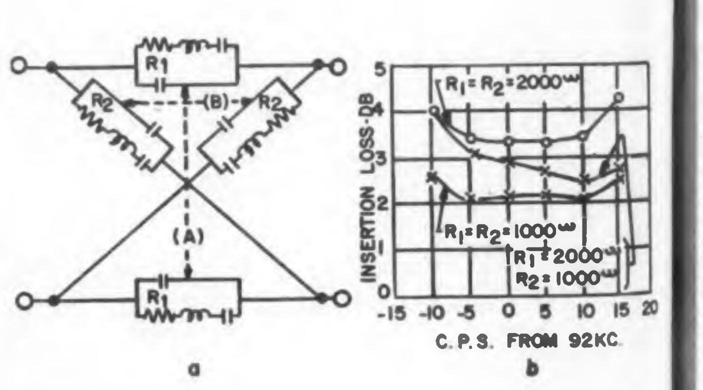


Fig. 4. Parameters of a narrow band crystal filter with two balanced quartz units.

a. The equivalent circuit.

b. The effects of variation in effective resistance.

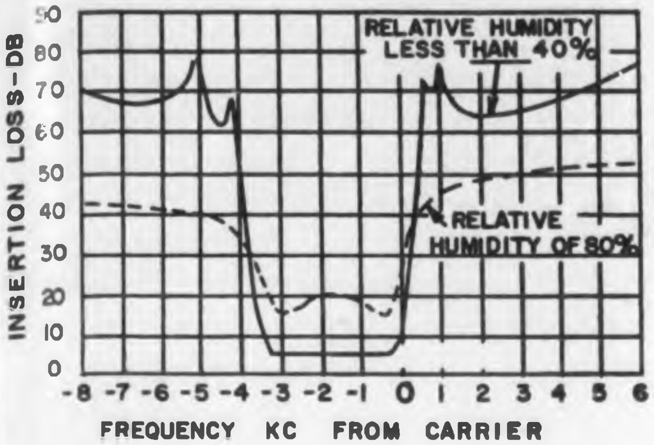


Fig. 5. A high relative humidity can ruin the discrimination of a crystal filter.

tive resistance as long as resistances in the series and diagonal branches are equal.

However, if the effective resistance in one branch is twice as large as that in the other branch, a highly distorted characteristic results, as shown by the middle curve of Fig. 4 b.

Temperature Coefficient. Just as unequal branch departures from nominal values of effective resistance, resonant frequency and impedance can degrade filter performance, so can unequal temperature coefficients of resonant frequency.

Other devations in a single unit can affect filter performance. Such deviations include the presence of unwanted resonances, even weak ones, inadequate insulation resistance between the metalized coatings, or unbalance between the halves of plates on which the plating has been divided.

Manufacture of Crystals

High humidity and lack of cleanliness during manufacture can wreck the performance of crystal filters. The crystals must have extremely high impedances at their anti-resonant frequencies. These impedances can be as high as 100 megohms with crystal plates in a relatively dry atmosphere. Such values can be maintained up to fairly high frequencies.

For example, Fig. 5 shows the result of high relative humidity on the transmission characteristic of a typical crystal filter. The discrimination almost disappears for a relative humidity of 80 per cent. If the crystal plates are contaminated by solder flux, dirt, or some other foreign substance, bad discrimination may result from much lower humidity values.

It is impractical to manufacture crystal filters in an atmosphere with a relative humidity greater than 40 per cent. In all cases, the filters must be hermetically sealed. The housing must be evacuated, or filled with an inert gas, preferably under pressure.

No Moving Parts in

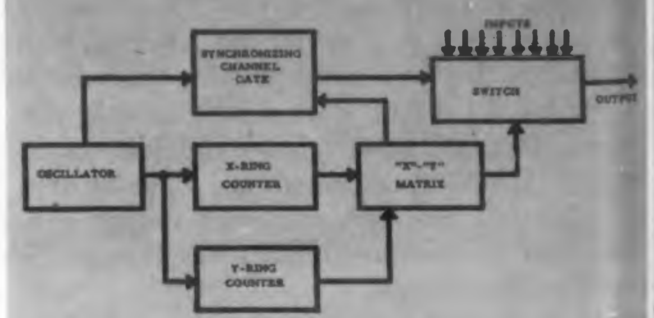
High Electronic

AN ELECTRONIC solid state commutator with no moving parts is available from the Applied Science Corp. of Princeton, N.J. It can handle up to 1000 samples per sec with an input-to-output accuracy of 1 per cent or better for any mixed source impedance up to 25 kohms. This accuracy figure includes linearity and offset factors.

The multichannel sampling switch develops a back current of less than 1 μamp during the time a channel is "off." This negligible back current eliminates the problem of transducer "loading."

Both the accuracy and non-loading features have been engineered as inherent parts of the ring counter actuated diode gating circuitry which forms the heart of the commutator.

The electronic commutator is designed for long-life applications in data handling systems using time-division multiplexing. The device will handle 0 to 5 v input signals in all IRIG



Functional block diagram of electronic commutator.

Accuracy Commutator

standard pulse amplitude (pam) and pulse duration (pdm) sampling rates. Standard channel configurations are 30 and 45, including synchronization pulses.

ASCOP's commutator retains all the conventional advantages of solid state switching. Power consumption is less than 3 w. Design life expectancy is 5000 hours, without maintenance. Operating temperature range is −60 to +80 C with special packaging available for extreme intermittent temperatures. The commutator's size is approximately 45 cu in., and the weight is approximately 2 lb, making it feasible for airborne applications. In addition, the unit offers better vibration resistance than mechanical switches. It is expected that this ASCOP design will replace some mechanical commutators now in operation.

For more information, turn to the Reader-Service card and circle **101**.

Electronic commutator has no moving parts and can handle 1000 samples per sec.

NEW PRODUCTS

Covering all new products that might generally be specified by an electronics engineer engaged in the design of original equipment.

TANTALUM CAPACITORS

Withstand temperatures to 150 C and vibrations of 2000 cps, per MIL-C-3965B. Series M2 tantalum capacitors is hermetically sealed and measures 1/2 in. long. At 85 C, ratings are available from 11 μf 90 v to 140 μf 6 v. At 150 C, ratings are 11 μf 75 v to 140 μf 4 v.

P. R. Mallory & Co., Inc., Dept. ED, 28 S. Gray St., Indianapolis, Ind.

CIRCLE 30 ON READER-SERVICE CARD

MASER AMPLIFIER

Extremely low noise figures can be achieved by using the Versitron solid-state maser amplifier. Operating in either the S-band or X-band, the Versitron has a noise temperature equivalent of approximately 25 Kelvin. Gain bandwidth products are 3 mc in the S-band and 10 mc in the X-band. The unit employs a regenerative type cavity amplifier and a nondestructible ruby crystal. Circulator input and output, liquid helium operating temperature and a stabilized magnetic field are other characteristics.

Advance Industries, Inc., Dept. ED, 640 Memorial Dr., Cambridge 39, Mass.

CIRCLE 31 ON READER-SERVICE CARD

DC AMPLIFIER

A high current dc amplifier for driving recording galvanometers, model 1411 features output of ±100 ma up to 30 kc, electrical offset control, output metering, damping resistance selector, dummy loads with substitution by relay, and continuously variable voltage gains from 1 to 3000. Other specifications include 100 K input impedance, ±2 μv drift limits, and less than 0.1 per cent non-linearity for the usual galvanometer frequency ranges.

Dynamics Instrumentation Co., Div. of Alberhill Corp., Dept. ED, 1118 Mission St., S. Pasadena, Calif.

CIRCLE 32 ON READER-SERVICE CARD

HYSTERESIS MOTOR

The stator of this hysteresis motor is made of a continuous steel silicon strip, punched and coiled. Designed for the instrumentation and tape recorder field, model 6-10.20 runs at 360 and 720 rpm giving direct drive for 3-3/4 and 7-1/2 ips. Starting and running torques are 4 and 5 in.-oz for 360 rpm and 5 and 6 in.-oz for 720 rpm. A three speed motor is also available with speeds of 450-900-1800 rpm.

Charles B. Stegman Assoc., Dept. ED, 5757 Tobias Ave., Van Nuys, Calif.

CIRCLE 33 ON READER-SERVICE CARD

NEW PRODUCTS

Manual Spectrometer

0.15 per cent linearity

A manual scintillation spectrometer for analysis of energy spectra of gamma emitting isotopes, model N-1260M has stability of 0.25 per cent per day. Linearity is 0.15 per cent, and background count is 25 cpm.

Hamner Electronics Co., Inc., Dept. ED, P.O. Box 531, Princeton, N.J.

CIRCLE 36 ON READER-SERVICE CARD

Recording System

Rectilinear readout and thermal writing

The 8-channel model RD 1684 00 ultralinear recording system has rectilinear readout and thermal writing. Frequency response is dc to 100 cps. The system features a choice of two individual plug-in amplifiers: one with sensitivity of 10 mv per chart line and stability of 1/2 chart line per hour, the other with sensitivity of 50 mv per line, and stability of 1/10 line per hour. Eight standard chart speeds from 0.4 to 100 mm per sec.

Brush Instruments, Dept. ED, 3405 Perkins Ave., Cleveland 14, Ohio.

CIRCLE 37 ON READER-SERVICE CARD

Programming System

Has removable pre-patched boards

Removable, pre-patched boards allow fast reprogramming in the A-MP 240 patchcord programming system. Designed for shock and vibration resistance, the system has 240 contact holes. A patented wiping action assures pre-cleaning of contact springs and taper pins.

Amp Inc., Dept. ED, 2100 Paxton St., Harrisburg, Pa.

CIRCLE 38 ON READER-SERVICE CARD

DC Insulation Tester

5 ma output at 100 kv

The VON 100 kv dc insulation tester checks and evaluates insulation of large motors, generators, transformers, cables and high voltage assemblies. Output is 5 ma at 100 kv.

The Hewson Co., Inc., Dept. ED, 443 Broad St., Newark 2, N.J.

CIRCLE 39 ON READER-SERVICE CARD

Frequency Standard

Crystal controlled

Transistorized, crystal controlled model 381 frequency standard has a frequency stability of ± 0.0002 per cent from -55 to $+90$ C ambient. It withstands shock of 100 g, acceleration of 20 g, and vibration of 10 g to 2000 cps. Total volume of standard at 50 cps pulse output is less than 13 cu in.

Gibbs Mfg. and Research Corp., Dept. ED, 450 N. Main St., Janesville, Wis.

CIRCLE 40 ON READER-SERVICE CARD

CIRCLE 41 ON READER-SERVICE CARD ➤

NEW PRODUCTS

Transistors

Germanium p-n-p alloy type

Germanium p-n-p alloy type transistors for various uses. Drift transistors 2N373 and 2N374 are for i-f amplifier and converter service respectively. Junction transistor 2N591 is for large-signal of driver service. Audio power transistors 2N301 and 2N301-A provide outputs to 5 w.

Radio Corporation of America, Semiconductor Div., Dept. ED, Somerville, N.J.

CIRCLE 470 ON READER-SERVICE CARD

Strobed Readout Amplifier

Transistorized

Designed as a readout amplifier for type S-3 ferrite magnetic matrix memory cores, the AI-600 is a two-transistor regenerative pulse amplifier. Signals above 18 mv cause the amplifier to generate a 10 v positive-going output pulse which has about 0.3 μsec rise, 1.5 μsec length, and 0.4 μsec fall across 2.2 K output load impedance. Recovery is within 6 μsec. A strobe input terminal is provided to permit control of the amplifier on time.

Airtronics, Inc., Dept. ED, 5522 Dorsey Lane, Washington 16, D.C.

CIRCLE 44 ON READER-SERVICE CARD

Polystyrene Capacitors

No derating from —60 to 85 C

HD&K Syncap polystyrene capacitors include these types: glass encapsulated, upright rectangular in metal cans, bath tub fixed or adjustable, metal tubular, bakelite encased, and uncased. Maximum dielectric absorption is 0.05 per cent; stability and retrace, 0.05 per cent. The units operate from —60 to +85 C with no derating. Capacitances range from 0.01 to 10 μf.

Wesco Electrical and Mfg. Co., Dept. ED, 27 Olive St., Greenfield, Mass.

CIRCLE 45 ON READER-SERVICE CARD

DC Coupling Preamplifier

Single-ended or push-pull input

In model 450-1300 dc coupling preamplifier input is single-ended or push-pull, impedance 5 meg each input side to ground; 50 mv input produces 1 v at output jack. Frequency response is 0 to 10 kc; linearity, 0.25 per cent.

Sanborn Co., Dept. ED, 175 Wyman St., Waltham 54, Mass.

CIRCLE 46 ON READER-SERVICE CARD

Isolation System

For shock and vibration problems

While steady loads to 50 g are applied, this isolation system isolates 50 g shocks and stands 20 g vibration from 5 to 2000 cps. It permits insensitive responses to temperatures from −85 to +500 F.

Litton Industries, Maryland Div., Dept. ED, 4900 Calvert Rd., College Park, Md.

CIRCLE 47 ON READER-SERVICE CARD

Multicoupler

Covers 2 to 32 mc

TRAK multicoupler model 21 couples one antenna to ten receivers and operates between 2 and 32 mc. It features 60 db isolation between outputs, 60 db attenuation of intermodulation components, and a 6 db noise figure.

CGS Labs, Inc., Dept. ED, Ridgefield, Conn.

CIRCLE 48 ON READER-SERVICE CARD

DC Amplifier

Delivers up to 6 w

Rack-mounted and transistorized, Model B-1 dc amplifier delivers up to 6 w, at an output impedance of less than 0.1 ohm, over the frequency range from dc to 20 kc.

Southwestern Industrial Electronics Co., Dept. ED, 2831 S. Post Oak Rd., Houston 19, Tex.

CIRCLE 51 ON READER-SERVICE CARD

Electronic Counter

Measures frequencies from 10 cps to 1.1 mc

The model 13-20 counter measures frequencies from 10 cps to 1.1 mc, periods from 0 to 10 kc, time intervals from 3 μsec to 100,000 sec, and 1 to 999,999 total events. The instrument also measures time and frequency ratios, frequency drift, and similar quantities, and will count and totalize discreet electrical impulses. Power input is 115 v ±10 per cent, 60 cps, 280 w.

Northeastern Engineering, Inc., Dept. ED, 25 S. Bedford St., Manchester, N.H.

CIRCLE 52 ON READER-SERVICE CARD

Bridge Balance

For strain gauges

This miniature strain gage balance box interconnects a power supply and 18 strain gage bridges to a multi-channel recorder. Means for balancing the bridges are included.

Datran Electronics, Dept. ED, 1836 Rosecrans Ave., Manhattan Beach, Calif.

CIRCLE 53 ON READER-SERVICE CARD

Tape Recorder

For telemetering

Start and stop time is under 30 msec in model 707 tape recorder for ground station telemetering instrumentation. The unit has a frequency response to 130 kc and an output of 4 v rms into 180 ohms. Plug in modules provide direct analog, pdm, and fm recording. Models for 1/2-in. tape have 7 tracks; 1-in. models have 14 tracks.

