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ELECTRONIC DESIGN is the fastest growing of all business publications.
Advertising increased 717 pages during 1955 over 1954.

◄ CIRCLE 1 ON READER-SERVICE CARD

ELECTRONIC DESIGN

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Contents

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ELECTRONIC DESIGN is published monthly by Hayden Publishing Company, Inc. at 19 E. 62nd Street, New York 21, N. Y., T. Richard Gascoigne, President; James S. Mulholland, Jr., Vice-President & Treasurer, and David B. Landis, Secretary. Printed at Publishers Printing Company, New York, N. Y. Acceptance under section 34.64 P. L. & R. authorized. 27,000 copies this issue.

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Editorial

Year of Accomplishment

This was a year of hard work, accomplishment, and great satisfaction for the staff of ELECTRONIC DESIGN. It has been a year of growth in physical size as well as in editorial coverage. The Annual Index (pages 34-37) gives some idea of the variety and scope of our editorial coverage during 1955.

Certain articles were of special interest. The five-part "Printed Circuit Design" series which ended in the January issue was the first to include practical design information on this timely subject. "Design for Automation" (May) guided designers working towards automatic assembly of their products. "Designing Reliable Transistor Circuits" (March and May); "Design Procedures for Power Transistors" (July, September, and October); as well as the special July transistor issue brought readers up to date in this new and exciting field.

The Third Annual Transistor Data Chart (July) also included a list of components specifically designed for use with transistors. Over 1,500 copies of this chart were sent out in response to readers requests.

The special computer issue (October) included an extensive listing of sources for computer components and building blocks.

New things also happened in our departments. The March issue included over 100 products displayed for the first time at the Radio Engineering Show. Over 1,700 devices of interest to electronic design engineers appeared in the New Product section during the year. We started a new project in August. For the first time, an American magazine began publishing on a regular basis, translations of Russian electronic articles. In June, we started "Standards and Specs" (brief summaries of newly issued standards). Another new service is the "Bulletin Board" where readers' special needs are brought to the attention of our wide audience for possible help.

There are just a few accomplishments that give us great satisfaction. Accomplishments, however, always set new standards for performance. They represent our point of departure for 1956. Next year we will come out twice a month to provide readers with the most timely and complete design information available. "Design '56" in the January 1, 1956 issue will set the stage for the year, and other new innovations will come thick and fast.

It's been a great year for us, but . . . "You ain't seen nothing yet!" Merry Christmas and a Happy New Year.

Engineering Review

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

Transistors Improved by Radiation . . . The maximum collector current of commercial point-contact transistors can be improved by neutron irradiation. This effect has been noted as a result of experiments made at the Harwell Pile, according to Dr. J. H. Stephen, Electronics Div., Atomic Reserach Establishment, Harwell, England. None of the other characteristics of the transistors were adversely affected by the irradiation.

In one experiment, a transistor showed a decrease after irradiation from 10 to 4microsec in the time for the collector current to decay from 15 to 2ma. The beneficial effect of the irradiation is believed to be permanent and to be due to the production of hole recombination centers by fast neutrons and not due to the impurities produced by transmutations. Their concentrations are much lower than those already present.

The irradiation dose is fairly critical. A satisfactory one was found to be 10^{14} neutrons per sq cm though the ratio of fast to slow neutrons is not known. Larger doses change other characteristics of the transistor and eventually destroy the semiconductor action altogether. No beneficial effects were apparent when a junction transistor was subjected to neutron radiation and considerable deterioration resulted.

Quality Records in Mass Production . . . SINTRAFUSED records, a new process designed to reproduce the quality of the original master record, will be available to the public on a mass-production basis.

In the new sintering process, developed by Custom Records, Inc., 41 E. 42nd St., New York 17, N. Y., the preform is produced without compounding of any kind. The blank is sintered, or fused to the size of the finished record, only somewhat thicker. This can be molded under low pressure into a record with almost no radial flow of the plastic. Lack of material flow over the face of the stamper eliminates distortion and stretching, contributing to the high quality of the record. The need for heavy, bulky, and expensive equipment is also eliminated with this process.

New Trends in Radar . . . Three of the largest radar indicators ever built to meet military specifications have been completed by the Stromberg-Carlson Company, a division of General Dynamics Corporation. The indicators have 22-inch viewing tubes, with a maximum range of 300 miles and a minimum range of 4 miles.

Another new advance is a high-brightness radar display system developed by RCA which projects radar images on a screen four feet in diameter and can be viewed under normal lighting conditions. The new system, for possible use in air traffic control and other applications requiring large, bright displays, permits satisfactory viewing in surroundings as brightly lighted as the average living room.

Interceptor-Fire Control Simulator . . . The Model 10 is a unique device designed to simulate the operation of an interceptor-fire control system during the attack phase of interception, the period commencing just after radar lock-on and ending at firing of the armament.

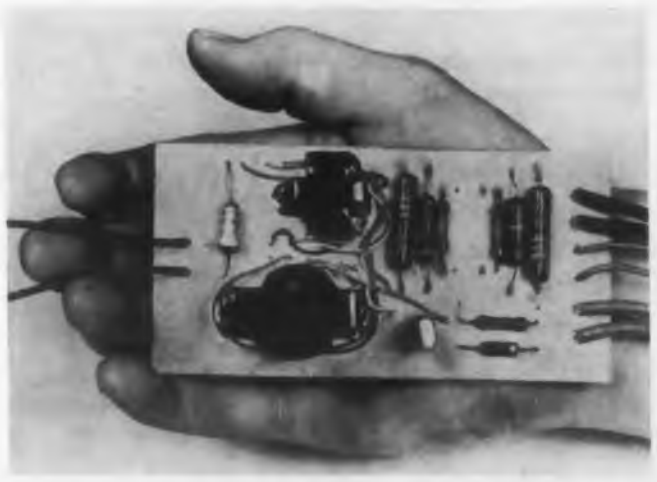
The new Simulator, developed by West Coast Electronics Co., Los Angeles, Calif., provides means for simulating targets in straight line or accelerated flight. Pursuit, lead-pursuit and lead collision attacks are simulated at the discretion of the operator.

It will have special application as research equipment in investigation of pilot problems pertinent to the operation of interceptor fire control systems, or for use in laboratory design studies of cockpit controls and displays.

European Design Trip . . . Many American electronic engineers are not aware of the great activity in electronics going on in Europe and the British Isles. We recently heard of an idea which would do much to acquaint our engineers with such activity at first hand.

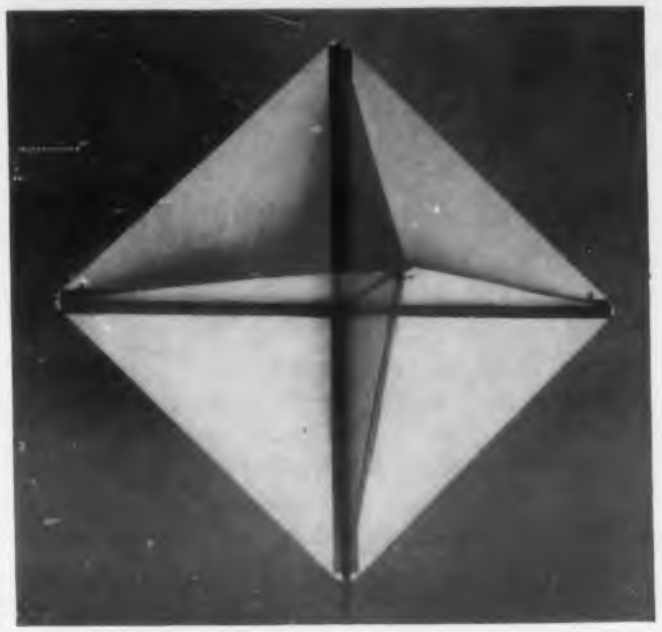
It has been proposed that a European Design Trip be organized to visit several electronic centers in Europe and probably wind up at one of the major industrial fairs that feature electronic equipment. Such a group, traveling during off season times—say early spring—could enjoy special rates. The entire trip need not take longer than 10 days to two weeks (traveling by air).

Readers are invited to send in their comments on the idea as well as suggestions for specific places to visit to ELECTRONIC DESIGN, 19 E. 62nd St., New York 21, N. Y.



Transistorized Repeater Extends Voice Range

A pint-sized repeater, weighing only 3½ lb., can be spliced into a field telephone line every 6 miles and will extend voice range to 30 miles. Heart of the new unit is a transistor that cuts down line loss which limits the range of speech. The device is being perfected at the Army Signal Corps Engineering Laboratories, Fort Monmouth, N. J.



Radar Reflector

Giving all the outward appearances of a kite is this octahedral radar device designed to make small boats easily conspicuous to larger vessels. Made of sheet aluminum, it can be opened like an umbrella and raised to the mast top, or even held aloft on the end of an oar.

Medical Electronics . . . Electronics is giving sufferers from arthritis a new kind of local-heat treatment. A new device, developed at the Hill Laboratories, Frazer, Pa., uses heat generated in a portable, cabinet-like control panel and fed into a lightweight hood-like arangement that covers any part of the body. A control system, made by Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., uses a computer to regulate temperatures within one-quarter of a degree.

A new color TV camera has been developed by the Radio Corp. of America specifically for medical use. The camera is more compact and flexible than conventional color cameras. Close-up details, in color, of operations or experiments can be transmitted from the surgery or research laboratory to doctors and scientists throughout the country. The color camera also can be used with a light microscope for color transmission of mircroscopic studies essential in pathological and biological studies.

The use of hoispital TV for nursing supervisors to scan patients at any time without disturbing them was predicted as an imminent technique by R. W. Cutler, of Skidmore, Owings & Merrill, New York architects. Nurses now learn patients' needs by talking to them through a telephonic device from the central nurses' station without time-consuming trips to the bedside; doctors receive mesages on a tiny radio carried in their pockets; and closed-circuit color TV has already found an important niche in medical education, Mr. Cutler stated.

An installation of color TV for hospital use will

be made by the Radio Corp. of America to serve three Government medical activities located at Walter Reed Army Medical Center, Washington, D. C.

A new surgical tool allows continuous monitoring of the activity of the heart during an operation both visually and audibly. Surgeons, by placing two or three electrodes on various parts of the body, can record the electrical activity of the heart visually on an oscilloscope as well as audibly through a loudspeaker or earphones. The device, called the Electrocardiophone, was described in a recent paper by A. J. Morris and J. P. Swanson of Levinthal Electronic Products, Inc., Redwood City, Calif.

International Engineers to View Color TV Progress . . . An extensive demonstration of color TV developments in this country for members of the Committee Consultatif International de Radio (CCIR) is being formulated by the National Television System Committee (NTSC) at the request of and in cooperation with the U. S. State Department.

The program, to be held in early March 1956, will consist of lectures, visits to manufacturing plants and an off-the-air showing of color TV. The off-the-air demonstration will be held March 5th at the UN building in New York City.

The CCIR is an international body of scientists and engineers charged with considering radio and TV problems of an international nature and recommending international standards. Studies of color TV developments in other countries will be made by the group.

Automobile Headlighting System . . . The new system is being designed to cast a shadow over that portion of the road occupied by oncoming cars, without the necessity of lowering and dimming headlights to reduce glare in the eyes of an approaching driver.

Known as the Bone-Midland system, engineers at Battelle Institute, Columbus, Ohio, have developed a demonstration unit of the new device that gives visibility from about 500 to 1000 feet, even while meeting and passing an approaching vehicle. This compares with a distance of 200 to 300 feet maximum obtained with presently available headlamps on low beam.

A photo-sensitive tube is being designed into the electrical system to control the position of the shadow in the opposing lane.

Correction: Robert C. Kelner, author of "Components needed for Digital Computers" appearing on Pages 32 and 33 of our October 1955 issue was incorrectly listed as chief engineer of Laboratory for Electronics, Inc. Mr. Kelner is actually Asst. Chief Engineer of this firm.

Lens Simplifies Making of Color TV . . . An optical lens has been designed specifically to simplify the task of achieving uniformity at an important step in TV color tube manufacture.

Designed by scientists at the David Sarnoff Research Center of RCA at Princeton, N. J. in conjunction with the RCA Tube Div. at Lancaster, Pa., the lense permits placing of over 1,000,000 tiny color phosphor dots on the face of a color TV picture tube, allowing an exact register of color during manufacture. Although the cost of the tubes will eventually be lower, it is still much higher than monochrome tubes.

Cores Know Hit Parade . . . Tiny doughnut-shaped ferrite cores are being used in new jukeboxes to remember selections. This magnetic memory has proved simpler and more reliable than former relay and switch mechanisms used for the purpose in Seeburg jukeboxes.

Tweeter in Own Enclosure . . . One speaker manufacturer is now offering tweeters in separate small enclosures complete with associated cross-over network and level control. Made by Electro-Voice, Inc., Buchanan, Michigan, the enclosure means that you don't have to cut holes in your present equipment to add a tweeter.

Radical Design Change in Tiny Loudspeaker . . . A miniature speaker only 2-1/8 inches in diameter and little over half an inch thick has been developed for use in transistorized pocket-size radios.

Designed by engineers at the David Sarnoff Research Center of RCA, the magnetic structure of the unit, instead of being housed in a bulky structure of its own, has been placed within the shell which surrounds the speaker's vibrating cone. Performance of the tiny speaker is comparable in all respects to the earlier types.

Electronics Helps Purify Water . . . An automatic electronic transmission system is being built to monitor operations of a new water filtration plant. Utilizing a variety of instruments to regulate flow, measurement, degree of acidity and the filtering stages, the system will feed into a centralized master control panel which will view the operation in its entirety.

The contract for the control system has been awarded to the Minneapolis-Honeywell Regulator Company and will be constructed as part of the new filtration plant being built for Ogden, Utah. The plant will treat more than 9,720,000 gallons of water daily.

Wire Brush Senses Holes . . . A midget wire brush only 2-1/2″ long, less than 1/16″ thick and 1/4″ wide is playing a vital role in operating one of today's intricate business machines. Made of music spring wire, the wires make contact with holes in a punched card, activating the machine to record the desired information. This same function is sometimes performed by tiny photocells.

The tensile strength of the wire is 300,000 lb psi and can be drawn from 0.008 to 0.002″. The wire used in fabricating the contact brushes is made by the Worcester Wire Works Div. of the National-Standard Co. Worcester, Mass.

Radio-TV Production Higher Than 1954 . . . For the first nine months of this year over a million more TV receivers were produced than during the similar 1954 period, and radio production during this same period almost totaled the entire output for 1954.

The January through September output, as reported by the RETMA, totaled 5,760,506 TV sets, compared with 4,733,315 for the same 1954 period. In the first nine months, 10,027,362 radios were manufactured, compared with 7,042,442 turned out during that period of 1954. Total 1954 radio production had been 10,400,530.

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G-E EXPLOSION-PROOF MOTOR FOR AUTOMATIC PILOT SYSTEM is rated 1/10 hp, 7500 rpm, 27.5 volts d-c. Duty cycle: continuous at 20% load with additional 80% load applied 15 seconds on, 15 seconds off. Emergency duty cycle: 20 minutes continuous full load after motor operating temperature has been stabilized at normal duty cycle.

G-E aircraft motor specialists help solve drive problem on new Collins automatic pilot

E. H. Fritze, Controls Engineer, Collins Radio Co. (pictured above) says: "In the development of a new automatic pilot system, we were faced with an electric-drive problem. When two other suppliers failed to meet our requirements, we called in General Electric.

"In conferences between our engineers and G-E aircraft-motor specialists brought in by our local G-E Sales Engineer, we arrived at a solution to our problem. Sample motors were delivered in three weeks, saving us considerable engineering time and expense. We find service like this very valuable," Mr. Fritze concludes.

EXTENSIVE TESTING BACKS SERVICE

When G.E. develops a new aircraft or armament motor, extensive environmental testing facilities are called into play. For example, the G-E motor for Collins was subjected to, and passed an insulation test, vibration test, shock test, and an accelerated life test. Such testing assures conformance with your most exacting requirements.

G-E SERVICE FOR YOUR DEVELOPMENT

If you have a development that calls for an aircraft or armament motor, the same fast, effective service provided the Collins Radio Company can be yours from General Electric. Just contact your local G-E Apparatus Sales Office early in your planning. Or write giving full details to Section 704–57, General Electric Company, Schenectady, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Electronics Invades Privacy of Homes . . . Modern intercommunication equipment, already widely used in today's business world, is being installed as a useful and intriguing feature of new homes.

The simplest form of today's equipment is a compact instrument, about the size of a small, portable radio. It combines in one unit both a speaker and microphone and has a capacity of up to 10 stations or 10 different locations in or about the home. With it, the homemaker can hear other rooms, or by flicking the switch, speak to other rooms instantly.

Design Simplicity Urged . . . "The greatest single deterrent to military electronic progress is the daily increasing complexity of new designs" said J. A. Rhoads, manager, Military and Missile Electronics Div., Hycon Mfg. Co., Pasadena, Calif. Mr. Rhoads declared that one of the problems in military electronics design is that new equipment is either simple to operate or simple to maintain, never both.

Talking Stamp Machine . . . A machine which issues stamps, makes change, and delivers recorded messages such as, "Now buy some more and save a trip" and "Thank you, these stamps are sanitary" was demonstrated to postmasters at their recent convention. The government reportedly will test a few of these machines in big city post offices.

Computer Given to University . . . A $430,000 network analyzer has been presented to Syracuse University by the New York State Electric and Gas Corp. and the Niagara Mohawk Power Corp., with the cooperation of the General Electric Co., Syracuse, N. Y. The analyzer will serve as a research aid and training ground for graduate students.

WHAT'S NEW IN AUDIO?
SEE
DESIGN '56

◀ CIRCLE 8 ON READER-SERVICE CARD

Electronic Organ in Kit Form . . . A spinet electronic organ which includes a full-size 61-note organ manual and a 13-note pedal keyboard with a master volume control pedal is available in build-it-yourself kit form.

Manufactured by Electronic Organ Arts, 4878 Eagle Rock Blvd., Los Angeles, Calif., the electronic components feature the latest printed circuitry. The nineteen stops include several couplers plus a variety of solo and ensemble voices.

Men Over Machines . . . "The machine never will be able to give a result which could not also be reached by the human brain", C. B. Ludwig of International Harvester Co. said at the annual Computer Applications Symposium at Armour Research Foundation. For example, he pointed out, the machine will not solve one equation with two unknowns because the human brain can not do it either.

Man and the Machine . . . Machine tool producers must give greater attention to the man who runs the machine if they are to remain in a competitive position, R. H. Hose, partner of Henry Dreyfuss, New York industrial designer, recently told the American Society of Industrial Designers. The general character of the entire instrument as it relates to human use must be considered, Mr. Hose said.

Large Families Mean More TV Sets . . . The number of persons in a household appears to have some influence on the presence of a TV set in the household. According to a report of the Bureau of the Census, 78% of households with four or five persons had sets and were more likely to have sets than either larger or smaller households. Generally, the frequency of two or more sets in a household increased as the size of the household increased. Therefore, TV manufacturers might be able to project future set demands on the basis of marriage and birth figures.

CIRCLE 9 ON READER-SERVICE CARD ➤

Tireless Tube

Beryllium copper tubing shown here in a test of flexible waveguide life demonstrates the great resistance this metal has to fatigue under repeatd flexure. Superior Tube Company, supplier of the tubing, has been able to achieve maximum fatigue resistance by a special processing schedule designed to minimize duplexing and grain growth.

IRE Confers Awards for 1956 . . . The recipients of two awards for contributions to the field of electronics were recently named by the IRE, sponsors of the awards.

Frank J. Bingley, color television research engineer of the Philco Corporation, was named to receive the Vladmir K. Zworykin Television Prize Award for 1956 for his contributions to colorimetric science as applied to TV. The Browder J. Thompson Memorial Prize for 1956 was awarded to Jack E. Bridges, research engineer of the Zenith Radio Corp., for his paper entitled, "Detection of Television Signals in Thermal Noise", which appeared on page 1396 of the Sept 1954 issue of the Proceedings of the IRE. The award is made annually to an author under thirty years of age at date of submission of manuscript for a paper recently published by the IRE which constitutes the best combination of technical contribution and presentation of the subject.

The awards will be presented during the IRE National Convention to be held in New York City, March 19-22.

TV to Foil Bank Robbers . . . A packaged closed-circuit TV unit for use in banks includes certain features that would give an alarm in the event of a bank robbery has been placed on the market. The TV monitor enables the teller to verify signatures and check other documents that are maintained in a remote file servicing more than one branch bank. The monitor is contained in the illustrated cabinet, which also includes cash receptacles. The unit was developed by Mosler Safe Co., 320 Fifth Ave., New York 1, N. Y., incorporating closed-circuit TV equipment made by Radio Corp. of America, New York, N. Y.

The following safety features are included in the unit: If the teller walks away from the unit leaving the cash unprotected, the top of the cabinet automatically swings shut and locks. If for some reason the cover fails to close within seconds, an alarm automatically sounds indicating that the cash is unprotected. If a bank robber leans over the counter and grabs a wad of bills or commands the teller to hand over his cash, one or several alarms will instantly warn that a stick-up is taking place.

The workings of these alarms have not been revealed for obvious reasons by the manufacturer. One possible answer might be in having a sensing device or switch placed in a rubber mat on which the teller stands. When the teller steps off the mat the mechanism operating closing the unit is automatically operated. As far as the alarm that sounds when the cash is removed, it could be based on a sensitive balance on which the cash rests.

Portable Radio-Phonograph

A battery-operated record player with crystal pick-up for 7", 45 rpm records is the feature of Bapbyphon-S. Up to six records can be stored on the inside of the cover and a safety lock protects the unit from shock during transport. A reduction disc is provided on the cover for records with a large center hole. It uses one 90v plate battery, two 1.5v single cells, and three 1.5v miniature cells. It is distributed by Chemtron Industries, Inc., New York City.

Hearing Earring

This clip-on earring contains a three-transistor hearing aid. It is manufactured by the Dahlberg Co., Golden Valley, Minneapolis, Minn., and utilizes Raytheon transistors.

G.I.-operated Language Translator . . . Using a modified Vari-typer, an Army soldier can set type in 50 languages although totally unacquainted with the language he is typing. The Vari-typer is a typewriter-like device with interchangeable type fonts. These units, located in mobile psychological warfare printing units, give the Army a means of distributing printed matter in the major political and geographical areas of the world. No bulky costly typesetting equipment is needed to quickly produce commercial-like typography for offset reproduction. The device could be tied to computers for automatic translating.

The Vari-typer was modified with a reverse carriage for writing Hebrew, Arabic, Persian, Urdu, Maylayan, etc. Up to 180 characters, compared to 26 letters of the English alphabet, can be printed. Research studies of each language reduced many varieties containing up to 700 characters to a basic alphabet adequate for communication purposes. The 50-language machine is simple to use. The message is written by a linguist in the language desired. The linguist then substitutes appropriate numbers for the characters. With the proper font in the machine, the operator merely strikes the keys according to the numerical sequence of the message.

Interest in translation equipment is high. New developments promise to almost revolutionize communications in countries now hampered in quick mass

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marion meters

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TO PANEL DESIGN

Marion Medalist meters combine handsome, modern design in a choice of colors to enhance the styling of your equipment, with the greater readability of scales up to 50% longer than ordinary type panel instruments of the same size. They are interchangeable with ASA/JAN 2½ and 3½ inch sizes. Delivery now in all standard ranges.