Midwestern Instruments, Dept. ED, P.O. Box 7186, Tulsa, Okla.

CIRCLE 54 ON READER-SERVICE CARD

Transducers

Pressure to frequency

Series P300 pressure to frequency transducers have infinite resolution and provide 1 per cent repeatability. Units can be supplied on any RDB standard subcarrier telemetering frequency between 1.7 and 70 kc.

Datran Electronics, Dept. ED, 1836 Rosecrans Ave., Manhattan Beach, Calif.

CIRCLE 55 ON READER-SERVICE CARD

Nuclear Battery

Safer to use

The model K nuclear battery delivers higher currents than Strontium-90 models, but is much safer to use. It uses krypton-85, a low cost radioisotope that diffuses quickly upon contact with air. A miniature unit has a current rating of 10 to 1000 μμa, an open circuit potential of several thousand volts, and a linear charging rate to several hundred volts.

Universal Winding Co., Inc., Patterson, Moos Div., Dept. ED, 90-28 Van Wyck Expressway, Jamaica 18, N.Y.

CIRCLE 56 ON READER-SERVICE CARD

One pot's answer to tough requirements

5,000,000
cycle life

2,000
cycle vibration
at 30 g's

just two characteristics resulting from patented

"dynamic balance"

Precision potentiometers capable of living up to toughest circuitry demands! Built-in immunity to extremes of vibration, shock and acceleration . . . and finest quality materials assure maximum precision, exceptionally long life. A new concept proved in both military and commercial applications. Available from ⅞" to 3".

Precision single turn potentiometers featuring:

- Linear or functional windings — 0.1% standard linearity
- Rotational speeds to 3,500 R.P.M.
- 165°C standard . . . 225°C special
- Ball bearings, class 7 stainless
- No hygroscopic . . . no fungus supporting materials
- NAS 710, procedure III

THIS IS KINTRONIC'S DYNAMIC BALANCE

arm is dynamically balanced on shaft

contact assembly is dynamically balanced on arm

Write for complete specifications of the "1,000 Series" Apply the inimitable performance of Dynamic Balance precision potentiometers to your project.

kintronic Division of Chicago Aerial Industries, Inc

10265 Franklin Avenue • Franklin Park, Illinois

CIRCLE 119 ON READER-SERVICE CARD

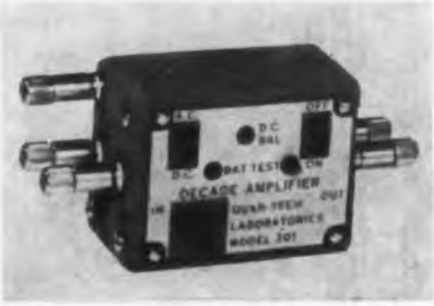
Voltage Regulated Power Supply
Range of 0 to 18 v, 0 to 0.5 amp.

The transistorized Model SC-18-0.5 delivers 0 to 18 v, 0 to 0.5 amp. Regulation for line or load is less than 0.1 per cent or 0.003 v, whichever is greater. Ripple is less than 1 mv rms. Recovery time is less than 50 μsec. Stability for 8 hr is less than 0.1 per cent of 0.003 v, whichever is greater.

Kepco Labs, Inc., Dept. ED, 131-38 Sanford Ave., Flushing 55, N.Y.

CIRCLE 120 ON READER-SERVICE CARD

Decade Amplifier
Permits ac and dc coupling



The frequency response of the Model 201 decade amplifier is flat within ±2 per cent dc to 100 kc, and 1 db to 500 kc. Its input impedance dc-coupled is 400 K shunted by 30 μμf; output impedance is nominally less than 100 ohms. It is a gain of 10, and its equivalent noise level is less than 20 μv.

Quan-Tech Labs., Dept. ED, Morristown, N.J.

CIRCLE 121 ON READER-SERVICE CARD

Line Voltage Regulators
Recovery time of 35 msec

The eight standard models range from 0.5 kva to 2 kva and are available in two grades of

MIL-T-27A. The output is kept within ±1 per cent of 115 v, 60 cps, with an input range of 100 to 130 v, 60 cps, and load variations of 0 to 100 per cent. The recovery time to the ±1 per cent region after a 10 per cent line step or a 25 per cent load step is less than 35 msec.

NJE Corp., Dept. ED, 345 Carnegie Ave., Kenilworth, N.J.

CIRCLE 123 ON READER-SERVICE CARD

Ferrite Load Isolator

Gives 15 db isolation

Used to provide isolation between a microwave source and its load, model XL157 ferrite isolator removes the reactive loading effect caused by long transmission lines or the frequency pulling of magnetron or klystron. Operable over the band 8.5 to 9.6 kmc, it gives 15 db isolation with an insertion loss of 0.5 db.

Cascade Research, Div. of Monogram Precision Industries, Inc., Dept. ED, Los Gatos, Calif.

CIRCLE 124 ON READER-SERVICE CARD

Metal Bellows

Wall thinness down to 0.0008 in.

These flexible metal bellows range from 1 to 0.125 in. O.D. and come in any wall thinness down to 0.0008 in. The metal is a nickel alloy of high tensile strength and low hysteresis with resistance to corrosion and temperature.

Servometer Corp., Dept. ED, P.O. Box 42, Clifton, N.J.

CIRCLE 125 ON READER-SERVICE CARD

NEW PRODUCTS

Cable Tester

Self-programming

The SPACE self-programming automatic cable evaluator checks for leakage and continuity between wire ends of a cable harness. Using a computer type memory, it performs up to 10 tests per second and can generate its own tape program.

James Cunningham, Son & Co., Inc., Dept. ED, P.O. Box 516, Zone 2, Rochester 8, N.Y.

CIRCLE 87 ON READER-SERVICE CARD

Rotator

Actuates large stabilized platforms

Torquer model ARTQ-1 actuates large stabilized platforms mounting heavy aerial cameras, infrared devices, and radar antennas. It is capable of high altitude continuous performance in ambient temperature of 130 C. The rotator develops torques up to 15 in. lb at a torquer weight of 6 lb.

The Aeroflex Corp., Aeroflex Labs Div., Dept. ED, 34-06 Skillman Ave., Long Island City 1, N.Y.

CIRCLE 88 ON READER-SERVICE CARD

Potentiometer

Low torque

Model HP-151 is a miniature, low torque 15-turn unit with standard resistance values from 50 ohms to 150 K. Linearity can be held to 0.05 per cent. The unit dissipates 4 w at 40 C and stands shock, vibration, acceleration, and temperatures from −65 to +85 C.

Hub-Pot Inc., Dept. ED, 1242 E. Transit St., Pomona, Calif.

CIRCLE 89 ON READER-SERVICE CARD

Amplifier Klystron

Delivers 10 kw

The VA-833A Klystron delivers in excess of 10 kw over a 1.4/1 range of frequencies from 685 to 985 mc. The conversion efficiency ranges up to 50 per cent and power gain ranges from 40 to 60 db.

Varian Associates, Tube Div., Dept. ED, 611 Hansen Way, Palo Alto, Calif.

CIRCLE 91 ON READER-SERVICE CARD

Servomotor

Full speed in 0.004 sec

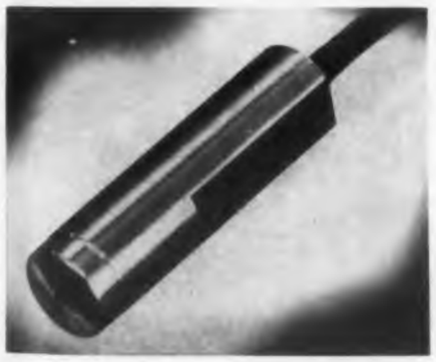
Model M-100 servomotor reaches full speed of 1450 rpm in 0.004 sec. Can be wound for Class H for transistor operation.

Dynamic Instrument Corp., Dept. ED, 59 New York Ave., Westbury, New York.

CIRCLE 93 ON READER-SERVICE CARD

Magnetic Memory Drums

200 bits per in.



The OL-12-E features balanced low impedance windings, low record current, and high playback voltage for use with transistorized circuits. Bit densities of up to 200 bits per in., at 1 mil spacing, read and record information at high frequencies.

Midwestern Instruments, Data Storage Devices Div., Dept. ED, P.O Box 7186, Tulsa, Okla.

CIRCLE 92 ON READER-SERVICE CARD

NEW PRODUCTS

Transistorized Preamplifiers

Provide 20 db gain

Light, rugged, waterproof, and easily connected, N-110 and N-120 transistorized preamplifiers provide 20 db gain. Input impedance is 1 meg; output impedance, 600 ohms; equivalent input noise, 10 μv. Frequency response is 100 cps to 80 kc.

Chesapeake Instrument Corp., Dept. ED, Shadyside, Md.

CIRCLE 74 ON READER-SERVICE CARD

Silicon Diode Package

Forward currents to 400 ma

This single silicon diode package offers protection against extremes and is qualified per MIL-T-5422C. It has forward current ratings up to 400 ma, and inverse voltage ratings up to 600 v.

Master Specialties Co., Dept. ED, 956 E. 108th St., Los Angeles 59, Calif.

CIRCLE 75 ON READER-SERVICE CARD

Explosive Bolts

For missile use

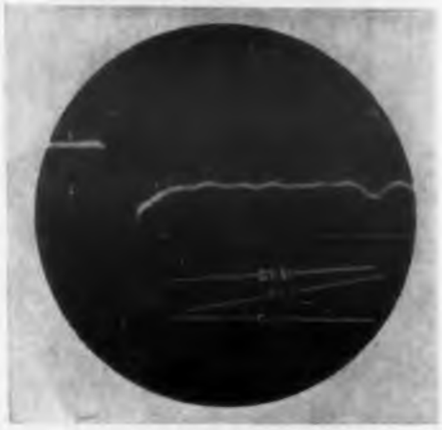
Explosive bolts and bolt cartridges, both fragmenting and non-fragmenting. They consist of special or standard bolts with provisions for integral or separately installed high explosive charge. Applications include multi-stage separation, nose cone separation, missile launcher release, rocket sled release, and jettisoning of special devices.

McCormick Selph Associates, Dept. ED, Hollister, Calif.

CIRCLE 76 ON READER-SERVICE CARD

Germanium Diodes

0.9 and 0.6 mμsec switching



Germanium diode S570G has a 0.9 mμsec switching time. It has a stored charge, after a 10 ma forward current, smaller than that of a 3 μμf capacitor at 6 v. The S555G diode is specified at 6 mμsec and offers better dc characteristics.

Transitron Electronic Corp., Dept. ED, Wakefield, Mass.

CIRCLE 77 ON READER-SERVICE CARD

Transistorized Power Supplies

Have microsecond transient response

A line of transistorized, precision laboratory power supplies with microsecond transient response. Shown is model 0-50-2 for 115 v ac, 60 cps input. In this model output is 0 to 50 v dc, continuously variable with resolution of 2 mv; voltage regulation is better than 1 mv for input variations. Other models range from 300 ma to 20 amp. All have constant current short protection and external sensing.

Transistor Applications Co., Dept. ED, 859 E. Alosta, Glendora, Calif.

CIRCLE 78 ON READER-SERVICE CARD

NEW PRODUCTS

Selenium Rectifier

Grain oriented

The selenium in these rectifiers has parallel grains. This structure allows higher current ratings for a given cell size. The rectifier is available in cell ratings of 18 to 36 v.

Vickers Inc., Electric Products Div., Dept. ED, 1815 Locust St., St. Louis, Mo.

CIRCLE 81 ON READER-SERVICE CARD

L-C Tuners

Metallized glass

L-C tuners combine a variable inductance and a capacitor. The inductor winding, which doubles as capacitor plates, is metallized on a stable glass cylinder. A piston in the cylinder changes both inductance and capacitance.

JFD Electronics Corp., Dept. ED, 6101 16th Ave., Brooklyn 4, N.Y.

CIRCLE 82 ON READER-SERVICE CARD

Switching Transistors

High frequency

Germanium high frequency switching transistors 2N425 through 2N428 feature the TO-9 package and are designed to MIL-T-19500A requirements.

Motorola Inc., Dept. ED, 4545 W. Augusta Blvd., Chicago 51, Ill.

CIRCLE 83 ON READER-SERVICE CARD

NEW PRODUCTS

Power Supply

28 v dc output

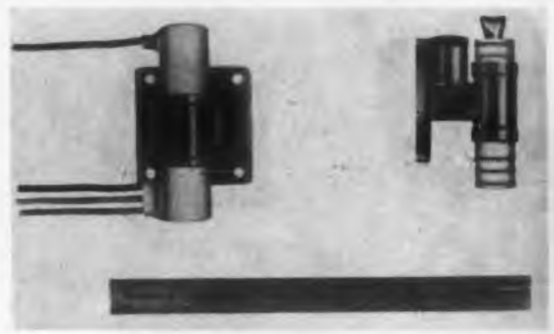
Power supply model M-1188 operates from an ac input of 120 v ±10 per cent, single phase, 60 cps and provides a regulated dc output of 28 v, adjustable 27.5 to 28.5 v. It has a current capacity of 0 to 5 amp, and voltage regulation accuracy is ±0.5 per cent for any combination of line and load changes within the foregoing range. Ripple is 1 per cent rms at room temperature, 2 per cent rms at –65 F. Ambient temperature ranges of –65 to +130 F.

Perkin Engineering Corp., Dept. ED, 345 Kansas St., El Segundo, Calif.

CIRCLE 67 ON READER-SERVICE CARD

Reflex Klystrons

For X, K, and C band



Two series of ceramic-metal reflex klystrons. The 1K20 models cover the 8500 to 11,700 mc range at output power levels to 50 mw. They withstand 15 g vibration with less than 100 kc frequency deviation. For use at any altitude, they are rated at 250 C seal temperature.

The 1K125C series cover the 3700 to 5000 mc frequency range, are capable of output powers to 2.3 w. They are tuned by an adjustable dielectric slug to minimize shock and vibration sensitivity.

Eitel-McCullough, Inc., Dept. ED, San Bruno, Calif.

CIRCLE 68 ON READER-SERVICE CARD

Indicator

Calibrates transducers

The ElectroSyn model 850 precision indicator offers a fast, accurate way to calibrate pressure instruments. Its two dials provide 1000 calibration marks about 0.1 in. apart.

Norwood Controls, Dept. ED, Norwood, Mass.

CIRCLE 69 ON READER-SERVICE CARD

Digital Voltmeter

For ac or dc operation

Model 406 digital voltmeter measures ac voltages to 0.1 per cent. It also provides dc measurements within ±1 digit. A switch selects ac or dc operation. Rack mounted and portable models available.

Zinn Instruments, Dept. ED, P.O. Box 733, Lomita, Calif.