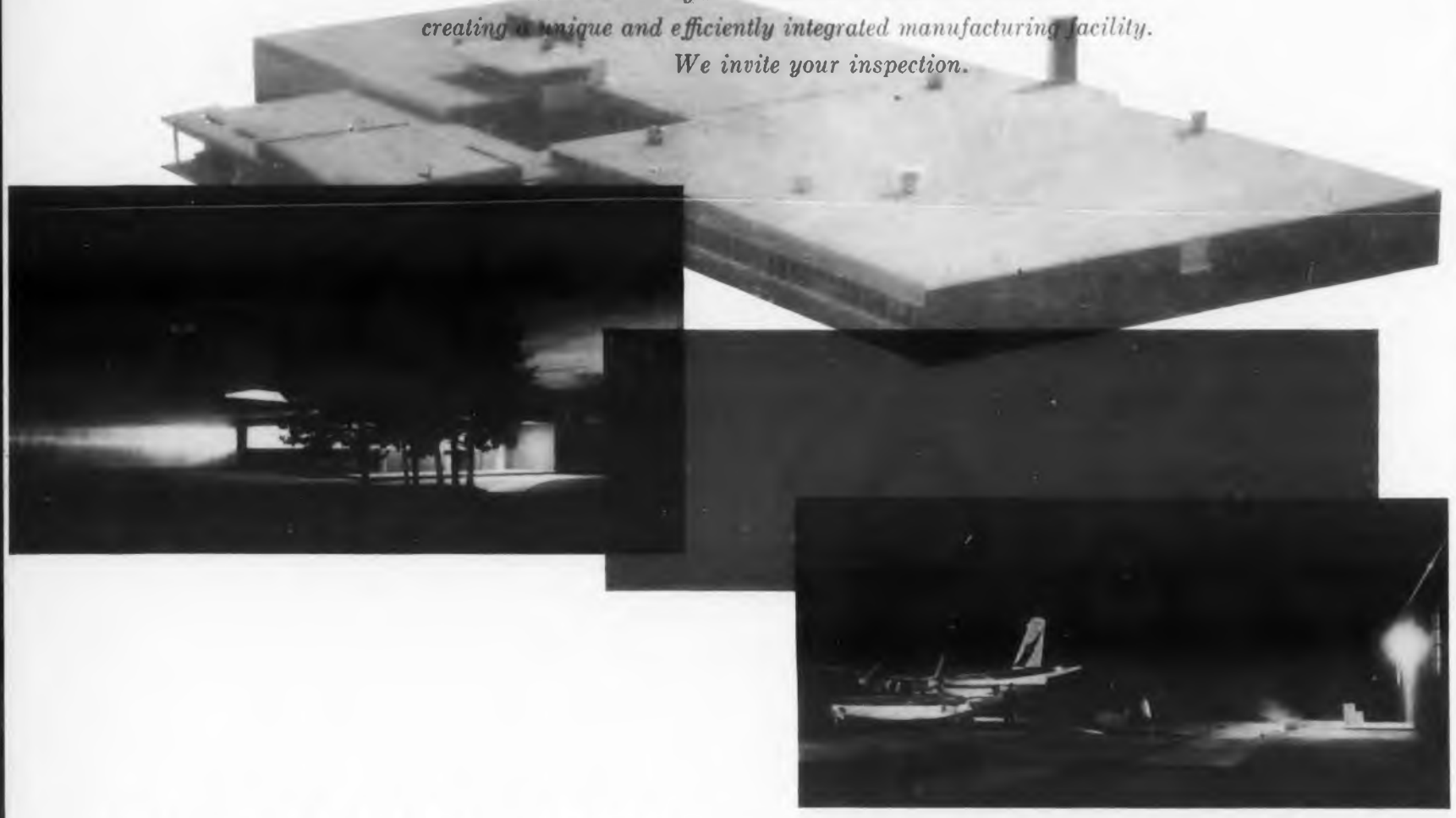
Comparison of Medalist and Standard Style

marion electrical instrument company

GRENIER FIELD, *New Hampshire's NEW Air-Industry Area*

Manchester, N. H., U. S. A.

Marion Medalist Meters,*
described on the reverse side . . . as well as
Ruggedized, Hermetically Sealed and other types of
Marion instruments for the electronics
and aviation industries — are now produced in this
modern plant. Providing an appropriate setting for
its outstanding products, Marion's new home combines advanced
architectural design with the most modern materials . . .
creating a unique and efficiently integrated manufacturing facility.
We invite your inspection.



M A R I O N E L E C T R I C A L I N S T R U M E N T C O M P A N Y

*Trademark Patents Pending

printing because of a lack of an alphabet. Composing machines such as the electrically-operated Photon which uses film images instead of metal type can be equipped with complete word forms when there is no alphabet. By a judicious choice of words an entire vocabulary such as Chinese can be stored in the machine. Since such words are written in an orderly sequence of strokes, machine operators often only need to start to compose a word. A built-in memory and binary system then predicts, after a few strokes what word is being formed and automatically selects it for reproduction. The Photon machine was developed by the Graphic Arts Research Foundation of Cambridge, Mass. MIT's group working on machine translation is interested in its applicability to translation work. The Vari-typer is made by Ralph C. Coxhead Corp., Newark, N. J.

Inductive Elevator Control . . . The new TVL electronic systems are being used to control the two-passenger elevators recently installed at four TV stations.

Developed by Union Switch & Signal—Division of Westinghouse Air Brake Co., Pittsburgh, Pa., the control in the system is accomplished by means of low frequency carrier wave on a signle, 3-conductor cable. The main advantage of this system over conventional wire control is that it enables the operator to stop at any level of the tower by simply pushing a button. Final limit switches located at both terminals can stop the car automatically.

The transmitter, placed in the elevator and operating at a frequency of 144kc, sends out tones of two different frequencies, one, controlling the ascent and the other, the descent. The receiver is installed at the lower end of the tower and, depending upon the direction of travel required, filters the signal and feeds it into relays which in turn control the operation of the elevator power supply.

ERMA, the Electronic Bookkeeper . . . ERMA—for Electronic Recording Machine, Accounting—is a revolutionary mechanical accounting machine capable of handling all bookkeeping details of up to 50,000 accounts daily, checking and rechecking each account automatically and with lightning speed. Where previously 50 bookkeepers have been required to handle that number of accounts, nine operators and ERMA will now perform the same work.

The device, developed for the Bank of America by Stanford Research Institute performs these operations: sorts checks and deposit slips and enters the amount instantaneously on each customer's account; rejects any check on which payment has been stopped or which would cause an overdraft; prepares and prints customers' monthly statements at the rate of 600 lines a minute.

The bank says happily that, arithmetically, ERMA cannot make a mistake.

Fee TV Stirs Opposition . . . Television servicing organizations have joined the fight against subscription TV. Associations of servicemen in Philadelphia and Cincinnati have passed resolutions denouncing fee TV because they will not have the opportunity to service the decoders required to unscramble subscription programs.

In the meanwhile, a new element has entered the controversy. Milton J. Shapp, President, Jerrold Electronics Corp., Philadelphia, Pa., supports fee TV, but suggests that it be brought into the home by cable.

Radar Movie Available Free . . . Information covering the causes of accidents involving radar-equipped ships is presented in a 20-minute sound film "Safe Passage". A recent study has determined that accidents involving radar-equipped ships may be caused by radar not turned on; radar not properly adjusted; improper action by operating personnel; and radar "hypnosis". Prints of the film illustrating these causes will be distributed for free showings to interested groups by Raytheon Manufacturing Co., Waltham, Mass.

Noise From Rain . . . Ice or snow particles dropping on aircraft speeding through the stratosphere have been found to set up pulses of current at the antenna terminals. Multiplied many times over, these pulses cause serious noise which impairs radio communication and navigation equipment.

This phenomenon, not previously understood, was discovered by Stanford Research Institute engineers in a study conducted recently in a unique, sub-zero wind tunnel.

Mechanization Can Avert Labor Shortage . . . The increasing use of mechanization will have to be stepped up more rapidly in the future if a serious labor shortage is to be averted Don G. Mitchell, chairman and president of Sylvania Electric Products Inc., said. In the electronics industry, Mr. Mitchell stated, mechanization already has prevented a labor shortage. He added that it was only through the use of automatic and semi-automatic equipment that the electronics industry exists at all.

Reactor to Test Atomic-Powered Aircraft . . . A $4,500,000 nuclear reactor to aid in development of an atomic airplane will be built by the National Advisory Committee for Aeronautics near Sandusky, Ohio. The reactor will be used to carry out research on problems of designing and building a nuclear powered aircraft. It will test both airframe and reactor-engine components.

Receiving Tube Sales Sets Record . . . The record sale of receiving tubes in August was broken again in September with a total of 47,588,000 sales, valued at $34,596,000. This represents an increase of over 2,000,000 tubes sold compared with the month of August and an increase of over $1,500,000 in comparision with August.

Cumulative sales reported by the RETMA for the first three quarters of with a manufacturers' value of $257-1955 were 347,668,000 receiving tubes 544,000 compared with 266,050,000 tubes worth $191,761,000 sold in the same 1954 period.

Aluminum for Zinc in Batteries . . . A development program with the objective of substituting aluminum for zinc in dry batteries is now in progress. The objective is a lower-cost battery with a longer shelf life. The Aluminum Co. of America, Pittsburgh, Pa., hopes to develop a new market for aluminum by producing such a battery. Alcoa iself has no plans for making bateries, but will make the results of its research available to battery manufacturers.

Patent Examiners Needed Immediately . . . There is an immediate need by the U. S. Patent Office, Washington, D. C. for engineers and scientists as Patent Examiners. The positions require a college degree in engineering or applied science or a college degree with a major in chemistry or or physics or with certain combined credits in these fields.

Starting salaries are $4345 per year and it is possible to reach $7570 in 5½ years. Vacations, sick leave, and pension benefits are liberal. For further information, contact the Commissioner of Patents, Washington, 25, D.C.

CIRCLE 15 ON READER-SERVICE CARD ➤

Luminescence Applied to Color TV Cameras . . . Research in luminescence—the conversion of energy other than heat into light—may speed up color TV camera development.

Scientists at the General Electric Research Laboratory in Schenectady, N. Y., have been exploring the possibilities of using the "flying spot scanner" design for color TV cameras. Although recently introduced in black and white TV to transmit images picked up from film, a lack of suitable phosphors has made this type of camera inapplicable to color transmission.

FM Broadcasts to Stores . . . Two FM radio stations have been licensed by the FCC to sell their programs to banks, drug stores, restaurants, and other commercial establishments as a sideline. The stations are WPEN-FM in Philadelphia, Pa., and WWDC-FM in Washington, D. C. According to the licenses, the stations will supply their regular programs to their customers with the advertisements dropped out. This new licensing program may help promote the growth of F-M in the United States.

Transistors Sealed by Cold Welding . . . Transistors and other semi-conductor devices are being hermetically sealed in metal containers by a cold welding process known as "Koldweld" since transistors, especially those made of germanium, are sensitive to heat. This process offers some advantages. In addition, sealing can be carried out in an alert atmosphere such as dry nitrogen.

Life tests of units produced by this technique have been very encouraging according to the General Electric Co., Ltd., of England. The process is available for licensing from Koldweld Corp., 10 East 40th St., New York 16, N. Y.

Electronic Reactor Simulator . . . A portable electronic nuclear reactor simulator for teaching purposes has been developed. The simulator, which employs an analog computer, is of sufficient accuracy for teaching. It was reported at the Nuclear Engineering and Science Congress now in progress (December 12-16) by L. Orr, W. Kerr, and H. J. Gomberg of the University of Michigan.

An important advantage of the computer in the simulator is that as the operator observes solutions developing an intuitive "feel" for system performance is developed. This "feel" may be much more difficult to acquire from a purely analytical treatment.

World Energy Community . . . A "world energy community" to develop cooperatively the forces of atomic fission and applied solar energy and later atomic fusion has been proposed by J. J. Hopkins, chairman and president of General Dynamics Corp. In an address to the World Symposium on Applied Solar Energy in Phoenix, Ariz., Mr. Hopkins proposed that all the nations of the world put into effect "a mutilateral, multipurpose, multidynamic program utilizing atomic fission, applied solar energy, and atomic fusion to balance in a master concept the world's economic needs with the world's means to fill those needs". To get his new project started, Mr. Hopkins urged that in 1957 a world energy congress, open to all nations, be organized under the auspices of the United Nations. The congress, he suggested, might be held at New Delhi or Tokyo, or sponsored jointly by India and Japan.

Speaker Operates on Ionized Air . . . A loudspeaker that utilizes ionized air instead of a vibrating membrane has been developed in Germany by a physicist named S. Klein. Known as the "Ionophone", the new type of speaker has a frequency range of 1 to over 20kc. It is a development of Telefunken Co., Hanover, Germany, according to their American representatives, American Elite Co., 7 Park Ave., New York, N. Y. In operation the ionized air is excited by a high voltage electrical field produced by a Tessla transformer. The ions are produced inside a quartz tube.

To date the new type of speaker has only been used in large experimental installations. The price is too high now for commercial production.

"How-to-Think" Programs Stressed . . . Management is now placing greater importance on "how-to-think" courses in contrast to "how-to-do" teaching in its industrial education program. This development was brought out by Arthur C. Studt, Hotpoint Co., Chicago, Ill., in an address at the recent American Management Association special conference. Mr. Studt also stated that the development of people is the greatest single problem of industry.