CIRCLE 70 ON READER-SERVICE CARD

Accelerometers

Single- and two-axis types

These accelerometers come in single- and two-axis units. Measurement range is ±10 g adjustable upward within amplifier limits. Output scale factor is 5 ma per g of applied acceleration, linearity is within ±0.01 per cent of applied acceleration, and the threshold is less than 0.00001 g.

Kearfott Co., Inc., Dept. ED, 1378 Main Ave., Clifton, N.J.

CIRCLE 71 ON READER-SERVICE CARD

NEW HERMETICALLY SEALED HIPERMAG CORE

PERMITS ENCAPSULATING, IMPREGNATING, OTHER PROCESSING ...WITH NO CHANGE IN MAGNETIC VALUES

Newest development in cores for magnetic amplifier applications is the Westinghouse Polyclad hermetically sealed Hipermag core.* Polyclad insulation is applied over a new specially designed aluminum box housing the core. This hermetically seals the core and allows encapsulating, casting or impregnating—without altering magnetic properties . . . Eliminates magnetic amplifier rejects caused by changed magnetic values.

Tested for all environmental conditions, Polyclad insulation is suitable for high temperatures, protects against humidity and high-voltage stress, provides high insulation strength, with breakdown values up to 3000 volts.

Polyclad coating eliminates the need for core taping; makes possible reduced insulation cost. Rounded corners prevent shorting wire to core, allow winding directly on the core.

These cores are supplied in special sizes or in standard AIEE sizes, in one-, two-, or four-mil oriented nickel-iron alloy Hipernik® V and in one- or two-mil 4-79 Permalloy. Complete listing in Westinghouse publication 44-720.

Hermetically sealed Hipermag cores are available in production lots with normal delivery. All Hipermag cores are tested — by Roberts constant-current, flux reset technique, or to your specifications.

For more information about Polyclad hermetically sealed Hipermag cores and other Hipersil® or Hipermag cores, call your Westinghouse representative . . . or write Westinghouse Electric Corporation, P.O. Box 231, Greenville, Pennsylvania.

*Patent applied for

J-70892

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

CIRCLE 72 ON READER-SERVICE CARD

NEW PRODUCTS

Trimming Potentiometer

Rectilinear

Rectilinear trimming potentiometers, series RP-125, are 1-1/4 in. long. They meet MIL-R-19 specifications and come in a complete range of resistances. They have completely enclosed glass reinforced Alkyd housings.

DeJur-Amsco Corp., Dept. ED, 45-01 Northern Blvd., Long Island City 1, N.Y.

CIRCLE 96 ON READER-SERVICE CARD

Tuning Fork Resonators

In frequencies from 400 to 2200 cps

For operation with transistors or tubes, MJ series tuning fork resonators take 15 g 11 msec shock. In frequencies from 400 to 2200 cps, and in 0.01, 0.02, or 0.05 per cent accuracy ratings in —55 to +85 C range. Accuracies unaffected under 5 g vibration to 40 cps.

Philamon Labs, Inc., Dept. ED, 90 Hopper St., Westbury, N.Y.

CIRCLE 97 ON READER-SERVICE CARD

Accelerometer

Needs no impedance matching devices

Model 2215 accelerometer needs no impedance matching deviecs. The high capacitance of piezite element, 7000 μμf, provides a sufficient time con tant to give good low frequency response when fed into standard read-out devices with input impedances from 1 to 10 meg. The unit has 5 mv per g sensitivity and flat frequency response below 2 cps to above 10 kc. It is linear dynamically, ±1 per cent, and useful from −300 to +200 F.

Endevco Corp., Dept. ED, 161 E. California St., Pasadena, Calif.

CIRCLE 103 ON READER-SERVICE CARD

Linear Amplifier

Non-overloading type

These non-overloading type linear amplifiers feature building block design with each major section packaged as a plug-in element. In three models: LA-600A, a basic amplifier with about the same performance characteristics as ORNL DD-2; LA-600B, which includes an integral/differential pulse height selector offering 1 μsec double pulse resolution; and LA-600C, a modification for use with the PA-400 multi-channel pulse height analyzer.

Eldorado Electronics, Dept. ED, 2821 10th St., Berkeley, Calif.

CIRCLE 104 ON READER-SERVICE CARD

Fluttermeter

For adjustment of recorder drives

Instrument to measure flutter or wow inherent in a recorder drive mechanism. A pre-recorded nominal 1000 cps signal is played on tape or disc through the recorder being tested. As the speed variations modulate the frequency of this signal, the fluttermeter amplifies this band of frequencies. The output of a magnetic discriminator is metered as a percentage of variation of the 1000 cps signal.

Kay Electric Co., Dept. ED, Maple Ave., Pine Brook, N.J.

CIRCLE 105 ON READER-SERVICE CARD

Switching Unit

For semiautomatic operation

This switching device is a modulation operated relay-carrier operated relay. For semiautomatic operation, it may be used in any suitable situation requiring a switching device actuated by radio or audio voltage.

Westronics, Inc., Dept. ED, 3605 McCart St., Ft. Worth, Tex.

CIRCLE 108 ON READER-SERVICE CARD

Transformers

For transistor application

For use in transistor application, these hermetically sealed transformers are tapped to allow a 6 to 53 v dc range. Model H-94 range is 6 v dc, 3 amp to 50 v dc, 1.2 amp; H-95 range, 6 v dc, 7.5 amp to 50 v dc, 3 amp; and H-96 range, 6 v dc, 18 amp to 50 v dc, 7.5 amp.

United Transformer Corp., Dept. ED, 150 Varick St., New York 13, N.Y.

CIRCLE 109 ON READER-SERVICE CARD

High-G Testing Unit

Tests live circuits

By the use of a slip ring assembly, this unit can test a component under live circuit conditions while it is being spun at high speeds. One unit produces a speed up to 15,000 rpm and creates a relative centrifugal force of 20,000 g.

International Equipment Co., Dept. ED, 1284 Soldiers Field Rd., Boston 35, Mass.

CIRCLE 110 ON READER-SERVICE CARD

Voltage Divider

±0.1 per cent linearity

Type 85-A Rinco-Pot voltage divider has resistance accuracy of ±0.05 per cent of full scale resistance, ±0.01 per cent linearity, and 0.002 per cent resolution. Frequency range is dc to 10 kc; resistance value, 10 K.

Rinco, Inc., Dept. ED, 7962 S.E. Powell Blvd., Portland 6, Ore.

CIRCLE 112 ON READER-SERVICE CARD

SNAP ACTION SWITCH.–Hermetically sealed, precision SBS-100A Limit-Switch meets MIL-S-6743 specifications. For missile and other use.

Sealectric Switch and Relay Corp., Dept. ED, 6025 N. Keystone Ave., Chicago 30, Ill.

CIRCLE 113 ON READER-SERVICE CARD

TEMPERATURE INDICATOR.–In combination with Thermal-Ribbons, Thermal-Indicator gives direct reading of temperature. Has −100 to +200 C operating range.

Minco Products, Inc., Dept. ED, 740 Washington Ave. N., Minneapolis 1, Minn.

CIRCLE 114 ON READER-SERVICE CARD

MOMENTARY ACTUATOR.–A4-86 spdt switch for push-button application on panel mounting for instruments and components for ground support equipment.

Electrosnap Corp., Switch Div., Dept. ED, 4230 Lake St., Chicago 24, Ill.

CIRCLE 115 ON READER-SERVICE CARD

POLYESTER FILM CAPACITORS. –Filmite E hermetically-sealed, metal-clad capacitors are shorter in length, have improved capacitance vs temperature stability curve.

Sprague Electric Co., Dept. ED, 347 Marshall St., North Adams, Mass.

CIRCLE 116 ON READER-SERVICE CARD

MULTIPLE VARIABLE RESISTOR. –Model 5 miniature 0.25 w unit supplied with up to four resistors on single steatite base plate. Resistance range of 1000 ohms to 5 meg.

Centralab, Div. of Globe-Union Inc., Dept. ED, 900 E. Keefe Ave., Milwaukee 1, Wis.

CIRCLE 117 ON READER-SERVICE CARD

CIRCLE 118 ON READER-SERVICE CARD ➤

NEW PRODUCTS

Potentiometers

±0.015 and ±0.01 per cent linearities

Two potentiometers. The MD 09-10, 7/8 in. in diameter, is a multiturn unit with ±0.015 per cent linearity, 0.0085 per cent resolution.

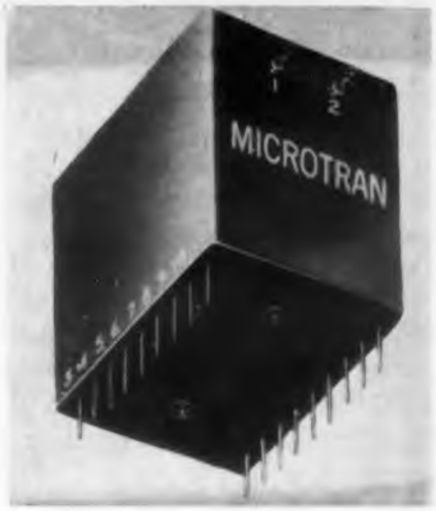
The MDH 20-10 is humidity resistant, packaged per MIL-E-5272A. The 10-turn unit has a 2-in. diameter and ±0.01 per cent linearity.

Litton Industries, Components Div., Dept. ED, 5873 Rodeo Rd., Los Angeles 16, Calif.

CIRCLE 62 ON READER-SERVICE CARD

Molded Transformer

At no mold charge



Epoxy molded with a partial tooling method, these custom-built transformers are supplied without mold charges. Alternate mounting by tabs, studs, or inserts. Units are designed to MIL-T-27A Grade 5 Class R and S; have 10,000 hr life.

Microtran Co., Inc., Dept. ED, 145 E. Mineola Ave., Valley Stream, N.Y.

CIRCLE 63 ON READER-SERVICE CARD

Thyratron

Anode current of 2.5 amp dc

An argon-mercury vapor thyratron, the NL-710L has a lug base. Ratings are: filament volts, 2.5; filament current, 9 amp; anode current, 2.5 amp dc; peak anode current, 30 amp; and peak inverse and forward volts, 1500.

National Electronics, Inc., Dept. ED, Geneva, Ill.

CIRCLE 64 ON READER-SERVICE CARD

◄ CIRCLE 65 ON READER-SERVICE CARD

Audio Oscillators

Furnish signals of 1 kc and 400 cps

PO-2 and CO-2 oscillators furnish audio signals of 1 kc and 400 cps at output levels of 0 and −60 db at an output impedance of 600 ohms. In the PO-2 output is available at two phone plugs; in the CO-2, at two clip leads.

Dunlap Electronics, Inc., Dept. ED, 764 Ninth St., Des Moines, Iowa.

CIRCLE 58 ON READER-SERVICE CARD

Drift Transistors

For rf equipment

Types 2N247, 2N370, 2N371, and 2N372 germanium pnp drift transistors have good stability and minimum feedback capacitance. Designed for use in am broadcast band and short wave receivers, the units feature high gain at 1.5 mc to 20 mc, lower base resistance, and reduced collector capacitance.

Sylvania Electric Products Inc., Dept. ED, 1740 Broadway, New York 19, N.Y.

CIRCLE 59 ON READER-SERVICE CARD

Integrating Gyros

Fully floated

Trimmed drift rates of 0.1 deg per hour are guaranteed in this series of 20 IG single axis floated integrating gyros. Of fully floated construction, the gyros are contained within a housing 2 in. in diameter.

Reeves Instrument Corp., Dept. ED, Roosevelt Field, Garden City, N.Y.

CIRCLE 60 ON READER-SERVICE CARD

NEW PRODUCTS

Power Supply

Multiple outputs

Output voltages for the model 308-B power supply as 0 to +600 v dc, −300 v dc, 0 to −150 v dc, and 6.3 v ac. For line voltage 115 v ±10 per cent, dc regulated high voltage output has less than 50 mv change no load to full load at any output voltage.

Mercury Electronic Co., Dept. ED, Box 450, Red Bank, N.J.

CIRCLE 128 ON READER-SERVICE CARD

Gearheads

For servo motors

Size 11 gearheads for BuOrd servo-motor MK 14 model 2. Planetary types with ratios up to 2500 to 1 with a torque rating of 25 oz in. and maximum backlash of 10 min. Over-all length is 0.800 in. Spur type gearheads are available with ratios up to 20,000 to 1.

U. S. Gear Corp., Dept. ED, 81 Bay State Rd., Wakefield, Mass.

CIRCLE 129 ON READER-SERVICE CARD

Lamp

60,000 hour life expectancy

Burning continuously at 5 v, this lamp can be expected to last 60,000 hours or 7 years. It measures 1/8 to 1/4 in. in length. The lamp withstands voltage surges up to 30 v.

Chicago Miniature Lamp Works, Dept. ED, 1500 N. Ogden Ave., Chicago 10, Ill.

CIRCLE 130 ON READER-SERVICE CARD

High Speed Commutator

Takes 1200 samples per sec

The Type 33-514 high-speed commutator will sample up to 100 inputs at a rate of up to 1200 samples per sec. In effect, the commutator is an automatic, high-speed sp100t switch.

Consolidated Electrodynamics Corp., Dept. ED, 300 N. Sierra Madre Villa, Pasadena, Calif.

CIRCLE 132 ON READER-SERVICE CARD

Precision Resistors

Tolerance of ± 0.05 per cent at 25 C

Packaged in two case styles, R-2 and R-5, these units range from 0.1 ohm to 750 K with a tolerance of ± 0.05 per cent at 25 C. The temperature range is -65 to $+125$ C. The power ratings of the R-2 and R-5 are 1/4 w and 1/3 w respectively.

General Transistor Corp., Dept. ED, 91-27 138th Place, Jamaica 35, N.Y.

CIRCLE 133 ON READER-SERVICE CARD

AC Voltage Regulator

Contains adjustable outputs

Model 2501, 2.5 kv ac line voltage regulator has a regulation accuracy specified at ± 0.01 per cent. Other specifications include an input voltage range of 95 to 130 v at 55 to 65 cps; output voltage adjustable from 110 to 120 v ac; 3 per cent maximum distortion; power factor from unity to 0.7 lagging; and time constant of 0.2 sec.

Sorensen & Co., Inc., Dept. ED, Richards Ave., South Norwalk, Conn.

CIRCLE 134 ON READER-SERVICE CARD

NEW PRODUCTS

Directional Coupler

Forward output of 50 ±0.3 db down

The model JP 400 mc precision coaxial directional coupler provides a forward output which is 50 ±0.3 db down from the forward power at center frequency. Reflected output is 40 ±0.3 db down from the reflected power.

Amtron Corp., Dept. ED, 17 Felton St., Waltham 54, Mass.

CIRCLE 137 ON READER-SERVICE CARD

Mercury Diffusion Pump

Measures 2 in.

The MHG-40 is an all metal, 2-in. mercury diffusion pump with high limiting forepressure. The water cooled, 3-stage unit can maintain a speed of 40 liters of air per second in the 3×10^{-4} to 2×10^{-2} mm Hg pressure range with a peak of 52 liters per second at 10 microns.