At the same conference, Frank P. Melograno, Hughes Aircraft Co., Culver City, Calif., revealed that his firm considers the number of technical papers read and published by each engineer when deciding on salary increases. Mr. Melograno also revealed that the turnover ratio for engineers is much lower than among other employees.

Getting Along With Tech Writers . . . Engineers do not get necessary credit for helping tech writers prepare handbooks according to engineer-speakers at a meeting of the Society of Technical Writers and Editors, 2 East 63 St., N. Y. C. The meeting's topic was, "How to Interview an Engineer for Technical Information". It was also stated that engineers are blamed if interruptions by technical writers cause their assigned projects to fall behind schedule.

The clear solution, according to experienced engineers, is that chief engineers, or management, must allocate engineering time for working with technical writers. This conclusion was buttressed by heads of technical writing firms, who insist on working from top management down so that all realize how much, and when, engineering time is needed. Most good cost analyses for equipment involving handbooks include liaison time engineers must give the writer. Some analyses also allow for technical writing time chargeable to engineering, since writers frequently detect errors on schematics and often can suggest engineering changes to simplify maintenance.

Industry trend is to use tech writing specialists rather than engineers for writing tasks. Most engineers do a poor job of writing (about one out of three is very inept in written communication according to one speaker, who formerly taught writing to engineering students) and are therefore more valuable on strictly engineering jobs. Also, instruction books for the military must conform to any one of several hundred specifications, and a specialist is necessary to produce the proper manual on schedule.

New Transistor Uses . . . The first transistorized portable electroencephalograph has been introduced by Offner Electronics, Chicago, Ill. The new unit is only a tenth the size of laboratory models. It has channels for recording eight signals from the brain simultaneously, and exceeds the sensitivity and accuracy of many larger models now in use.

An ultrasonic control system for torpedoes now uses transistors instead of tubes. Developed by Westinghouse Research Laboratories, Pittsburgh, Pa., the fully transistorized system is simple and compact, needs no warm-up time, and can operate directly on the low voltage of the torpedo battery.

Electronic Waiter . . . Following our recent suggestion (ELECTRONIC DESIGN, *October, 1955, p. 15*) that an electronic waiter is needed, a reader has outlined a possible avenue of development. Rather than taking the form of a robot, the engineer suggested a conveyor belt system moving on a level below that of the restaurant floor. A small one-foot-square elevator would lift the food from the conveyor to the table center.

The customer would receive a complete menu and a pencil with electroconductive lead on entering the restaurant. He would select his meal by marking boxes next to his food choices, including degree of

cooking such as rare, medium, or well done. The menu would be dropped into a slot in the table where it would be read. Its instructions would be fed to a computer, which would signal the proper food-preparation stations, and program the food courses.

The computer would know when to send the next course either by receiving a push-button signal from the guest or when the guest piles the empty dishes from the previous course on the elevator.

The computer would total the check and either send it to the guest or directly to the cashier. If the customer has a dinner's club charge plate, then the previous step could be eliminated, and the bill sent to a central billing agency.

The subject of electronic waiters is not new. Our own Jim Lippke described an electronic restaurant without waiters way back in the October, 1948 *Popular Science* (*pp. 156 and 157*). His arrangement called for a push-button menu selector on each table. When a customer pushes a button for a particular dish, the pre-cooked frozen dish is removed from a refrigerator and heated up in a radar stove. It is then dispatched to the correct table via conveyor belts running in the wall next to the tables.

Electronic Testing Done by Blind . . . A new ultra-sensitive electronic sound gauge enables blind employees to successfully carry out precision testing of close tolerance production parts. The sound gauge, used by Burroughs Corp., Detroit, Mich., is connected by cable to an amplifier. Production parts are inserted into a measuring anvil, and a thickness reading is taken electronically with the reading being transformed into a sound tone.

The operator, wearing a head phone, hears a low pitched tone for parts under the required thickness and a high pitched tone for those parts over the required thickness. Parts meeting the requirements produce no tone at all.

Hi-Fi TV Sound Tuner

Just plug this unit in, tune it to any VHF TV channel, and then sit back and enjoy HI-Fi audio, played right through the TV set.

The Model 55 TV Sound Tuner, manufactured by the Rauland-Borg Corporation, is designed for use with their "Golden Ensemble" television system.

Does Anyone Know?

Is the lack of a certain circuit, component, instrument, or material delaying your design project? Do you believe that some design laboratory is capable of producing a special component? Is your list of suppliers of certain components incomplete? Prepare your specifications or needs in less than 150 words, typewritten on company letterhead stationery, and send them to Does Anyone Know?, ELECTRONIC DESIGN, *19 East 62nd St., New York 21, N. Y. Include a name and address where our readers can communicate with you. If a sketch is necessary, please draw in black ink on white paper (no ozalids). The following requests were recently received. If you can supply any of these requests, please write to the address given.*

Wire Contact Relay: Require names of manufacturers of wire contact relays for commercial use. The relay should be a small plug-in type. The wire contacts need not make or break more than 1/4amp at 48v, d-c, inductive.

Write to: Bernard Silverman, Friden Calculating Machine Co., Inc., San Leandro, Calif.

Glass-Filled Teflon Sheets . . . Design information on such sheets for terminal-board applications.

Write to: A. Henderson, Div. 51, U. S. Naval Ordnance Laboratory, Corona, Calif.

Transformers: The names of firms that manufacture transformers used to couple power to a rotating structure—used in place of slip rings. For use at either 115v or 230v. Capacity of about 3000w.

Write to: R. D. Egan, Research Assistant, Stanford Univ., Radio Propagation Laboratory, Stanford, Calif.

Problem Solved: The following letter shows that electronic design engineers are willing to help each other—if they know each other's needs.

Dear Editor:

Recently I utilized your "Bulletin Board" to locate a type of vacuum tube that was required in my work. I am sure that you will be pleased to learn that the first day I received my copy of ELECTRONIC DESIGN containing my request for data, six of your readers phoned to supply the necessary information. I received a letter the following day with the same information. This response was overwhelming. Thanks for your help and for offering this valuable service to electronic design engineers. *Dr. Byron St. Clair, Chief Engineer, Waveforms, Inc., 333 Sixth Ave., New York, N. Y.*

Meetings

Dec. 28-30: *Conference on Low Temperature Physics and Chemistry,* Louisiana State University, Baton Rouge, La. Sponsored by the National Science Foundation and Louisiana State University. Topics for discussion will include liquid and solid helium, superconductivity, ionic and nuclear paramagnetism and magnetic cooling, electronic and thermal properties of metals at low temperatures. Those wishing to attend should write to Dr. J. M. Reynolds, Dept. of Physics, Louisiana State University, Baton Rouge, La.

Jan. 9-10, 1956: *Second National Symposium on Reliability and Quality Control in Electronics,* Hotel Statler, Washington, D. C. Sponsored by the Professional Group on Reliability and Quality Control of the IRE, American Society for Quality Control, and RETMA. Of particular interest to electronic designers are sessions on "Quality Control and Automation"; "Advances in Tube Reliability"; "Controlling Relay Characteristics"; and "Reliable Capacitors". For information, write to IRE, 1 E. 79th St., New York, N. Y.

Jan. 16-18, 1956: *Conference on The Practical Utilization of Recorded Knowledge—Present and Future,* Western Reserve University, Cleveland, Ohio. The conference will discuss problems in the processing, dissemination, and utilization of the increasing volume of recorded information in such fields as chemistry, physics, patents, etc. A series of papers is being prepared to summarize the "state of the art". For information, write to Dean Jesse H. Shera, School of Library Science, Western Reserve University, Cleveland 6, Ohio.

Jan. 30-Feb. 3: *AIEE Winter General Meeting,* Hotels Statler and Governor Clinton, New York, N. Y. Approximately 380 papers and 95 technical sessions are scheduled. Most of the 43 technical committees will sponsor sessions. For information, write to AIEE, 33 W. 39th St., New York 18, N. Y.

Feb. 2-3, 1956: *Symposium on Microwave Techniques,* University of Pennsylvania, Philadelphia, Pa. Sponsored by the IRE Professional Groups on Microwave Theory and Techniques and Antennas and Propagation and the Philadelphia Section of the IRE. Sessions are planned on radiating systems, guided microwave transmission, components, propagation, and measurements. For information, write to IRE, 1 E. 79th St., New York, N. Y.

Feb. 16-17: *Conference on Transistor Circuits,* Irvine Auditorium and University Museum Auditorium, University of Pennsylvania, Philadelphia, Pa. Sponsored by the Professional Group on Circuit Theory of the IRE, Science and Electronics Div. of AIEE, and the University of Pennsylvania. Papers will deal with linear and pulse circuit techniques. For information, write to J. D. Chapline, Research Div., Philco Corp., Tioga & C Sts., Philadelphia, Pa.

Feb. 27-29: *Symposium on Microwave Crystal Rectifiers and Their Application,* Hexacon Building, Signal Corps Engineering Laboratories, Fort Monmouth, N. J. Sponsored by the Office of the Assistant Secretary of Defense, Advisory Group on Electron Tubes, Working Group on Seimconductor Devices. The primary purpose of the meeting is the exchange of technical information relating to the microwave crystal rectifier among the system and application engineers, the microwave crystal rectifier manufacturers, and the research and development engineers. The relationship between the design of the radar and countermeasures systems and the microwave crystal rectifier will be emphasized. For information, write to W. G. Matthei, Evans Signal Laboratory, Belmar, N. J.

Feb. 28-29: *Fifth Scintillation Counter Symposium,* Shoreham Hotel, Washington, D. C. Sponsored by the AIEE, IRE, and National Bureau of Standards. Topics tentatively selected for discussion are Multipliers and Circuitry, Scintillation, Spectroscopy, and Particle Identification, and Special Problems and Techniques. For information, write to IRE, 1 E. 79th St., New York, N. Y.

March 19-22: *IRE National Convention and Radio Engineering Show,* Waldorf-Astoria Hotel and Kingsbridge Armory and Palace, New York, N. Y. Sessions are planned on twenty-three technical subjects and the program and exhibits will follow those of previous years. For information on exhibits, contact W. C. Copp, IRE Advertising Dept., 1475 Broadway, New York 36, N. Y. For other information, write to IRE, 1 E. 79th St., New York, N. Y.

April 5-6: *Conference on Magnetic Amplifiers,* Hotel Syracuse, Syracuse, N. Y. Co-sponsored by the AIEE Committee on Magnetic Amplifiers, the IRE Professional Group on Industrial Electronics, and the Central New York Section of the Instrument Society of America. Special technical papers on the theory and application of magnetic amplifiers. Fifty companies will have exhibits. Those interested in presenting a paper should submit a 200-word summary to Paul Schmidt, Chairman, Technical Program

Committee, 3A-104 Bell Telephone Laboratories, Whippany, N. J., by December 31, 1955. For information, write to C. F. Spitzer, General Electric Co., Building 3, Syracuse, N. Y.

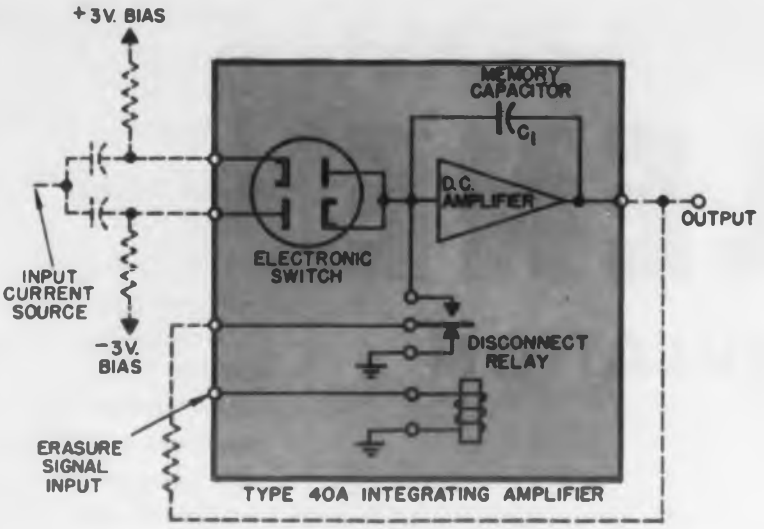
April 10-12: *Twelfth Annual Meeting and Metal Powder Show,* Hotel Cleveland, Cleveland, Ohio. Sponsored by Metal Powder Association. The meeting will emphasize the manufacture of structural parts from metal powders, self-lubricating bearings, iron powder electronic cores, and ferrites. The show will display developments of powder suppliers, parts manufacturers, and press, furnace, and other equipment manufacturers. For information, write to Metal Powder Association, 420 Lexington Ave., New York 17, N. Y.