Consolidated Electrodynamics Corp., Rochester Div., Dept. ED, 1775 Mt. Read Blvd., Rochester, N.Y.

CIRCLE 138 ON READER-SERVICE CARD

TRANSFORMER.—Reference type with guaranteed accuracy of ±10 ppm at 400 cps. Encased in stainless steel.

Bush Transformer Corp., Dept. ED, 707 North St., Endicott, New York.

CIRCLE 139 ON READER-SERVICE CARD

POWER TRANSISTOR.—DT80 has an 80 v collector diode rating and offers a gain at 1.2 amp of 100. Gain spread is held to a two-to-one ratio.

General Motors Corp., Delco Radio Division, Dept. ED, 726 Santa Monica Blvd., Santa Monica, Calif.

CIRCLE 140 ON READER-SERVICE CARD

LINEAR POSITIONER.—Lineatrol is a gear motor which has a potentiometer to produce a remote indication of position or for use in automatic control circuits.

The Jordan Co., Inc., Dept. ED, 3235 W. Hampton Ave., Milwaukee 9, Wis.

CIRCLE 141 ON READER-SERVICE CARD

SERVO-HANGERS.—Designed to mount most standard servo components, for both 60 cycle and 400 cycle systems. All necessary hardware is included with the hangers.

Reeves Instrument Corp., Commercial Products Division, Dept. ED, 207 E. 91st St., New York 28, N.Y.

CIRCLE 143 ON READER-SERVICE CARD

CIRCUIT BREAKER.—Protection for circuits from 1/2 to 3 amp. It measures 0.68 by 1.14 in. and projects 1.81 in. behind the panel.

Mechancial Products, Inc., Dept. ED, Jackson, Mich.

CIRCLE 144 ON READER-SERVICE CARD

POWER SUPPLY.—Model PS38A-1 supplies up to 4 amp at 28 v dc output (variable from 24 to 32 v).

Magnetic Controls Co., Dept. ED, 6405 Cambridge Ave., Minneapolis 26, Minn.

CIRCLE 145 ON READER-SERVICE CARD

PRESSURE SWITCH.—Will close or open contact at any preset absolute pressure in the range of 0.2 psia to 15.0 psia. Repeatability is 0.1 psia.

Aero Mechanism, Inc., Dept. ED, 8938 Lindblade St., Culver City, Calif.

CIRCLE 146 ON READER-SERVICE CARD

SCALER.—Model 132, features universal high-speed counting for use in medical and industrial research. Capacity of 99,999 counts indicated on five cold cathode Dekatron glow tubes.

Baird-Atomic, Inc., Dept. ED, 33 University Rd., Cambridge 38, Mass.

CIRCLE 147 ON READER-SERVICE CARD

LOG CONVERTER.—Accessory for the RCL 256-channel analyzer, Model 21006 precision converter gives logarithmic analog display on cathode ray tube or strip chart recorder.

Radiation Counter Labs, Inc., Dept. ED, Skokie, Ill.

CIRCLE 148 ON READER-SERVICE CARD

INDICATOR LIGHTS.—Series L5100 units contain two recessed rubber O rings that afford watertight fit. They mount in a 1/2 in. panel hole.

Hetherington, Inc., Dept. ED, Folcroft, Pa.

CIRCLE 149 ON READER-SERVICE CARD

RELAY.—The E420D 4pdt, 20 amp relay meets MIL-R-5757B and MIL-R-6106B requirements.

Electro-Mechanical Specialties Co., Inc., Dept. ED, 1016 N. Highland Ave., Los Angeles 38, Calif.

CIRCLE 150 ON READER-SERVICE CARD

GRASSHOPPER FUSES.—Designed to carry their rated capacity for ten minutes.

McGraw-Edison Co., Bussmann Mfg. Div., Dept. ED, University at Jefferson, St. Louis 7, Mo.

CIRCLE 151 ON READER-SERVICE CARD

NEW PRODUCTS

INSULATION BREAKDOWN TEST SET.—Portable Model MD-1 is a commercial version of military set. Operates from a 115 v, 60 cps power source or a 24 v dc power supply.
Industrial Instruments, Inc., Dept. ED, 89 Commerce Rd., Cedar Grove, N.J.
CIRCLE 154 ON READER-SERVICE CARD

VOLTAGE REGULATORS.—Stabiline type TM automatic tubeless magnetic regulators come in 1 and 5 kva ratings for 115 v, 60 cps ±5 per cent, single phase duty.
The Superior Electric Co., Dept. ED, Bristol, Conn.
CIRCLE 155 ON READER-SERVICE CARD

POLARIZED RELAYS.—Series P spdt relays will handle over 1000 pulses per sec. Various coil resistances up to 5000 ohms each coil. Contact ratings from 60 ma to 2 amp with voltages to 120 v ac or dc.
The Hart Mfg. Co., Dept. ED, 110 Bartholomew Ave., Hartford 1, Conn.
CIRCLE 156 ON READER-SERVICE CARD

INSTRUMENT KNOBS.—Aluminum. In 12 different colors and 1/8 and 1/4 in. shaft sizes.
Vemaline Products Co., Dept. ED, P.O. Box 222, Hawthorne, N.J.
CIRCLE 157 ON READER-SERVICE CARD

MAGNETIC DC AMPLIFIERS.—Model 100C3 low level amplifier is added to Series 100C. Power gain greater than 120,000. In voltage gains of 250, 500, and 1000.
California Magnetic Control Corp., Dept. ED, 11922 Valerio St., North Hollywood, Calif.
CIRCLE 158 ON READER-SERVICE CARD

PIN HEADERS.—For use as tube bases, these solid headers can withstand 700 C.
Advanced Vacuum Products Inc., Div. of General Ceramics Corp., Dept. ED, Stamford, Conn.
CIRCLE 159 ON READER-SERVICE CARD

PHOTOELECTRIC TACHOMETER.—DY-2504A transistorized unit measures rotation speed or accumulated turns. Comes with output-pulses/per revolution of 60, 100, 120, 180, 200, or 360.
Dynac, Inc., Dept. ED, 395 Page Mill Rd., Palo Alto, Calif.
CIRCLE 160 ON READER-SERVICE CARD

PRECISION GEARS.—Stock face widths of 1/16 in. Also 1/32 and 3/32 in. face widths available.
Dynamic Gear Co., Inc., Dept. ED, 20 Merrick Rd., Amityville, N.Y.
CIRCLE 161 ON READER-SERVICE CARD

FERRITE ISOLATORS.—For 3/8 and 7/8 in. coaxial systems. The 3/8 in. isolator operates over 2000 to 4000 mc range, provides 10 db isolation.
Airtron, Inc., Dept. ED, 1096 W. Elizabeth Ave., Linden, N.J.
CIRCLE 162 ON READER-SERVICE CARD

CARD-TAPE CONVERTER.—Digital to analog Model 275 converts coded decimal and straight decimal inputs to a proportional analog dc voltage.
Electro Instruments, Inc., Dept. ED, 3794 Rosecrans St., San Diego, Calif.

CIRCLE 164 ON READER-SERVICE CARD

METERS.—For 5 per cent accuracy requirements. In ranges of dc sensitivities from 1 ma to 100 amp; in voltmeters up to 300 v.
Burton-Rogers Co., Dept. ED, 42 Carleton St., Cambridge 42, Mass.

CIRCLE 165 ON READER-SERVICE CARD

POWER SUPPLY TESTER.—For wide load conditions. Readily modified to test principal parameters of all supply types and makes having any number of dc outputs.
Western Design & Mfg. Corp., Div. of U.S. Industries, Inc., Dept. ED, Santa Barbara Airport, Goleta, Calif.

CIRCLE 166 ON READER-SERVICE CARD

VACUUM GAGE.—Type GTC-110 single-station, thermocouple unit. Powered by 1.5 v battery; covers range from 0 to 1000 microns Hg.
Consolidated Electrodynamics Corp., Dept. ED, 300 N. Sierra Madre Villa, Pasadena, Calif.

CIRCLE 167 ON READER-SERVICE CARD

CONVERTERS.—Series 1220 frequency to dc units provide selectable time constants from 1 msec to 2 sec. Full scale frequency ranges of 500, 2500, and 10,000 cps.
Systron Corp., Dept. ED, 2055 Concord Blvd., Concord, Calif.

CIRCLE 168 ON READER-SERVICE CARD

MOUNTING SCREW.—One-piece fastener eliminates retaining device and cross-threading.
Illinois Tool Works, Shakeproof Div., Dept. ED, St. Charles Rd., Elgin, Ill.

CIRCLE 169 ON READER-SERVICE CARD

CONNECTOR PLUGS.—Line of plugs to seal open ends of window connectors. Also spare wire caps.
Amp Inc., Dept. ED, 2100 Paxton St., Harrisburg, Pa.

CIRCLE 170 ON READER-SERVICE CARD

HEATING ELEMENT.—Wire mesh surface heating element is self mending in case of damage and gives a heat source every 0.028 in.
Electrofilm, Inc., Dept. ED, P.O. Box 106, North Hollywood, Calif.

CIRCLE 171 ON READER-SERVICE CARD

RECTILINEAR POTENTIOMETER.—Model 110 for measurement of linear motion. Nearly infinite resolution, typical linearity of 0.05 per cent for a 1 in. stroke.
Computer Instruments Corp., Dept. ED, 92 Madison Ave., Hempstead, N.Y.

CIRCLE 172 ON READER-SERVICE CARD

NEW PRODUCTS

CONDENSER ELECTROMETER.—Dynacon radioactivity measuring system for soft beta emitters such as tritium, carbon-14, and sulfur-35. Will accept and measure samples in solid, liquid, or gas phase.

Nuclear-Chicago Corp., Dept. ED, 229 W. Erie St., Chicago 10, Ill.

CIRCLE 174 ON READER-SERVICE CARD

CONNECTORS.—5-way binding post connectors with gold-plated machined brass parts. Have 30 amp current capacity, 1000 v working voltage.

The Superior Electric Co., Dept. ED, Bristol, Conn.

CIRCLE 175 ON READER-SERVICE CARD

CLOSED CIRCUIT TV.—Low-cost system combining TE-6-A camera, suitable lens, monitor or standard TV receiver, and required length of cable.

General Electric Co., Technical Products Dept., Electronics Park, Syracuse, N.Y.

CIRCLE 176 ON READER-SERVICE CARD

POWER SUPPLY.—The 301E features chopper stabilization and built-in standard cell reference. Output voltage is 1.02 to 512 v dc at 0 to 300 ma.

John Fluke Mfg. Co., Inc., Dept. ED, 1111 W. Nickerson St., Seattle 99, Wash.

CIRCLE 177 ON READER-SERVICE CARD

PRESSURE TRANSDUCER.—Type TR 719 operates in ranges from 15 to 3000 psi. Relatively good resistance to shock, vibration, and accelerations.

Servomechanisms, Inc., Dept. ED, 12500 Aviation Blvd., Hawthorne, Calif.

CIRCLE 178 ON READER-SERVICE CARD

CHARGING CHOKES.—Production models withstand −40 to +150 C. Encapsulated coil resists corona effects, voltage, and temperature shock.

Osborne Electronic Corp., Dept. ED, 712 S.E. Hawthorne Blvd., Portland, Ore.

CIRCLE 179 ON READER-SERVICE CARD

TRANSISTOR CLOSURES.—E-I standard line includes strain-free solderable types, compression weldable types, and compression solderable types.

Electrical Industries, Dept. ED, 691 Central Ave., Murray Hill, N.J.

CIRCLE 180 ON READER-SERVICE CARD

MULTIPLIER PHOTOTUBE POWER SUPPLY.—Has output of 800 to 2000 v dc at 0 to 25 ma; provides regulation of 0.015 per cent for both line and load, no load to full load.

Dressen-Barnes Corp., Dept. ED, 250 N. Vinedo Ave., Pasadena, Calif.

CIRCLE 181 ON READER-SERVICE CARD

TOGGLE TENSION LATCH.—Model 30L for use on airborne equipment boxes and similar closures requiring minimum latch clearance.

Camloc Fastener Corp., Dept. ED, 61 Spring Valley Rd., Paramus, N.J.

CIRCLE 182 ON READER-SERVICE CARD

TOROIDAL CORES.—Color coded Genalex III types in five standard permeability ranges: 14, 26, 60, 125, and 140. Seven standard sizes from 0.5 to 1.35 in. O.D.

Wallace E. Connolly & Co., Dept. ED, P.O. Box 295, Menlo Park, Calif.

CIRCLE 185 ON READER-SERVICE CARD

MOLDED NYLON SCREWS.—Expanded line includes machine screws with round, fillister, and flat heads. Also headless set screws with variety of points.

Gries Reproducer Corp., Dept. ED, 400 Beechwood Ave., New Rochelle, N.Y.

CIRCLE 186 ON READER-SERVICE CARD

PRESSURE SWITCHES.—Dual circuit units to actuate instruments, warning signals, and safety devices. For dc use.

John W. Hobbs Corp., Dept. ED, Yale Blvd. and Ash St., Springfield, Ill.

CIRCLE 187 ON READER-SERVICE CARD

TRANSISTORIZED DIGITAL MODULES.—Shift flip-flop model SF-101 and M-Pac plugboard model PB-101 are additions to series M transistorized dc to 100 kc digital modules.

Computer Control Co., Inc., Dept. ED, 92 Broad St., Wellesley 57, Mass.

CIRCLE 188 ON READER-SERVICE CARD

DIMPLE MAGNETS.—For loudspeaker and transceiver applications. Magnets utilize Alnico 5Cb, need no pole tips or retainers, though pole tips may be used.

Thomas & Skinner, Inc., Dept. ED, 1157 E. 23rd St., Indianapolis, Ind.

CIRCLE 189 ON READER-SERVICE CARD

TUBE BASE PLUGS.—In 7 and 9 pin miniature types with straight or bent pins, flat sides or stepped, and knurled inserts for side-screw applications.

Electronic Techniques, Inc., Dept. ED, 13761 Saticoy St., Van Nuys, Calif.

CIRCLE 190 ON READER-SERVICE CARD

INSTRUMENT DOLLIES.—Flat-top dolly for uses requiring level surface. Tilt-top for scopes.

P.B.R. Mfg. Co., Dept. ED, H and Luzerne Sts., Philadelphia 24, Pa.

CIRCLE 191 ON READER-SERVICE CARD

INDICTAOR LIGHT ASSEMBLY.—Type 50 extra-short horizontal assembly for use with the standard miniature bayonet T31/4 lamp.

Drake Mfg. Co., Dept. ED, 1711 W. Hubbard St., Chicago 22, Ill.

CIRCLE 192 ON READER-SERVICE CARD

MEMORY CORE ANALYZER.—Model 3303, 100 channel unit provides definitive analysis. Linearity better than 0.5 per cent; input counting rates greater than 10^6 cpm.

Radiation Instrument Development Lab, Inc., Dept. ED, 5737 S. Halsted St., Chicago 21, Ill.

CIRCLE 193 ON READER-SERVICE CARD

NEW PRODUCTS

NEUTRON SURVEY METER.—Fast-slow model 20806 has 10 times greater neutron sensitivity than previous models. Fast model 20807 and slow model 20808 also available.

Radiation Counter Labs, Dept. ED, 5121 W. Grove, Skokie, Ill.

CIRCLE 196 ON READER-SERVICE CARD

POWER SUPPLIES.—30 v output with ripple below 1 per cent rms for voltage or load within rating. Regulation from no load to full load is 12 per cent.

Gates Electronic Co., Dept. ED, 2090 Barnes Ave., Bronx 62, N.Y.

CIRCLE 197 ON READER-SERVICE CARD

CERAMIC CAPACITORS.—Double-cup high-voltage types 90C and 91C for use in rf circuits up to 10 kv.

Sprague Electric Co., Dept. ED, 347 Marshall St., North Adams, Mass.

CIRCLE 198 ON READER-SERVICE CARD

PRESSURE TRANSDUCER.—Model P-501 adjustable range, double-coil variable reluctance type with a flat diaphragm pressure sensing element.

Yuba Consolidated Industries, Inc., Yuba Research and Development Center, Dept. ED, Benicia, Calif.

CIRCLE 199 ON READER-SERVICE CARD

CONTROL PANEL ENCLOSURES.—Type 12, completely liquid-tight, in single and double door models.

Keystone Mfg. Co., Dept. ED, 23328 Sherwood Rd., Warren, Mich.

CIRCLE 200 ON READER-SERVICE CARD

POWER PENTODES.—Models 6EH5, 12EH5, 25EH5, and 50EH5 for use in audio output stages of radio and TV receivers.

Radio Corporation of America, Electron Tube Div., Dept. ED, Harrison, N.J.

CIRCLE 471 ON READER-SERVICE CARD

TRANSISTORIZED POWER SUPPLY.—Model M-990 magnetic amplifier transistorized dc supply. Output of 24 to 32 v dc at 8 amp.

Perkin Engineering Corp., Dept. ED, 345 Kansas St., El Segundo, Calif.

CIRCLE 202 ON READER-SERVICE CARD

EXPLOSION-PROOF DIGITAL INDICATOR.—Type 6 3- or 4-channel units for use in hazardous areas. Range is up to 9000 counts.

George L. Nankervis Co., Cox Instruments Div., Dept. ED, 15300 Fullerton Ave., Detroit 27, Mich.

CIRCLE 203 ON READER-SERVICE CARD

HELICAL GEAR ASSEMBLIES.—Can be used to increase or decrease speed. Ratios from 1 to 1 up to 4 to 1. Shaft sizes of 1/8, 3/16, and 1/4 in. diam.

PIC Design Corp., Dept. ED, 477 Atlantic Ave., East Rockaway, N.Y.

CIRCLE 204 ON READER-SERVICE CARD

SWITCH.—Model PLH push type switch enables the user to lock in a circuit and then release it by depressing the same button again.

The Capitol Machine Co., Switch Div., Dept. ED, 36 Balmforth Ave., Danbury, Conn.

CIRCLE 206 ON READER-SERVICE CARD

VENTED CABINET.—Measures 24 in. wide by 15 in. deep and holds standard contrasting silver grey hammertone panels.

WYCO Metal Products, Dept. ED, 6918 Beck Ave., North Hollywood, Calif.

CIRCLE 207 ON READER-SERVICE CARD

POWER SUPPLY.—Model 62-121 has a regulation of .05 per cent for a line change of 105 to 125 volts. Output range is 0.5-36 v dc at 15 amps.

Dressen-Barnes Corp., Dept. ED, Pasadena, Calif.

CIRCLE 208 ON READER-SERVICE CARD

FLEXIBLE COUPLINGS.—For close-tolerance use. Designed to eliminate back-lash and transmit uniform angular velocity at high speeds. Shaft sizes from 1/8 to 5/16 in.

Robertshaw-Fulton Controls Co., Bridgeport Thermostat Div., Dept. ED, Milford, Conn.

CIRCLE 209 ON READER-SERVICE CARD

SELENIUM RECTIFIERS.—Federal Slim-Line, in two sizes, covers range from 150 to 450 ma for half-wave rectifier applications and for B-plus supplies in voltage doubler circuits.

International Telephone and Telegraph Corp., Dept. ED, Clifton, N.J.

CIRCLE 210 ON READER-SERVICE CARD

SERVO GEAR CLAMPS.—Line consists of two piece T147 for use at high speeds; single piece T151 for speeds below 1000 rpm; and low-cost T143 for 200 rpm and under.

Sterling Precision Corp., Dept. ED, 17 Matinecock Ave., Port Washington, N.Y.

CIRCLE 211 ON READER-SERVICE CARD

TWO-POINT NUT.—Elimination of hex surfaces yields 40 per cent space saving in Kaylock H50 self-locking nut. Threaded nut element has two integral wrenching points.

Kaynar Mfg. Co., Inc., Dept. ED, Box 2001, Terminal Annex, Los Angeles 54, Calif.

CIRCLE 212 ON READER-SERVICE CARD

CIRCLE 213 ON READER-SERVICE CARD ➤

New Product Announcement

STEMCO TYPE MX* THERMOSTATS

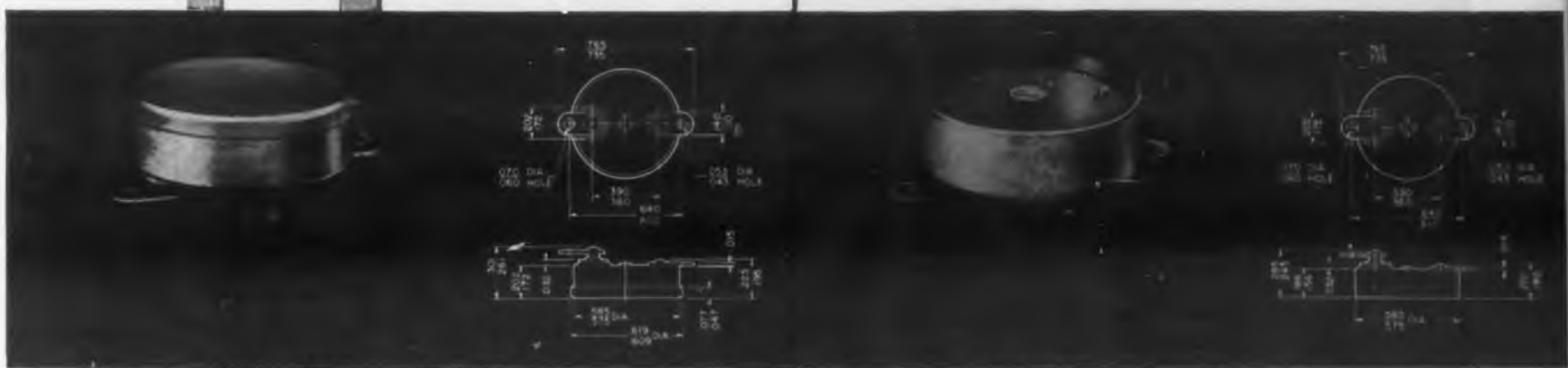
especially designed for missile, avionic and electronic applications

New Stemco Type MX Thermostats are miniature snap-acting units designed to *open* on a temperature rise. Being compact, lightweight units able to withstand high G's under wide ambient temperature ranges, Type MX thermostats are ideal for missile, avionic and other electronic applications where close temperature control is mandatory.

Basic design flexibility of the Stemco Type MX Series means the units can be supplied from regular production runs in a wide variety of models, both semi-enclosed or hermetically sealed. Ceramic or metal bases for semi-enclosed units, round enclosures or CR-7 crystal cans for hermetically sealed units. Several types of terminal arrangements, mounting provisions, brackets, etc., are available.

Stemco Type MX thermostats give you performance . . . small cubage . . . rugged reliability . . . *at a production price.*

*** 2° to 6°F differentials available**



AA-7286

STEVENS *manufacturing company, inc.*
Mansfield, Ohio

STEMCO THERMOSTATS

NEW PRODUCTS

SELENIUM RECTIFIER.—Low-cost unit for use in vibrating cushions and other appliances.
Radio Receptor Co., Inc., Dept. ED, 240 Wythe Ave., Brooklyn, N.Y.

CIRCLE 215 ON READER-SERVICE CARD

SERVO PNEUMATIC REGULATOR.—Model 192000-2 handles inlet pressures of 600 to 3000 psig with a flow rate of up to 40 lb of air per minute. For fuel pressurizing applications.
Wallace O. Leonard, Inc., Dept. ED, 373 S. Fair Oaks Ave., Pasadena, Calif.

CIRCLE 216 ON READER-SERVICE CARD

SPDT CHOPPERS.—Line of 7- and 4-pin miniature choppers for low noise applications.
James Vibrapowr Co., Dept. ED, 4050 N. Rockwell, Chicago 18, Ill.

CIRCLE 217 ON READER-SERVICE CARD

RELAY.—The PE-3 is used with resistive type photoelectric scanning heads within 25,000 ohms to 1.5 meg resistance.
Farmer Electric Products Co., Inc., Dept. ED, 2300 Washington St., Newton Lower Falls, Mass.

CIRCLE 218 ON READER-SERVICE CARD

ROTARY SWITCH.—Type JL multiple switch has eight contact positions and up to ten sections controlled by one knob.
Electro Switch Corp., Dept. ED, Weymouth 88, Mass.

CIRCLE 219 ON READER-SERVICE CARD

BREAD BOARDS AND HANGER UNITS.—Component and bearing hangers can be shifted to any position for highly accurate bread board mock-up.
Dynamic Gear Co., Inc., Dept. ED, 20 Merrick Rd., Amityville, N.Y.

CIRCLE 220 ON READER-SERVICE CARD

DIGITAL COUNTERS.—Feature low torque, low moment of inertia, high speed, and long life.
Durant Mfg. Co., Dept. ED, 1993 N. Buffum St., Milwaukee 1, Wis.

CIRCLE 221 ON READER-SERVICE CARD

JACK.—No. 2425 feed-through type accepts banana plug with 0.107 in. pin diam, 3/8 in. pin length.
Cambridge Thermionic Corp., Dept. ED, 445 Concord Ave., Cambridge 38, Mass.

CIRCLE 222 ON READER-SERVICE CARD

SNAP-ACTING SWITCH.—Type A switch for use in automatic devices. Electrical rating, 15 amp, 125 and 250 v ac.
The W. L. Maxson Corp., Unimax Switch Div., Dept. ED, Ives Rd., Wallingford, Conn.

CIRCLE 223 ON READER-SERVICE CARD

THERMISTOR THERMOMETER.—Model 46TUC multi-channel unit with range from 0 to 50 C in five over-lapping ranges 11 degrees wide.
Yellow Springs Instrument Co., Inc., Dept. ED, Yellow Springs, Ohio.

CIRCLE 224 ON READER-SERVICE CARD

PLASTIC SCREWS.—Lexan plastic screws, with shanks threaded just enough for each application, provide greater strength.

Pylon Co., Inc., Dept. ED, Attleboro, Mass.

CIRCLE 227 ON READER-SERVICE CARD

MOTOR TACHOMETER.—Model SJ9HLX7-1CC size 10 damping type motor has minimum stall torque of 0.5 in.-oz, operates from −54 to +105 C.

Eastern Air Devices, Inc., Dept. ED, 391 Central Ave., Dover, N.H.

CIRCLE 228 ON READER-SERVICE CARD

WIRE HARNESS.—Copper shielded Zippertubing with plastic or metal zipper track. ID's start at 3/8 in.; put-ups are 25 to 300 ft.

The Zippertubing Co., Dept. ED, 752 S. San Pedro St., Los Angeles 14, Calif.

CIRCLE 229 ON READER-SERVICE CARD

TRANSFORMER.—For industrial electronic tubes. Rated 30 kva, 240 v input with 3 secondaries, 10 v at 1000 amp.

Nothelfer Winding Labs, Inc., Dept. ED, P.O. Box 455, Trenton, N.J.

CIRCLE 230 ON READER-SERVICE CARD

DELTA UNIT.—Model 902-1 measures any physical quantity that can be converted into a change in capacitance.

The Decker Corp., Dept. ED, Bala Cynwyd, Pa.

CIRCLE 231 ON READER-SERVICE CARD

INTERNALLY THREADED INSERT.—Self-aligning Keensert series designed to compensate for misalignment of bolt holes.

Newton Insert Co., Dept. ED, 6500 Avalon Blvd., Los Angeles 3, Calif.

CIRCLE 232 ON READER-SERVICE CARD

TRANSISTORIZED DC POWER SUPPLY.—Unireg model Q26-30-1 with output range of 26 to 30 v at 0 to 1 amp.

Universal Electronics Co., Dept. ED, 1720 22nd St., Santa Monica, Calif.

CIRCLE 233 ON READER-SERVICE CARD

LINE VOLTAGE REGULATORS.—Claude Lyons automatic regulators weigh 11.5 lb, are independent of load from 0 to 100 per cent of rated value.

British Industries Corp., Dept. ED, 80 Shore Rd., Port Washington, N.Y.

CIRCLE 234 ON READER-SERVICE CARD

VERTICAL OUTPUT TRANSFORMERS.—Types A-113X, A-115X, A-113Z, and A-115Z drive 90 and 110 deg yokes with 10 to 14 mh inductance and 11 to 15 ohm resistance.

Triad Transformer Corp., Dept. ED, 4055 Redwood Ave., Venice, Calif.

CIRCLE 235 ON READER-SERVICE CARD

JACKS AND PLUGS.—Miniature jacks 2378 and 2515 and matching plugs 2379 for tight patch work on panel boards.

Cambridge Thermionic Corp., Dept. ED, 445 Concord Ave., Cambridge 38, Mass.