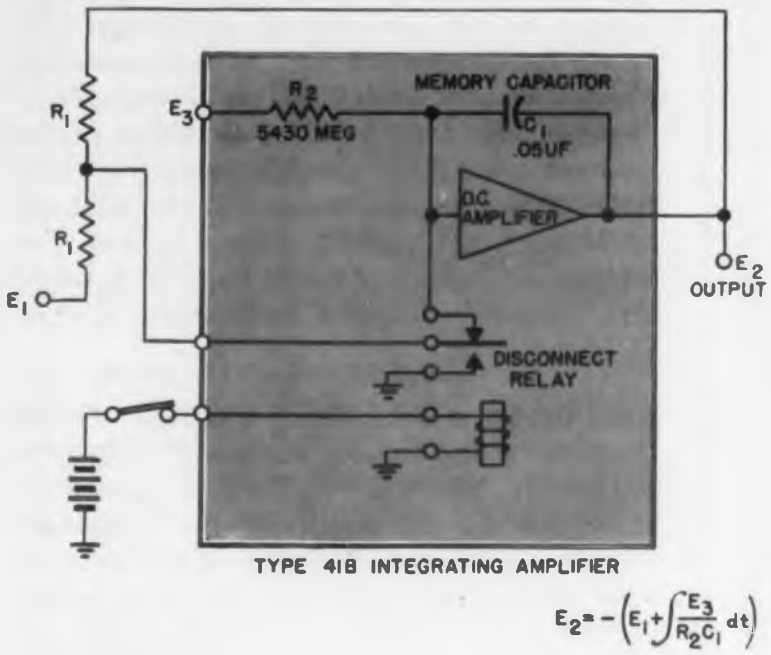
April 18-20: *National Industrial Research Conference,* Illinois Institute of Technology, Chicago, Ill. Sponsored by Armour Research Foundation of Illinois Institute of Technology. "Research for Profit" will be the theme of the conference and the program is designed to guide industry in the administration of more profitable research. Twelve papers will be presented. For information, write to Armour Research Foundation, Illinois Institute of Technology, Chicago. Ill.

April 25-27: *Symposium on Nonlinear Circuit Analysis II,* Engineering Societies Building, 33 W. 39th St., New York, N. Y. Sponsored by the Microwave Research Institute of the Polytechnic Institute of Brooklyn. The program will consider basic methods and recent advances in the analysis and design of nonlinear networks and will emphasize the use of nonlinear network theory in the study of oscillators, switching and discontinuous systems, and nonlinear systems with random inputs. An exposition of the fundamental mathematical methods of analysis will be correlated with applications in such fields as automatic control where specific practical systems illustrate such nonlinear phenomena as subharmonic generation, parametric damping, jump resonance, and stabilized oscillation. For information, write to Polytechnic Institute of Brooklyn, Microwave Research Institute, 55 Johnson St., Brooklyn 1, N. Y.

June 11-15: *Seventh National Plastics Exposition,* Coliseum, New York, N. Y. Sponsored by The Society of the Plastics Industry, Inc. Approximately 250 companies are expected to exhibit products, techniques, materials, machinery, and services. A technical conference will run concurrently with the show. For information, write to The Society of the Plastics Industry, Inc., 67 W. 44th St., New York, N. Y.

Fig. 1. This is one form of the basic amplifier, to which many variations can be made.





$$E_2 = -\left(E_1 + \int \frac{E_3}{R_2 C_1}\, dt\right)$$

Fig. 2. In this circuit the amplifier is used as a voltage integrator.

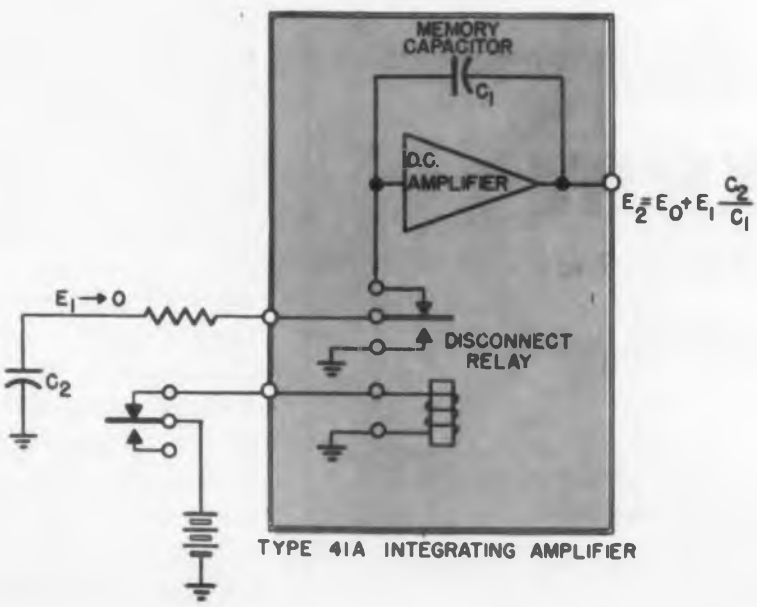


Fig. 3. An incremental charge is being inserted into an amplifier.

Using an Electronic Analog Memory

Richard N. Close and George O. Thogersen
Airborne Instruments Laboratory, Inc., Mineola, New York

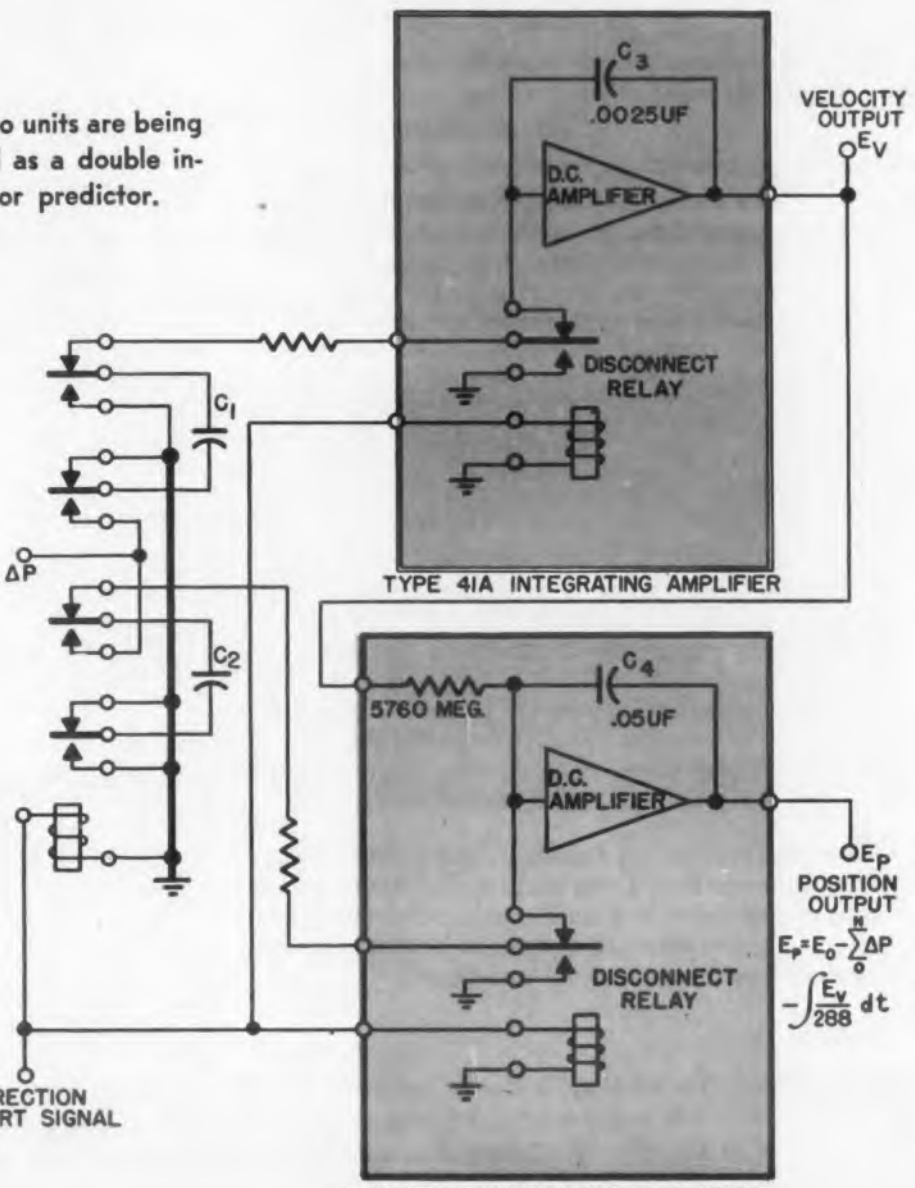


Fig. 4. Two units are being employed as a double integrator or predictor.

LONG-TERM memory applications in precision analog computers and tracking systems can be filled by the relatively compact and inexpensive electronic integrating amplifier discussed here. One or more of these amplifiers can replace bulky and expensive servomechanisms having mechanical ball-and-disc integrators and very much slower response times. The circuit diagram and technical specifications of this device were given in a previous article*.

The basic amplifier is designed for integration and storage of very short or random sequence pulses and accepts charge through an electronic switch keyed on by the signal to be stored, as shown in Fig. 1. It finds its principal use in the integration and storage of radar video pulses or pulse inputs from high speed computers. The response time for input pulse charging is very short—the full output voltage of ±100v can be developed across the 0.05μfd feedback capacitor in less than one half millisecond. Small corrections to the stored charge can be made in one or two microseconds. Once stored the charge will remain for long periods of time. Incidental discharge rate is less than 40mv per minute for the basic type.

One variation is designed for storage and integration of signals whose properties are such that they may be introduced through a disconnect relay operated by an external control signal. It is identical to the basic type, except that the electronic switch consisting of a pair of back-biased diodes has been removed. Incidental discharge rate is twice as good, being less than 20mv/min for the modified version.

Both types are available with an additional input for providing continuous and precise integration of an externally applied voltage. This input converts the applied voltage (which is usually in the order of ±50v) into an input charging current which flows through the charging resistor R (which is usually of the order of 1 to 30 billion ohms). The standard integrating time constant supplied is 288sec ±2%. The units are available with a variety of storage capacitor values ranging from 0.0025μfd to 0.1μfd and continuous integration input resistors up to 30,000 megohms.

An application in which an amplifier is used as a voltage integrater is shown in Fig. 2. It is being set to an initial value by converting it momentarily to an operational summing amplifier. When the relay is deenergized, the output voltage that is initially the negative of E_1 begins to change at the rate of E_3/R_2C_1.

Inserting an incremental charge into an integrating amplifier by the charge exchange method is shown in Fig. 3. An external capacitor C_2 is charged to an initial value E_1 and then removed from its charging source and connected between the input of the integrating amplifier and ground. Because the input of the integrating amplifier is maintained at a virtual ground by feedback action, all of the charge will be removed from the external capacitor C_2 and transferred to the integrating capacitor C_1, where it will produce a voltage increment

$$E = E_1 C_2/C_1.$$

A double integrator or predictor in a rate aided tracking system is shown in Fig. 4. An 0.0025μfd capacitor is used in the velocity memory so that the sensitivity for velocity correction will be 20 times greater than that for position correction. The correction applied to the velocity memory must be of opposite polarity to that applied to the position memory in order for the tracking loop to be stable. This is accomplished by connecting capacitor C_1 to C_3 in the inverse sense to that in which C_2 is connected to C_4. The equation of the tracking loop is:

$$velocity\ correction\ (\Delta V) = position\ correction\ (\Delta P)/\Delta T$$

where T is the correction interval.

A signal amplitude memory is illustrated in Fig. 5. The integrator is used as the output element in a feedback loop which continuously reproduces an input signal. When the feedback loop is broken at sometime, T_1, the integrator will store for future readout the input signal amplitude existing at that time. The time gated bias signal breaks the feedback loop by biasing the diode elements beyond cutoff. The amplifier (A) amplifies the error signal resulting from the comparison of the integrator output with the signal input. Using this technique sawtooth waveform voltages have been sampled with an accuracy corresponding to ±1 microsec of time or ±0.1% of full sawtooth amplitude (100v).