CIRCLE 236 ON READER-SERVICE CARD

NEW PRODUCTS

DECADE BOXES.—Line of ten models: three capacitance, three resistance, four inductance.
Aerovox Corp., Dept. ED, New Bedford, Mass.
CIRCLE 241 ON READER-SERVICE CARD

REVERSIBLE SYNCHRONOUS MOTOR.—Model RSM 80 in.-oz continuous duty motor, instantly reversible, in output speeds from 2/3 to 3600 rpm. Weighs 14 oz.
Hurst Tool & Mfg. Co., Inc., Dept. ED, Princeton, Ind.
CIRCLE 242 ON READER-SERVICE CARD

TRANSISTORIZED POWER SUPPLY.—Voltage regulated model SC-150-1 delivers 0 to 150 v, 0 to 1 amp. Regulation under 0.01 per cent or 0.002 v, whichever is greater.
Kepco Labs, Inc., Dept. ED, 131-38 Sanford Ave., Flushing 55, N.Y.
CIRCLE 243 ON READER-SERVICE CARD

GROUNDING SWITCH.—GS-1 rotary switch for use where one or two circuits are occasionally connected to ground.
P. R. Mallory & Co., Inc., Dept. ED, Indianapolis 6, Ind.
CIRCLE 244 ON READER-SERVICE CARD

HIGH PRESSURE SEALS.—Hexseals series N-5000 one piece units for use on miniature push-button and toggle switches. Operate from −160 to +500 F.
Automatic & Precision Mfg. Co., Dept. ED, 252 Hawthorne Ave., Yonkers, N.Y.
CIRCLE 245 ON READER-SERVICE CARD

VIDEO MONITOR CRT.—Type 8FP4 90-deg crt for closed circuit and industrial TV receivers. Measures 11-7/16 in. front to back.
Sylvania Electric Products Inc., Dept. ED, 1740 Broadway, New York 19, N.Y.
CIRCLE 246 ON READER-SERVICE CARD

UNIVERSAL CRYSTAL SOCKET.—Tests crystals with variety of holder pins or leads. Usable from lowest frequencies to over 100 mc.
Lehigh Valley Electronics Engineering & Mfg. Co., Dept. ED, 215 S. Third St., Allentown, Pa.
CIRCLE 247 ON READER-SERVICE CARD

RETAINING RING KIT.—Contains 376 cadmium plated Truarc retaining rings. Sizes packed individually in numbered envelopes. Shaft sizes from 1/4 to 2-1/2 in.
Bearings Inc., Dept. ED, 3634 Euclid Ave., Cleveland 15, Ohio.
CIRCLE 248 ON READER-SERVICE CARD

FLOW INTEGRATOR.—Model 26 square-root integrator automatically totals flow. Maximum rate of 300 counts per minute.
Librascope, Inc., Dept. ED, 40 E. Verdugo Ave., Burbank, Calif.
CIRCLE 249 ON READER-SERVICE CARD

ALLOY CONTACTS.—Mass-produced Cor-Bond contacts made in one heatless operation. Variety of types and shapes.

Fansteel Metallurgical Corp., Dept. ED, 2200 Sheridan Rd., North Chicago, Ill.

CIRCLE 252 ON READER-SERVICE CARD

HIGH CURRENT CONNECTOR.—Series C2 miniature hexagonal unit, two contact, for high altitude applications.

DeJur-Amsco Corp., Dept. ED, 45-01 Northern Blvd., Long Island City 1, N.Y.

CIRCLE 253 ON READER-SERVICE CARD

CYCLING TIMERS.—Type 511 and 521 have 1 to 8 independent timed intervals, quickly adjustable. Cycle times from 6 sec to 48 hr.

Cramer Controls Corp., Dept. ED, Centerbrook, Conn.

CIRCLE 254 ON READER-SERVICE CARD

TWO-STAGE REGULATOR.—Type GS has magnetic amplifier control input stage and grid-controlled rectifier power output stage. Three sizes: 5, 12.8, and 36 amp maximum.

Clark Controller Co., Dept. ED, 1146 E. 152nd St., Cleveland 10, Ohio.

CIRCLE 255 ON READER-SERVICE CARD

CENTRIFUGAL BLOWER.—Turns about 3400 rpm, drawing 3.5 amp. Delivers about 285 cfm at 1.2 in. of back pressure.

Western Gear Corp., Dept. ED, P.O. Box 182, Lynwood, Calif.

CIRCLE 256 ON READER-SERVICE CARD

MAGNETIC SWITCHES. — Miniaturized types 6-81, normally open, and 6-83, normally closed, operate 45 deg from vertical position.

The Mercoid Corp., Dept. ED, 4201 Belmont Ave., Chicago 41, Ill.

CIRCLE 257 ON READER-SERVICE CARD

MOVING COIL MECHANISM. — End-pivoted model MEP-7 for use with aircraft instruments needing flag or alarm indications with short deflection angle. Weighs 1/2 oz.

Marion Electrical Instrument Co., Dept. ED, Grenier Field, Manchester, N.H.

CIRCLE 258 ON READER-SERVICE CARD

CURRENT TRANSFORMER TESTER. — Type AL-1 provides tests at any load from light to 200 per cent. Current ranges are 10 to 2000 amp.

Knopp Inc., Dept. ED, 1307 66th St., Oakland 8, Calif.

CIRCLE 259 ON READER-SERVICE CARD

CHASSIS SLIDE.—Model 4000 needs 1 in. side space on each side. Pair holds 350 lb.

Grant Pulley and Hardware Corp., Dept. ED, High St., West Nyack, N.Y.

CIRCLE 269 ON READER-SERVICE CARD

FANS AND BLOWERS.—F frame line for 115 or 220 v, 1 or 3 phase, 60 or 400 cps applications.

Air-Marine Motors, Inc., Dept. ED, 369 Bayview Ave., Amityville, N.Y.

CIRCLE 270 ON READER-SERVICE CARD

NEW LITERATURE

Deflection Components 472

Precision deflection systems and components designed for ITV and broadcast cameras and other cathode ray tube applications are described in 6-page Form 3R 3295. Pictures and text present commercial and ruggedized components for image orthicons, vidicons, TV monitors, radar, flying spot scanners, and compositrons. Radio Corporation of America, Commercial Electronic Products, Camden 2, N.J.

Hardware 276

Catalog W600 lists a full line of electronic and electrical components. It includes solder terminals, swagers, terminal boards, hardware, insulated terminals, coils, coil forms, and capacitors. Dimensional drawings and detailed specifications cover each product. Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass.

Precision Marking 277

A four-page pamphlet, "Precision Marking And Fabrication in All Metals, Plastics and Phenolics," is available. The bulletin describes the manufacture of precision engraved marking and fabrication of dials, scales, panels, instruction plates, and precision screen printing. Gray Pantograph Engraving Co., 200 Washington St., Hoboken, N.J.

Toroids and Filters 278

A 24-page, clip-bound catalog containing a table of operational functions, diagrams, and information on useful relationships for network design. Ortho Filter Corp., 196 Albion Ave., Paterson 2, N.J.

Power Supplies 279

A line of transistorized low-voltage high-current dc supplies, with outputs of 6, 12, or 28 v, at 15 or 30 w, is discussed in a product data sheet now available. Complete specifications for 6 different models are provided. Sorensen & Co., Inc., Richards Ave., S. Norwalk, Conn.

Connector Test Report 280

Laboratory testing of miniature electrical connectors is the subject of a 29-page report now available. A complete series of tests for electrical, environmental, and physical characteristics is discussed with the aid of diagrams and tables. The Deutsch Co., 7000 Avalon Blvd., Los Angeles 3, Calif.

PC Facilities 281

A concise discussion of printed circuit facilities. The 4-page brochure outlines the physical and engineering facilities for circuits used in missiles, guidance systems, computers, data processing equipment, radar and quality instruments. Electralab, Inc., Industrial Center, Needham Heights 94, Mass.

Clutches and Brakes 284

Described in a 4-page leaflet are the performance, specifications, and dimensional characteristics of miniature industrial clutches and brakes. The illustrated units feature high torque rating, rapid response, zero backlash, and light weight. Autotronics, Inc., Box 812, Florissant, Mo.

Semiconductors 285

Electrical and physical characteristics of semiconductor products are covered in a recently published folder. Product lines have been broken down into categories which include: silicon junction diodes, medium voltage diodes, zener reference diodes and elements, zener power voltage regulators, and silicon solar cells. Hoffman Electronics Corp., Semiconductor Div., 930 Pitner Ave., Evanston, Ill.

Resin Rods 286

Fact Sheet No. 1 is a 4-page brochure, which gives sizes available, new engineering data, tips on machining, and typical uses of Teflon rod stock. Diameters of these rods range from 1/32 to 2 in., in extremely small increments. Chemplast, Inc., 3 Central Ave., E. Newark, N.J.

Decade Counter Tubes 287

An 8-page brochure is now available concerning electrical characteristics and application data on the most popular counter tube types. While listing min and max ratings on a variety of bi-directional counter tubes, it also contains information on the latest drive circuits, including an improved 0 to 4 kc driver and a simple circuit for counting rates of 30 kc and below. Sylvania Electric Products, Inc., 1100 Main St., Buffalo, N.Y.

Vibration Film 288

"Vibration and Its Measurement" is the title of a technical film, which gives viewers the opportunuity to see special equipment designed for measuring accelerometer sensitivity at 500 F while mounted to a standard shaker, in addition to the test procedures and special devices designed to measure lateral sensitivity. Design criteria for an accelerometer are compared with desired ranges of frequency, dynamic loading and environment. Endevco Corp., 161 E. California St., Pasadena, Calif.

PC Design Data 289

In an effort to define correctly certain special terms regarding high quality printed circuitry, a collection of design data sheets has been released. Entitled "Printed Circuit Design Data," it presents a more exact description of the various contributory factors and provides important definitions of such terms as: registration, silver migration, and bond strength. Electralab, Inc., Industrial Center, Needham Heights 94, Mass.

Resin Wall Chart 290

A compilation of data concerning various standard resins. The resin categories covered in the chart are: stycast casting resins, eccocoat plastic surface coatings, eccobond adhesives, cements and sealants, eccoseal impregnating resins, and eccobild tooling resins. Such properties as thermal expansion coefficient and max and min use temperatures are shown. Information is given as to possible uses and expected results. Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.

Printed Circuits 291

A 4-page booklet supplies information pertaining to printed circuits, copper-clad laminates, base laminates, and fabricated parts. The bulletin provides tables, design recommendations, and tolerances. Northern Plastics Corp., Second & Market Sts., LaCrosse, Wis.

Relays 292

A wide assortment of relays, steppers, solenoids, rectifiers, and related components is described in a 16-page folder. Universal Relay Corp., 42 White St., New York 13, N.Y.

Toroids and Filters 293

Toroids, filters and related networks for military, industrial and commercial applications. Catalog 104 consists of 16 color pages covering applications together with schematics and performance curves. Developments in the field of telemetering, including a new series of constant delay band pass and low pass filters, are featured. Burnell & Co., 10 Pelham Parkway, Pelham, N.Y.

Mean Temperature Nomogram 294

To avoid the incorrect "easy method" of finding the average temperature difference, a nomogram for logarithmic mean temperature difference has been devised. It involves three columns: the initial temperature difference, the key, and the final temperature difference. Dean Products, Inc., Dean Thermo-Panel Coil Div., 616 Franklin Ave., Brooklyn 38, N.Y.

Transistor Chart 295

The availability of a revised transistor interchangeability chart has been announced. It covers all EIA registered types comparable to the company's own types. General Transistor Corp., 91-27 138th Pl., Jamaica 35, N.Y.

Resistance Soldering 296

The techniques of resistance soldering on a production basis are described in Bulletin 105M. Advantages of this type of soldering, application notes and equipment available are discussed in the 18-page illustrated brochure. Wassco Electric Products Corp., 204 S. Larkin Ave., Joliet, Ill.

What The Russians Are Writing

J. George Adashko

MICROWAVES

Experimental Study of the Mutual-Synchronous Operation of Reflex Klystrons in the Three Centimeter Band by S. D. Gvozdover, A. I. Kostiyenko, and C. P. Lyubimov. REE 1/58, pp 105-111, 8 figs.

An experimental investigation is made of pair-by-pair mutual-synchronous operation of several reflex klystrons with shifted frequency characteristics, feeding a common load. It is shown that this operation can take place without jumps in the frequency and the oscillator power. The resultant range of electronic tuning of the system of several klystrons can exceed the sum of the ranges of the individual klystrons. This article is a continuation of work done by one of these authors and reported in *Radiotekhnika i Elektronika*, 1957, Vol. 2, page 1048, August issue.

Contribution to the Theory of a Spin Generator by S. S. Kurochkin. REE 2/58, pp 198-201.

The Bloch equations (*Physical Review*, 1946, 70, 460 and 474) are used to determine the conditions under which self-excited oscillations can be maintained in a frequency modulated self-oscillator. The frequency of the oscillations is determined by a system of nuclear spins (specimen) placed in perpendicular crossed magnetic fields (this generator was proposed by Schmelzer, Lectures on the Theory and Design of an Alternating-Gradient Proton Synchrotron, Geneva, 1953). See Figs. 1 and 2. The author also determines the oscillation frequency and explains the mechanism whereby the build up of the frequency amplitude is limited.

Effect of Load on Mutually-Synchronous Operation of Two Reflex Klystrons by A. I. Kostiyenko and G. P. Lyubimov. REE 1/58, pp 112-115.

Companion article to the one by Gvozdover, Kostiyenko and Lyubimov on page 104 of the same issue of *Radio-*

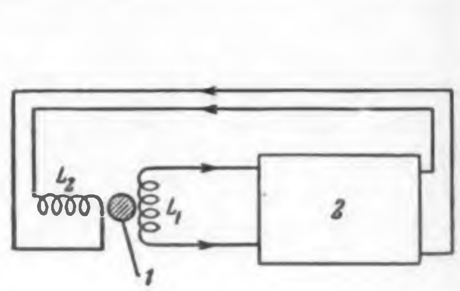


Fig. 1. Spin generator with crossed coils.

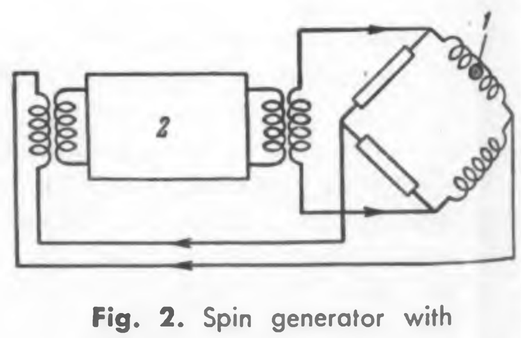


Fig. 2. Spin generator with bridge.

tekhnika i Elektronika. The authors have determined experimentally the dependence of the bandwidth of synchronization and of the range of electron tuning of two mutually-synchronous klystrons in the three-centimeter band on the impedance-frequency characteristic of the load. It is shown that both the resulting range of electron tuning, as well as the bandwidth of the synchronization, depend very strongly on the form of the impedance vs. frequency curve of the load and the maximum occurs when the input impedance of the load changes little with frequency. Reference is made to an article by Reed in the *Bell System Technical Journal*, 1953, Vol. 32, No. 3, page 715.

CIRCUITS

Synchronization of Self-Oscillators by a Periodic Sequence of Pulses by P. N. Zanadvorov. REE 2/58, pp 202-213, 7 figs.

The author considers the possible ways of investigating the synchronization of self-oscillators by means of periodic sequence of pulses. The investigation is carried out by means of phasing functions. In the case of low-amplitude radio frequency pulses it is possible to effect synchronizations at frequency deviations corresponding to poly-harmonic beats. The stability region of the synchronization and of the stationary process are examined.

Radio Station for 420—425 Mc by B. Yelizarov. R 2/58, pp 24-26, 2 figs.

Description of a walkie-talkie, awarded first prize in the 14th-All-Union Exhibit for Radio-Amateur Equipment.

Low Frequency Power Amplifier with High Efficiency by D. V. Ageyev. R 2/58, pp 45-47, 6 figs.