* "Operational Amplifier", ELECTRONIC DESIGN, August, 1955, pp 28 to 29.

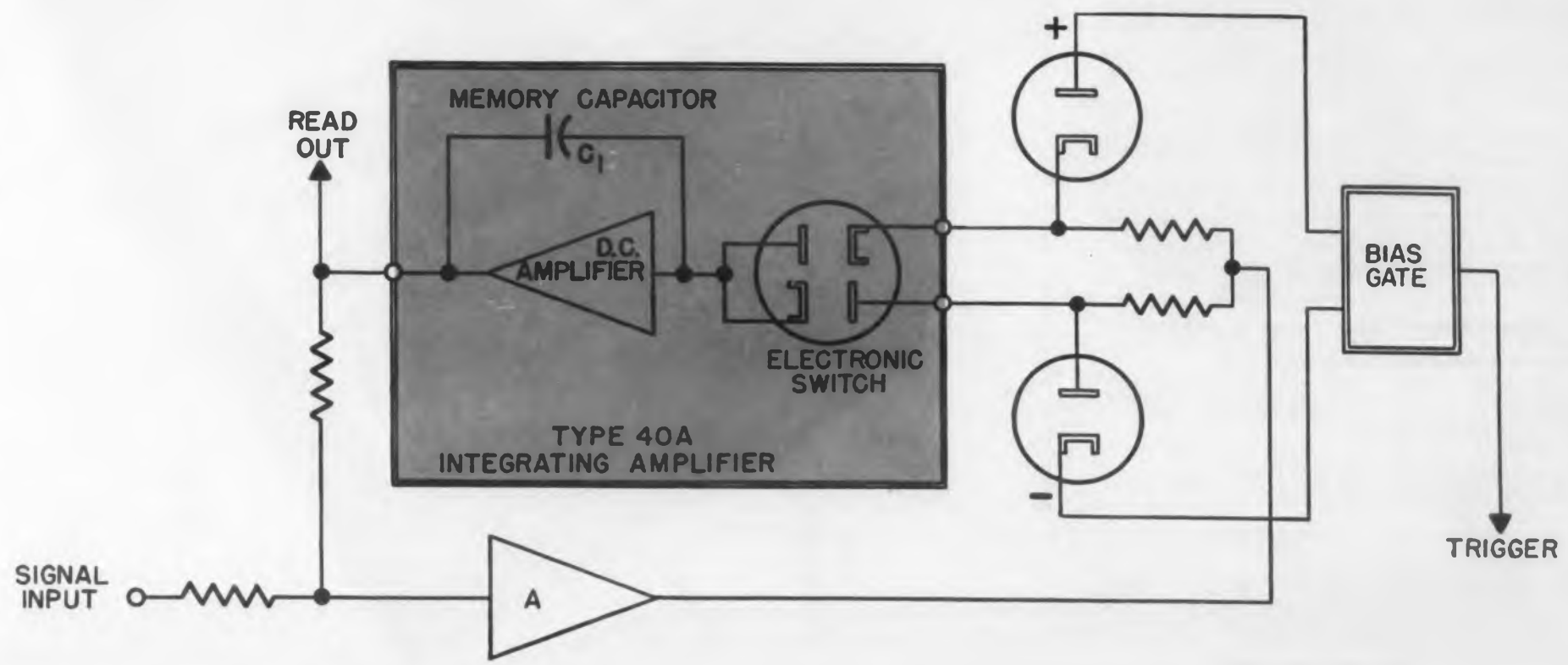
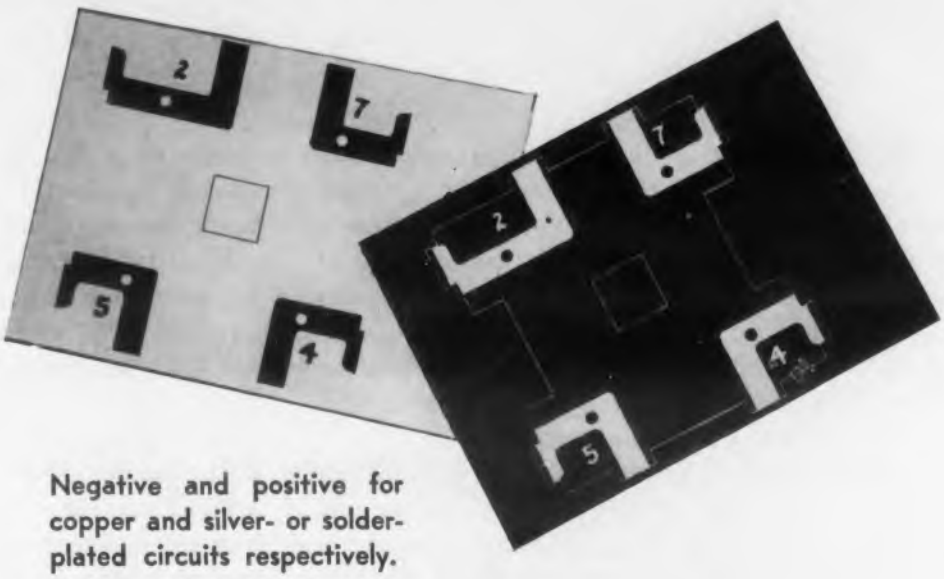
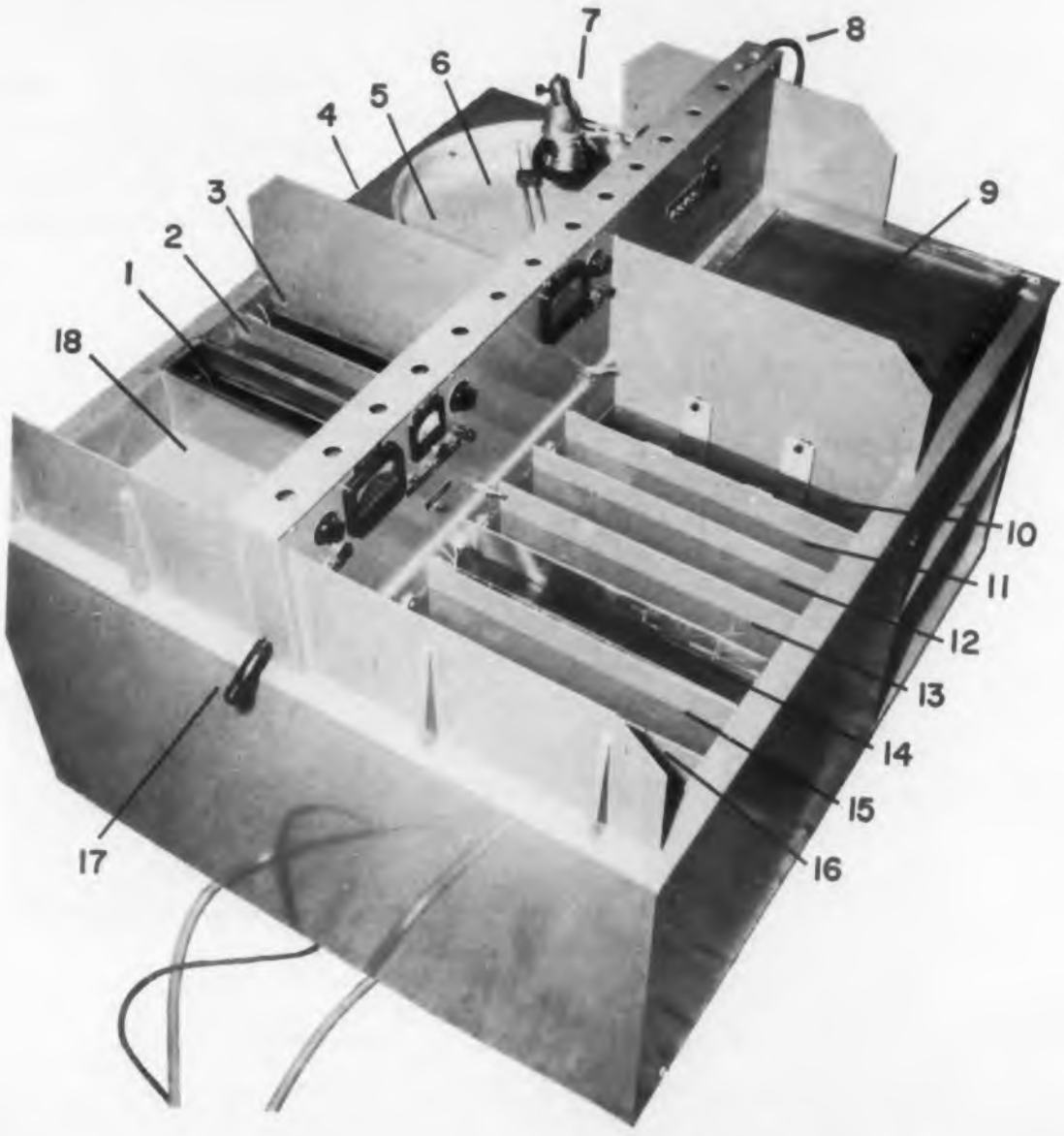


Fig. 5. In this signal amplitude memory, the amplifier is used as the output in a feedback loop.



Negative and positive for copper and silver- or solder-plated circuits respectively.

Printed Circuit Machine



CONTAINING all facilities for producing printed circuits, this unit makes it easy to change the design while developing prototypes. Heretofore, experimental printed circuit boards have been obtained mostly from production suppliers as only these people had the necessary relatively-expensive equipment. For this reason, design changes, however small, involved a loss of valuable time and consequently precluded desirable design flexibleness. Optimum design can be achieved with this unit in the laboratory.

Built into a single housing which conceals all piping and wiring, the Protomaka, manufactured by Printed Electronics Corp., Natick, Mass., is 60″ long, 50″ wide, and 45″ high. It requires a single-phase 115v, 15amp, power source, a hose connection to a cold water faucet, and a drain for the waste hose line.

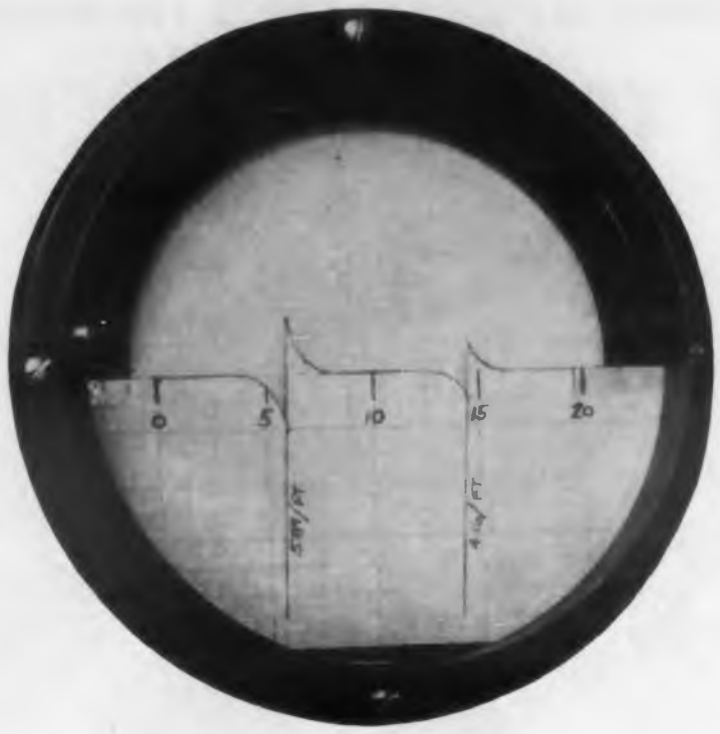
Copper-clad insulating material up to 12″ by 16″ can be processed by mounting to the whirler table. Centrifugal force thus smoothes out the photosensitive material (resist) coatings. The resist is dried by a red lamp as the plate rotates.

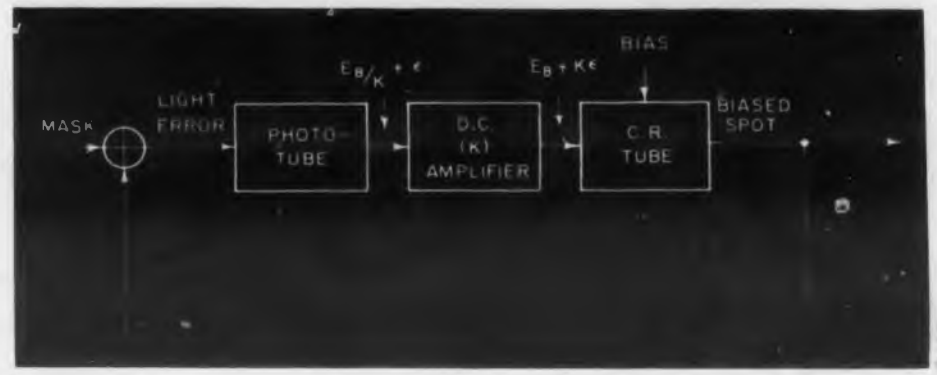
A vacuum-frame top on the self-contained light table assures perfect contact between the negative and circuit board during exposure. Development, or fixing, takes place in the developing tank. Rinsing tanks are located next to developing and etching tanks.

Printed circuit wiring with silver plating or solder plating may be obtained by using the usual positive transparency. Appropriate cleaning, neutralizing, and rinsing tanks, as well as electro plating equipment, is included.

Each operation is regulated by controls conveniently placed immediately above its particular section. The air compressor, vacuum pump, electrolytic current sources, etc., are all inside the cabinet. For more information, turn to the Reader's Service Card and circle number **23.**

1. Copper, solder resist etching solution
2. Overflow rinse
3. Copper, silver resist etching solution
4. Overflow rinse
5. Developer
6. Centrifugal resist coater
7. Infrared heat lamp
8. Compressed air gun
9. Black light exposure, light table and vacuum frame
10. Lead-tin plating chamber
11. Overflow rinse
12. Acid chamber
13. Overflow rinse
14. Alkali chamber
15. Overflow rinse
16. Silver plating chamber
17. Water spray nozzle
18. Sink

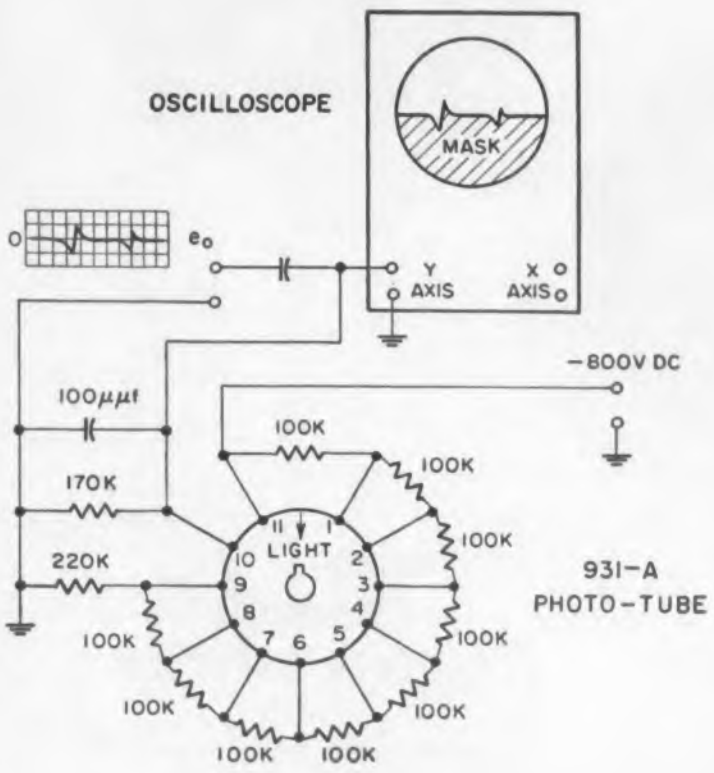




Block diagram of the theoretical control loop.

How to Make a Function Generator

Charles A. Belsterling, Research Engineer
Franklin Institute, Philadelphia, Pa.



BASED on the well-known principles of the photo-former, the function generator described in this article can be assembled from equipment commonly found in the design and development laboratory. This generator will produce voltage waveforms as a single or multiple valued arbitrary function of a linear time sweep or a controlled variable voltage.

The photo-former is essentially a closed-position feedback loop containing an amplifier, a cathode-ray tube, a mask for the tube, and a phototube. The vertical position of the spot on the cathode-ray tube is the output unit. The input is the reference mask, and the phototube measures the error between output position and the mask by sensing the amount of light showing from behind the mask. The output voltage of the phototube is amplified and fed back negatively to correct for the error and force the spot to hold a vertical position on the edge of the mask. The circuit of the generator is shown at the left.

To avoid the necessity of push-pull output of the phototube and minimize errors due to light dynamics, it was made to operate in the loop single-ended by the addition of a constant positive voltage to bias the spot above the mask. Then the phototube must supply a voltage proportional to this bias in addition to the voltage representing spot error. The latter (which is a function of light dynamics) can be made very small compared with the magnitude of the bias. Thus the instantaneous bias, which is the voltage representing the vertical distance from a reference line to the mask is the unit of interest. If the spot is swept horizontally across the cathode-ray tube face, it is forced to follow the top edge of the mask and the phototube output is a voltage proportional to the vertical distance from a reference line and the edge of the mask or a voltage waveform which is a direct reflection of the mask. The theoretical control loop is shown in the block diagram.

Any oscilloscope with good d-c amplifiers contains all the components for operation and control except the phototube and its high-voltage power supply. Frequently the analog computer or other apparatus that this generator would operate with will provide the necessary −800v d-c. In this case, the only construction required is to mount a 931-A photo-multiplier tube in a conventional camera hood to expose the light-sensitive side of the tube about nine inches from the cathode-ray tube face. The output of the phototube is degeneratively connected to the Y-input terminals of the oscilloscope and the output voltage is taken off at this point through a blocking capacitor.

The required controls are all present on the panel of the oscilloscope to produce time-varying waveforms of almost any shape by using the internal

The mounting frame at the right holds the photo-tube over the scope face.

saw-tooth sweep generator to drive the spot horizontally and the Y-position control to introduce the vertical bias. When used in conjunction with oscilloscope displays on an analog computer, the sweeps of the display and function generating units can be common for synchronism. To produce any linear time-varying periodic function, it is only necessary to cut a cardboard template of the proper shape and attach it to the face of the cathode-ray tube. Only the wave-form is important because magnitudes can be adjusted through a variable-gain amplifier.

Other functions can be generated simply by applying a voltage representing one variable on the X terminals of the oscilloscope and mounting a mask representing the relationship of Y to X on the face of the cathode-ray tube.

The time lags of the control loop must be minimized in order to have good high-speed following and to prevent instability. A short-persistance phosphor or optical filter should be used on the cathode-ray tube. Cabling capacitances must be kept low. The band width of the oscilloscope amplifiers should be wide.

The writer believes that further analysis and compensation of the loop would improve the following ability of the generator. The addition of a decoupling output stage to the scope would prevent loading of the Y-axis amplifiers and allow for scale adjustment.

time on our hands

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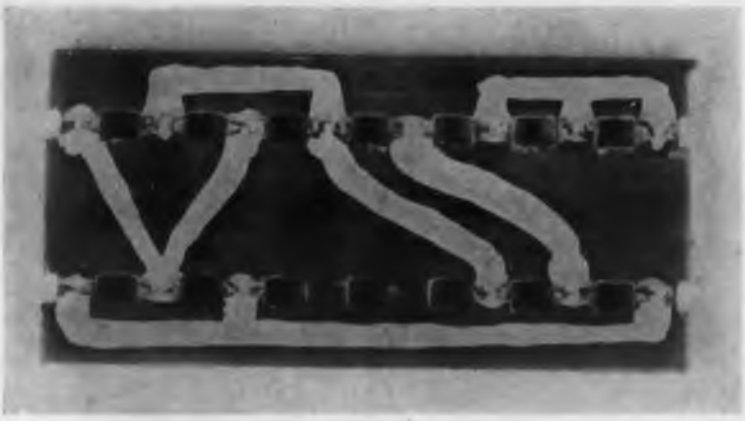
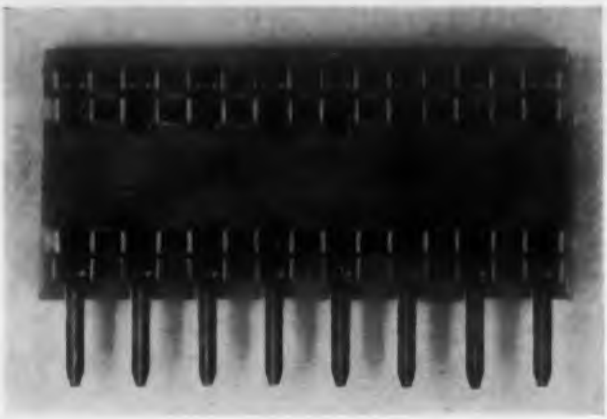
444 *TRADEMARK

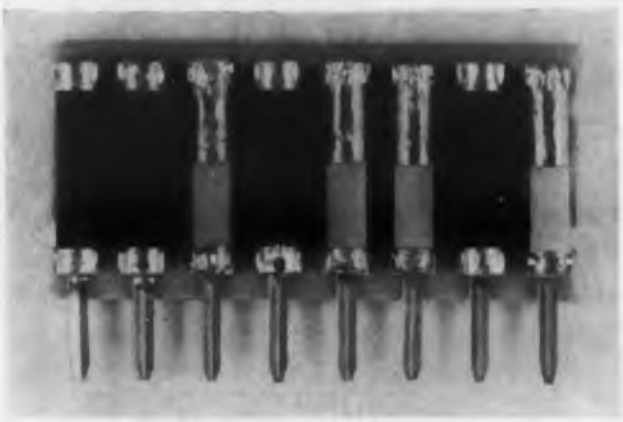
CIRCLE 25 ON READER-SERVICE CARD FOR MORE INFORMATION



The printed circuit on the phenolic board is made by the "embossed" process.

Mounting clips and terminals are inserted in the board automatically.





After the components are automatically inserted, they are dip-soldered to the clips.

An encapsulated subcircuit. Another type of encapsulation is shown above.

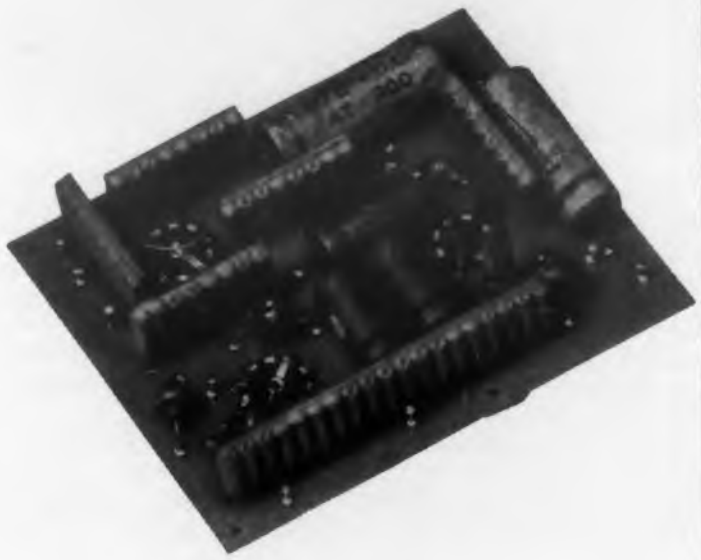
One form of the modular sub-circuits containing 10 components.

Modular Sub-Circuits

ANOTHER type of modular sub-circuit for use with printed circuits has been developed. These units lend themselves to automatic insertion, and could lead to considerable savings in the manufacture of easily serviced printed circuits. Up to 92 specified components can be interconnected and encased in plastic as illustrated. The cost of the units is about the same as that of the components they would replace.

The units, known as "PAC-s", are automatically assembled and manufactured themselves. This is an important point, since they are not made in stock circuits for "off-the-shelf" sales. They are available from Erie Resistor Corp., 640 West 12 St., Erie, Pa. They are presently assembled with cylindrical resistors and capacitors that this firm has been manufacturing for a number of years. However, diodes, or even transistors, with the proper configuration for insertion in the component-mounting clips, could be included.