In 1951, D. V. Ageyev proposed the use of pulse power amplification for low frequency circuits for better efficiency, and proposed also a method of technical realization of this idea. A few years later R. Charbonnier proposed a different pulse-amplifier design. Both versions had certain shortages, which are claimed to be eliminated in the scheme described in this article.

ELECTRON PHYSICS

Experimental Investigation of the Electron Conductivity of a Space Charge Cloud in a Magnetron by V. P. Tychinskiy. REE 1/58, pp 116-130, 10 figs.

This paper was delivered on the day of radio conference held in May 1956. Electron conductivity was measured and cyclotron resonance curves of magnetrons were determined. These results were compared with calculated values obtained by the author in an earlier paper (*Radiotekhnika i Elektronika*, 1957, Vol. 2, No. 7, page 112). The author finds good qualitative agreement, and frequently quantitative agreement, with the calculations and explains the anomalies of the electronic efficiency of magnetrons, due to the resonant layers produced in the space charge cloud. Some of the most recently published work in this field (D. Reverdin, *Journal of Applied Physics*, 1951, 22, 257; L. E. S. Mathais (*Journal of Electronics*, 1955, Vol. 1, No. 1, page 18; and H. C. Nedderman, *Journal of Applied Physics*, 1955, Vol. 26, No. 12, page 1420) are found to contradict each other.

Electron Beam in a Helix Placed in a Dielectric Medium by V. P. Shestopalov. REE 1/58, pp 131-141, 3 figs.

The propagation of electromagnetic waves in a helix placed in a dielectric medium is investigated in the presence of an electron beam. An expression is derived for the components of the electromagnetic field in various regions of the system, and the resultant dispersion equation is analyzed. As the dielectric constant of the medium in which the helix is placed is increased, the gain of the system diminishes with increase in the range of electron-beam velocities for which amplification is possible.

Certain Laws of Electronic Current in Vacuum by M. D. Khaskind. Journal of Applied Physics, 2/58, pp 424-428, 2 figs.

The author uses the method of similarity and dimensionality to derive a substitute for the Langmuir "three-halves" law, which is known to be incorrect for low anode voltages. The author claims to establish a general law, which is obeyed by the voltage-current characteristic of the electron current in diodes, and which also explains saturation current in thermionic emission. The use of the dimensionality method explains why deviations in the characteristic from the "three-halves" law takes place both in the presence and in the absence of initial velocities of the electrons that leave the cathode. This means that in addition to the initial velocities, there are other factors which are not taken into account in the "three-halves" law theory.

Nonlinear Theory of Traveling Wave Tube. Part III. Effect of Space Charge Forces by L. A. Vaynshteyn and G. F. Filimonov. REE 1/58, pp 80-84, 8 figs.

The nonlinear equations of the traveling wave tube, derived in the first two parts of the article (*Radiotekhnika i Elektronika*, 1957, Vol. 2, No. 7, page 883 and No. 8, page 1027) are used to investigate the effect of Coulomb repulsion forces on the operation of a traveling wave tube operating as an amplifier. The results are compared with the works of other investigators, who take the space charge forces into account differently. These other workers are Tien, Walker and Volontis (*Proceedings IRE*, 1955, Vol. 43, page 260), Rowe (*Proceedings IRE*, 1956, Vol. 44, page 200; *Transactions IRE*, 1956, ED-3, 39) and Tien (*Bell System Technical Journal*, 1956, Vol. 35, page 349).

Grid Integrators of Increased Accuracy for the Calculation of Fields in Electron-Optical Systems by G. V. Der-Shvarts. REE 2/58, pp 252-256, 3 figs.

The author gives the theory of grid electric-integrators that permits integration of the Laplace equation for plane-symmetrical and axially-symmetrical fields.

Mechanism Whereby the Efficiency of a Backward Wave Generator (Karsinotron-O) Increases with the Space-Charge Parameter by G. N. Rapoport. REE 2/58, pp 255 to 261, 4 figs.

Companion article to the preceding one, explaining the increase in backward-wave oscillator efficiency with increasing QC. The author uses a special model of backward wave tubes with separate sections of velocity modulation, drift, and power taken from the electron beam. Besides the references listed in the first article, the author refers also to work by Sullivan (*Proceedings IRE*, 1954, 42, 1658) and Heffner (*Proceedings IRE*, 1954, 42, 1930).

SEMICONDUCTORS

Certain Possibilities of Employing the Diffusion Capacitance of Semiconductors by B. K. Kozlov. EC 1/58, pp 22-25, 6 figs.

The distributed diffusion capacitance in the p-n junction of semiconductors has been getting considerable attention in recent times. The author discusses the practical applications of this phenomenon, as applied to the automatic tuning of a heterodyne and to dielectric amplification. See Figs. 3 and 4.

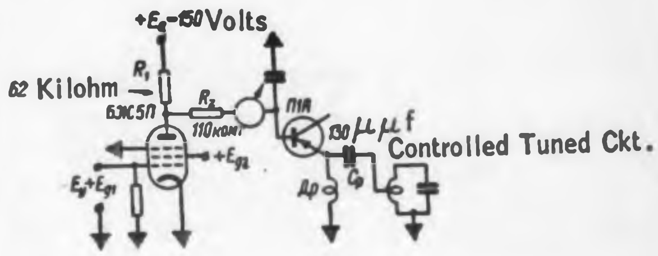


Fig. 3. AFC for heterodyne. Changing the grid voltage of the tube by 0.1 v changes the heterodyne frequency by approximately 10 kc at a signal frequency of 250 kc. Thus, it is possible to obtain a very high AFC coefficient with a properly designed frequency detector and a dc amplifier. In this case the AFC is due not only to the change in the diffusion capacitance, but also the change of the active resistance of the emitter-base section. This circuit operates satisfactorily at frequencies up to 15 mc.

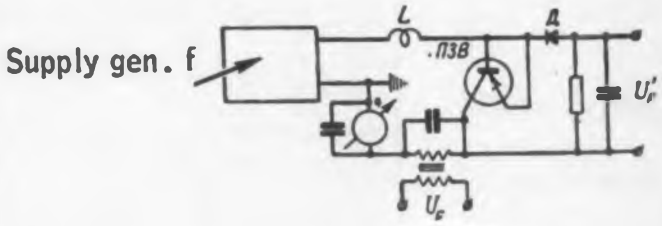


Fig. 4. Dielectric amplifier stage. A 24 mv signal (U_F) can be amplified to about 0.3 v at F = 1 kc, showing a good possibility of amplifying low-level signals. The author states that this is by far not the optimum design.

Certain Titanate Ferrites at Microwave Frequencies by R. G. Mirimanov and L. G. Lomize. REE 1/58, p 155.

Report on the measurements of the dielectric constant and losses at 3.2 cm.

GERMAN ABSTRACTS

E. Brenner

Design Of Two Phase Networks

THE NETWORK shown in Fig. 1 can be designed so that the output voltages V_1 and V_2 differ in phase by 90 deg. in a frequency band f_1 to f_2, within an error margin, L, which depends on the frequency ratio f_2/f_1 and the number of all-pass sections, n. Darlington's graph shown in Fig. 2 relates L to f_2/f_1 for various values of n. The theoretical background for the design of such a network was reported in a previous paper (abstracted in *ED*, Nov. 1, 1957).

The networks N_1 and N_2 consist of n all-pass lattice two-ports of the type illustrated in Fig. 3. The element values are related to the (real) characteristic impedance R_o and to the characteristic roots p_m by the formulas

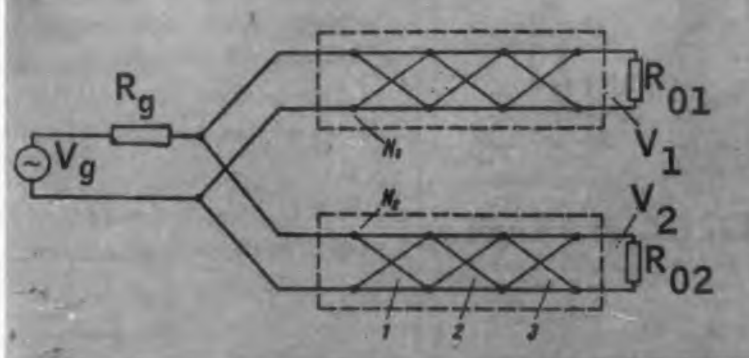


Fig. 1. Two phase network.

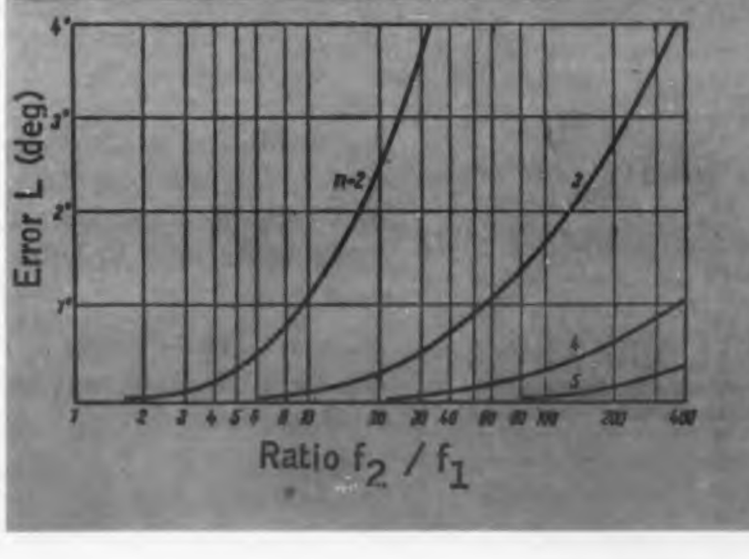


Fig. 2. Curve to relate error in degrees, L, to frequency ratio and number of sections, n.

$$R_1 = R_0 - \frac{(1-\alpha)}{(1+\alpha)}\,;\; R_2 = R_0 \frac{4\alpha}{1-\alpha^2}\,;$$

$$C = \frac{(1+\alpha)^2}{4\alpha R_0 p_m} \quad (1a)$$

$$R'_1 = R_0^2/R_1\,; \qquad R'_2 = R_0^2/R_2\,; \quad L = R_o^2\, C \quad (1b)$$

The parameter α is the attenuation of each lattice with R_o as the termination impedance. The value of the source impedance, R_g, is of no consequence.

For each lattice chain the output input voltage ratio is proportional to the ratio of polynomials $h(-p)/h(p)$ where $h(p)$ is a Hurwitz polynomial which, for the assumed structure, has real roots only.

The function which relates V_2 to V_1 has the form

$$\frac{V_1(p)}{V_2(p)} = \frac{k_1\, h_1(-p)\, k_2(p)}{K_2\, h_1(p)\, h_2(-p)} = K_3 \frac{H(p)}{H(-p)} \quad (2)$$

The zero and pole location for the desired phase characteristics are given by

$$p_m = \frac{2\pi f_1}{j}\, sn \left[j\, \frac{4m+1}{4n} K^1\, k \right] \quad (3)$$

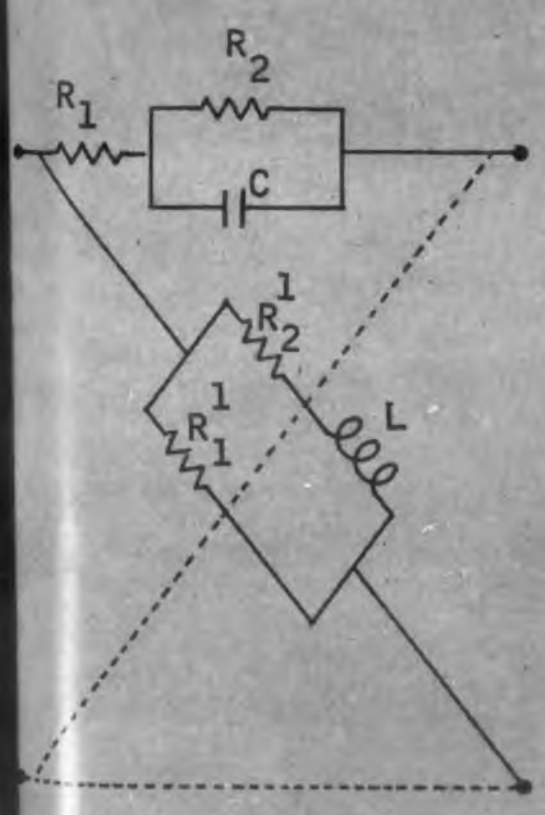


Fig. 3. Symmetrical all-pass lattice.

where K^1 is the complete elliptic integral of the first kind with modulus $(1-k^2)^{1/2} = k^1$ and k is f_1/f_2.

Function *sn* is the elliptic sine function. Equation 3 gives as many roots in the left half as in the right half plane. It can be shown that a root in the right half plane, $p_m^{(r)}$, is related to a root in the left half plane, $p_m^{(L)}$, through

$$p_m^{(r)}\, p_m^{(L)} = (1-2\pi)^2 f_1 f_2. \quad (4)$$

It frequently happens that the use of elliptic functions in equation 3 is inconvenient. In that case the roots $p_m^{(r)}$ can be determined by expansion, using the Thetafunction. A rapidly convergent series is obtained:

$$P_m^{(r)} = 2\pi\sqrt{f_1 f_2}\cdot \frac{\sin \pi v_m - q^2 \sin 3\pi v_m + q^6 \sin 5\pi v_m - q^{12} \sin 7\pi v_m + \ldots}{\cos \pi v_m + q^2 \cos 3\pi v_m + q^6 \cos 5\pi v_m + q^{12} \cos 7\pi v_m + \ldots} \quad (5)$$

where

$$v_m = \frac{1}{2}\, \frac{4m+1}{4n}\,;\; m = 0, 1, 2, \ldots n-1$$

and

$$q = exp\left[-\pi \frac{K(k)}{K(k^1)} \right] \approx \epsilon + 2\epsilon^5 + 15\epsilon^9 + 150\epsilon^{13} + \ldots$$

and

$$\epsilon = \frac{1-\sqrt{k}}{2+2\sqrt{k}}$$

The roots $p_m^{(L)}$ are then determined from (4). Except for the constant k_3, the expression (2) is now known. The factors in Eq. 2 are then assigned to either N_1 or N_2 according to the following rule: The factors $p_m^{(r)}$ are assigned to one network; the factors $p_m^{(L)}$ are assigned to the other. This is also equivalent to arranging the roots in order of increasing absolute value and assigning them to N_1 and N_2 alternately.

At this point the αs are still arbitrary positive numbers, less than unity. They are generally chosen such that R'_2 is the resistance of the coil whose inductance is L. The characteristic impedance R_o is chosen so that convenient inductance values are obtained.

The original paper includes a numerical example with $n = 3$.

Abstracted from an article by G. Wunch Nachrichtentechnik, *Vol. 8, No. 4, April 1958, pp 154-158.*

STANDARDS AND SPECS

Sherman H. Hubelbank

Specifying Core Materials

AIEE No. 431, Proposed Standard for Presenting Data On Magnetic Amplifier Core Materials, April 1958.

The scope of this standard is to set forth the basic data on magnetic amplifier core materials that should be presented by manufacturers of core materials so that the magnetic amplifier will have available the parameters of the material that are particularly significant to magnetic amplifier design. The tests proposed are not intended as methods to be used for matching and grading magnetic amplifier cores. Copies of this proposed standard are available from the American Institute of Electrical Engineers, 33 West 39 Street, New York 18, N.Y. without charge.

Steatite Standards, 1958

Up-to-date information concerning the various grades of steatite is contained in this standard. Steatite is defined as a generic term for kiln-fired ceramic compositions composed chiefly of various magnesium-silicate crystals. Included in this standard are the electrical properties, mechanical properties, and manufacturing tolerances required for design applications of steatites. Included in the material on testing are test specimens, inspection by acceptance sampling, military spec qualification samples, loss factor tests, dielectric tests, flexural strength tests, resistance to thermal change test, and non-porosity tests. The appendix includes design fundamentals for steatite ceramic components, standard design recommendations, and typical values. Copies of this standard may be obtained from the Steatite Manufacturers Association, 53 Park Place, New York 7, N.Y. for $1.00 per copy.

Connectors

MIL-C-25955(USAF), Connectors, Electrical, Environmental Resisting, Miniature, With Snap-in Contacts, 9 January 1958

Miniature electrical connectors, plugs, and receptacles are covered by this recently issued spec. These connectors are of an environment resisting class with snap-in contacts and receptacles of identical mating dimensions of a hermetically sealed class with non-removable contacts.

Toggle Switches

MIL-S-21195(SHIPS), TOGGLE SWITCHES, 23 JANUARY 1958
Requirements for toggle-type switches for use in ac and dc applications are covered in this spec. A typical type designation of switches meeting this spec is ST42A.

Capacitors

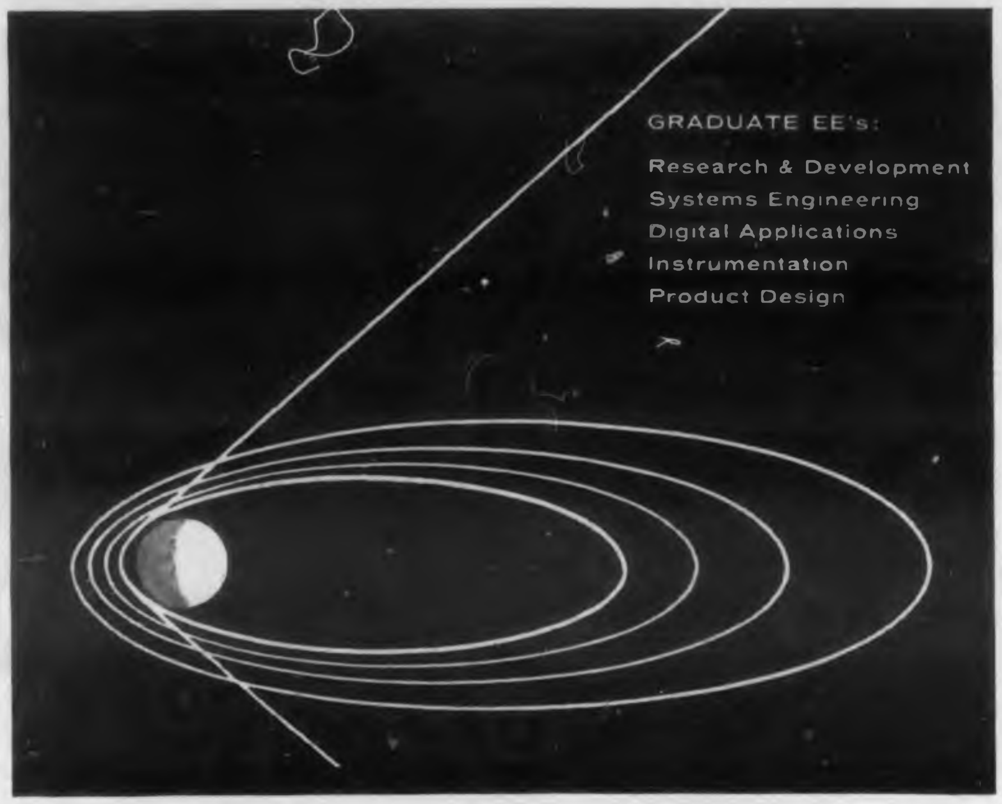
MIL-C-0025B(USAF), CAPACITORS, FIXED, PAPER-DIELECTRIC, DIRECT-CURRENT (HERMETICALLY SEALED IN METALLIC CASES) 13 DECEMBER 1957
This is a limited coordinated spec for use by the Air Force. It has not been approved as a revision to MIL-C-25A, dated 9 March 1953, however, pending its issuance as a coordinated spec it may be used in procurement. The spec covers d-c, paper-dielectric, fixed capacitors hermetically sealed in metallic cases, intended primarily for filter, bypass, and blocking purposes where the a-c component of the impressed voltage is small with respect to the d-c voltage rating. This spec also covers removable mounting brackets for use with the capacitors.

USAF BULLETIN 134, STANDARDIZED NOMENCLATURE, SYMBOLS AND UNITS OF RADIOMETRIC QUANTITIES IN SPECIFICATIONS CONCERNING INFRARED EQUIPMENTS AND PROCUREMENT ITEMS, 13 JANUARY 1958
This document presents the radiometric nomenclature, symbols, and units along with the evaluation procedures to be used within the Air Force in the description and evaluation of infrared procurement items including equipments, devices, techniques, and research data.

MIL-T-9107(USAF), PREPARATION OF TEST REPORTS, AMENDMENT 1, 21 JANUARY 1958
It is no longer necessary that the following notice be included as part of test reports: "The information furnished herewith is made available for study upon the understanding that the Government's proprietary interests in and relation thereto shall not be impaired. It is desired that the Judge Advocates' Office, WCJ, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio, be promptly notified of any apparent conflict between the Government's proprietary interests and those of others."

Air Traffic Control

U.S. STANDARD MANUAL OF RADAR AIR TRAFFIC CONTROL PROCEDURES, 1 MAY, 1958
This standard has been officially adopted by the U.S. Army, Navy, Air Force, Coast Guard, and the Civil Aeronautics Administration to standardize the operation of the radar traffic control services.



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MILITARY POSITIONS OPEN

- Radar transmitters and receivers
- Radar circuit design
- Antenna design
- Electronic countermeasure systems
- Military communications equipment design
- Pulse circuit design
- IF strip design
- Device using kylstron, traveling wave tube and backward wave oscillator
- Display and storage devices

CIVILIAN POSITIONS OPEN

2-WAY RADIO COMMUNICATIONS

• VHF & UHF Receiver • Transmitter design & development • Power supply • Systems Engineering • Selective Signaling • Transistor Applications • Crystal Engineering • Sales Engineers

PORTABLE COMMUNICATIONS

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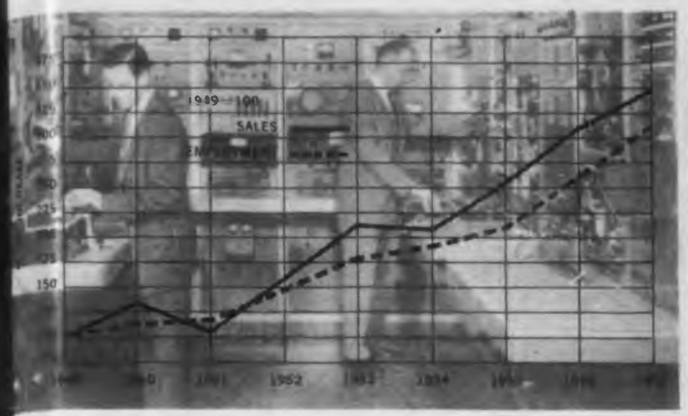

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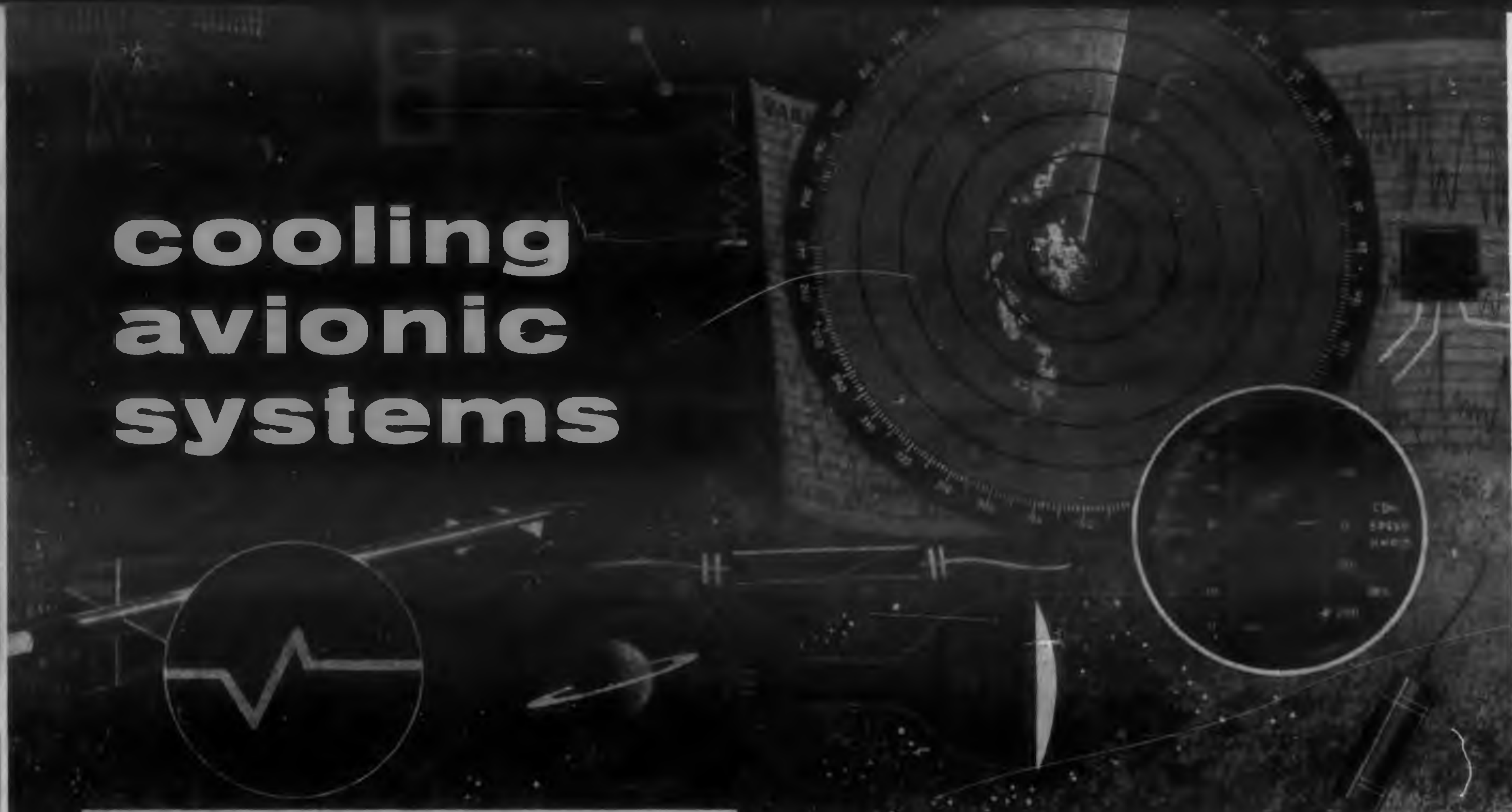

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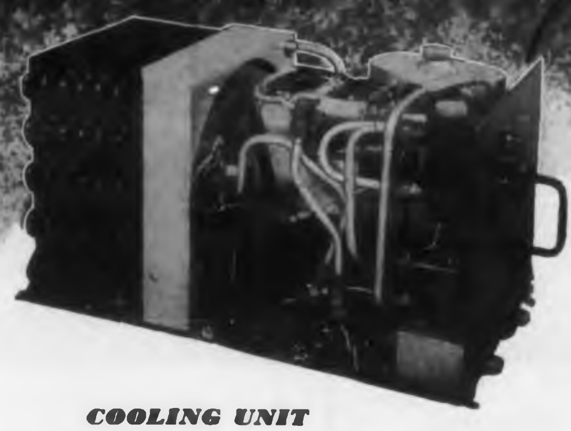

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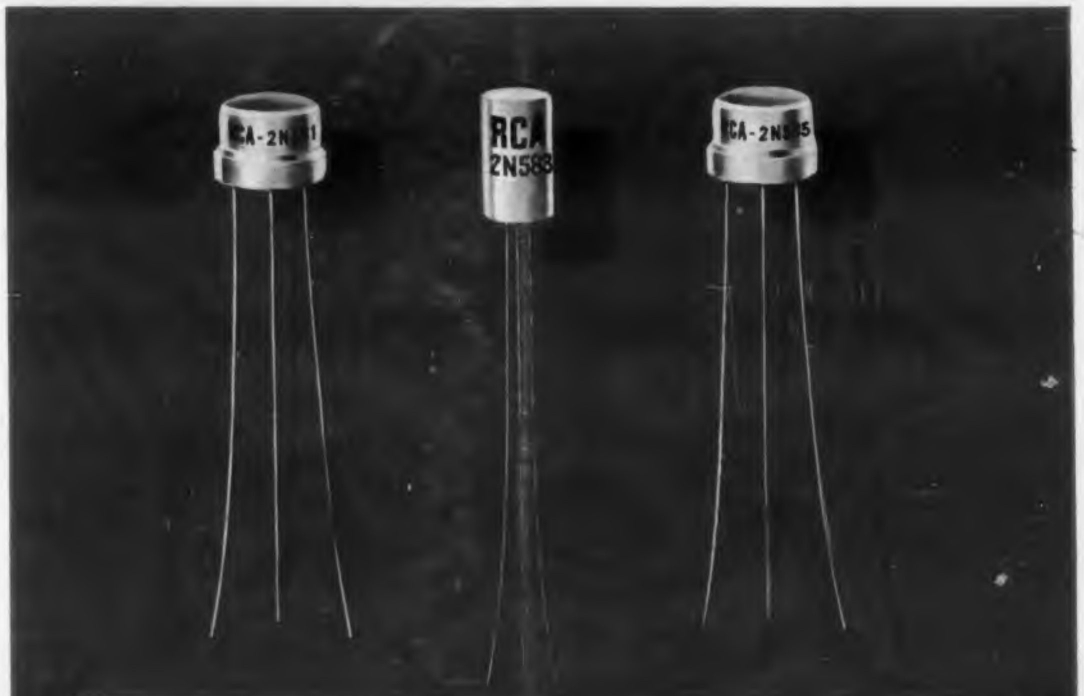

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