The units are assembled around strips of XXXP phenolic with the proper printed-circuit conductors already applied by the "embossed" technique. The mounting clips and terminal pins are next assembled into the square holes in the phenolic. After the components are inserted in the proper clips, they are dip-soldered. Then the entire assembly is



A number of the units have been employed in this printed circuit.

encased in an alkyd plastic. The alkyd is light-brown in color, but dyes could be added for color coating. The actual circuit of the PAC is printed on the outside of the unit. At present, the manufacturer is concentrating on 1.6″ long units containing eight components, but types up to 18″ long containing 92 components could be made. For the longer versions, separate sub-circuits could be included in the same package.

Half-watt resistors with values from 5 ohms to 5 megohms in tolerances from ±5 % to ±20% are available. The capacitance values range from 1$\mu\mu$fd to 5010$\mu\mu$fd. If these units are to be automatically inserted in a printed circuit, a key can be included along one side of the body for proper orientation.

The body is strong enough to stand the rough handling of hopper feeding in insertion machinery. When hand insertion is used, savings result from inserting a number of components at once instead of one by one.

Since these units can stick up into previously unused space around a vertically mounted tube, the space occupied by a printed circuit can be reduced. The usual advantages of modular construction such as servicing, modification and ease of assembly are gained with these units. For more data, turn to Reader Service Card and circle **26.**

Index of 1955 Articles

January

Designing with Pulses, by A. Fitzpatrick (p 20) Methods of testing various components and checking the characteristics of equipment with pulses are described and illustrated.

Audio Goes "Flat" (p 24) This "Design Forum" article discusses a number of combined preamplifier-amplifier-power supply units that were marketed after the first article noting this trend was published (ED, August, 1954). A table of comparative tubes is included.

Multi-Tube Oscillograph (p 28) Eight dual-gun cathode-ray tubes are incorporated in this 16-channel oscillograph. (Wm. Miller Instruments).

Low Output Impedance Transducer (p 30) In many servo systems this device does not require impedance-matching amplifiers. (Perkin-Elmer Corp.).

High Capacity Magnetic Memory (p 32) Reversing the usual arrangement, this memory has the leads moving past a sheet of tape. (Clevite-Brush Development Co.).

Printed Circuit TV Chassis (p 34) Nine plug-in printed circuit boards contain most of the circuitry in this "Design Forum" TV receiver.

Long-Life Tubes (p 36) This line of tubes is guaranteed for 10,000 hours of life (Amperex Electronic Corp.).

Ternary Counter (p 38) Sequential gate control and frequency division are two uses for these two tube plug-in units. (Walkirt Co.).

Printed Circuit Design: 5—Applications, by G. Maisch (p 40) A dozen unusual applications of printed circuitry are illustrated and discussed in the last section of a five-part series.

Power Transistors (p 44) Five types of transistors, three with collector current limits of 800ma are discussed. (Minneapolis-Honeywell Regulator Corp.).

Experimental Encapsulation Technique, by G. Quayle, S. Hubelbank (p 46) A technique for protecting transistors against heat damage during encapsulation.

Miniature AM-FM Radio (p 48) The construction of a tiny radio that receives either a-m or f-m signals is discussed in a "Design Forum" piece.

Tube Tester (p 50) This instrument indicates instantaneous shorts between tube elements (Rheem Mfg. Co.).

February

Human Engineered Oscilloscope Panel, by M. Weiss (p 18) Designed by human engineering principles this hypothetical panel offers the engineer many "Ideas for Design".

Tinkertoy Components (p 20) New components for use in making tinkertoy electronic assemblies (Bell Telephone Labs.).

Miniature Cathode-Ray Tube (p 22) Monitoring displays are inexpensively added to an instrument panel by means of these tiny tubes which have faces less than 1" in diameter. (National Union Electric Corp.).

Constant-Force Springs (p 24) There are many mechanical functions for these constant-compression-force springs in electronic equipment. (Hunter Spring Co.).

Cores for Adjustable Inductances (p 26) Inductors wound on these cores can be adjusted slightly by a unique means of changing the air gap. (Ferroxcube Corp.).

Ratings Transistors to Prevent "Runaway", by N. DeWolf (p 28) The nomographs in this article provide a quick means of rating a transistor to prevent its destruction in use.

Armed Services Reliable Electron Tubes (p 30) Table of approved tubes as of October, 1954, including commercial tube counterpart type number, description and comments on use of tube.

High Frequency Transistors (p 32) Circuits for using transistors in superheterodyne broadcast receivers. Characteristics for transistors with 5, 10 and 20Mc alpha cut-off frequencies are included. (Raytheon Mfg. Co.).

Dual-Purpose Crystals (p 34) These crystals are low in cost and have a very high output, high temperature stability, and tailor-made frequency responses. They may be used as speakers (or tweeters) as well as microphones. (Ronette Acoustical Corp.).

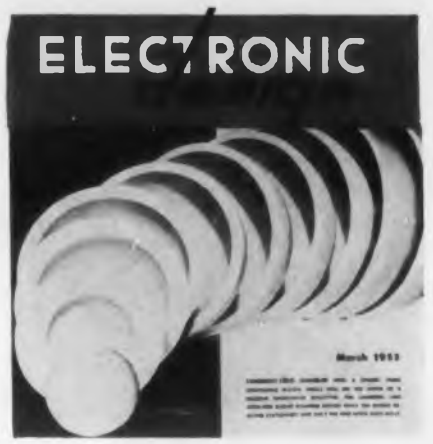
Coaxial F-M Tuning Assembly (p 36) The tuning method used in this f-m tuner is of interest to all designers of communication equipment.

Microvoltmeter and Preamplifier (p 38) Full-scale reading of 300mv with less than 15mv drift are characteristics of this meter. The chopper-stabilized amplifier section employing feedback has 1v output. (Kalbfell Labs, Inc.).

Resistor-Selection Charts, by R. G. Lindstrom (p 40) These charts are plotted in RETMA standard values instead of decimal values.

Packaged Switching Unit (p 42) This ac-dc relay contains four germanium diodes inside its standard can to rectify a-c for chatter free switching. (Hi-G, Inc.).

Plug-In Decade Resistor (p 44) Resistance values up to 10 megohms can be readily added to an instrument or breadboard unit with this device. (Telex, Inc.).



March

Designing Reliable Transistor Circuits, by N. B. Saunders (p 24) Lists circuit design factors to offset expected transistor variations. General discussion and specific swamping stabilization techniques.

Component Mounting Posts (p 28) This melamine mounting post accommodates resistors, capacitors, diodes, etc., to save space, shorten leads and improve ventilation. (Sangamo Electric Co.).

Unitized Tape Recorder (p 30) Unitized "building block" construction of this tape recorder gives maximum flexibility for data recording. (A-V Mfg. Corp.).

New Thermistor Applications, by S. Hubelbank (p 32) Nine different thermistor applications are discussed. Circuits are given for six.

Fast-Response Thermocouple (p 36) This thermocouple responds to temperature changes as short as 1/4microsec. (Midwest Research Institute).

Designing Potted Circuits, by F. Davidson (p 38) The procedure for designing potted circuits and a discussion of possible danger points are given.

Control Area for a Giant Computer (p 40) Human engineering principles were responsible for many of the features of the control equipment for NORC. "Design Forum" article.

Radio Frequency Permeameter (p 44) This device helps measure magnetic properties of toroidal cores in the r-f range. (National Electronics Labs, Inc.).

Luneberg Lens (p 46) This spherical lens made up of concentric plastic shells can focus microwave energy from a point source into a narrow beam or vice versa. (Emerson & Cuming).

Encapsulated Trimming Potentiometer (p 48) Completely encapsulated and featuring ideal internal tap construction, this tiny potentiometer is extremely stable over wide variations of climatic conditions. (Eastern Precision Resistor Corp.).

Solderless Breadboard System (p 50) Components are self-supporting and are equipped with binding posts to accommodate connectors terminated with U-shaped clips. Savings in circuit construction time may be 98%. (Science Electronic, Inc.).

Hearing Aid in Eyeglass Frames (p 52) The development of a remarkable electronic device is discussed and illustrated.

Ellipse Drawing Tool (p 54) Preparation of engineering drawings is speeded with this tool. (Fowler Engineering Co.).

Technical Problems Affecting National Defense: Supplementary List (p 56) Most of these problems can be solved electronically.

Shielding Beads (p 58) These ferrite beads threaded on supply leads attenuate unwanted h-f feedback. (Ferroxcube Corp. of America).

Small Variable Capacitor (p 60) Two section capacitor 1-3/8" x 1-5/16" x 15/16" having a capacitance of 123 1mmfd is suited for minature transistor radios. (Radio Condenser Co.).

Midget Power Resistors (p 62) This 5.5w wire wound resistor made of fine wire is no larger than 1/2w composition types and has matched characteristics. (British Electronics Sales Co., Inc.).

Microstrip Microwave Receiver (p 64) A printed circuit hybrid ring in the r-f head of 890-940Mc superheterodyne receiver save considerable size. (Federal Telecommunications Labs.).

One-Piece Miniature Tube Shields (p 66) These tube shields are permanently attached to integral base-sockets including u-h-f shield types. Shield telescopes over base for tube removal. (Staver Co.).

Impedance-Admittance Matching Chart, by M. Crothers (p 68) Matching networks are readily designed with this type nomograph.

April

Using Magnetic Cores in Computers, by R. D. Kodis (p 22) This article calls for wider use of magnetic cores in computers and presents charts to support this thesis. A number of operational circuits utilizing magnetic cores are also presented.

Magnistors-Amplifiers or Storage Elements (p 26) Magnistors, which are small saturable reactors used as amplifiers or two-state storage devices, are described. (Potter Instrument Co., Inc.).

High-Frequency Relay (p 28) This unusual transistorized relay operates at up to 50Mc on as little as 20μw of control power. (Olympic Radio & Television, Inc.).

Standardized Communication Equipment (p 30) The design of a line of mobile communication units in which only two standard housings are utilized is discussed in this "Design Forum" article. (General Electric Co.).

Diode Function Generator (p 32) Functions having two variables can be generated with this all electronic computer unit which uses diode-shaping networks. (Reeves Instrument Co.).

Expandable Breadboard Chassis (p 34) Breadboard and prototype circuit design is greatly perfected by this modular assembled chassis. (U. M. & F. Mfg. Corp.).

Designing Reliable Transistor Circuits—11, by N. Saunders (p 36) This article describes a variety of specific stabilization methods for achieving utmost reliability in transistor circuits. Includes 25 diagrams and schematics.

Plug-In Delay Lines (p 40) Plug-in delay lines are equipped with octal plugs and sockets for tandem interconnection to change delay time. (Jacobs Instrument Co.).

Using Built-In VTVM's, by J. Salz (p 42) Miniaturized vacuum tube voltmeters can be included in actual operating equipment for rapid sequential or continuous metering of critical circuits. Switching circuits for incorporating these types of VTVMs are described.

Harmonic Eliminator (p 44) Low frequency harmonics and line noise is eliminated by this device for delivering 500w of pure sine wave power. (Curtiss-Wright Corp.).

High-Output Power Controller (p 46) Two thyratron tubes are utilized in this compact controller which can replace relays. (Standard Plastics and Electronics Co.).

Choosing the Proper Type of Fan, by J. C. Van Rijn (p 48) A new concept in choosing the proper type of blower for cooling electronic apparatus is presented along with several design nomographs.

Signal Generator with Oscilloscope (p 52) Swept frequency tests on bandwidths of 100Mc or less and up to 2000Mc can be viewed on the built-in scope of this signal generator. (Canoga Corp.).

Copper Clad Resistors (p 54) Copper clamps encircling a standard composition resistor increase its heat transfer capabilities. (Allen-Bradley Co.).

Capacitor-Selection Chart, by R. G. Lindstrom (p 56) The characteristics of many insulating materials over a wide range of temperature are included to aid in capacitor selection.

May

Design for Automation, by R. C. White (p 24) Describes aspects of component design to make them suitable for hopper feed methods. Includes factors which should be avoided.

Using Glass in Electronic Designs: 1—Properties of Glass, by W. H. McKnight (p 28) The properties of one of the most widely used materials in electronic devices are summarized in this article.

Verticle-Chassis Radio (p 30) A new departure in small, table model radio construction is described in this "Design Forum" piece. (General Electric Co.).

Encapsulated Plug-In Circuits (p 32) A variety of circuits are available in these plug-in devices with an unusual method of securing. (Alcor Electronics Corp.).

Electro-Mechanical Circuit Elements (p 34) Resonance occurs in two parallel inertia bars instead of the conventional LC circuit. These transducers operate in the range of 100cy to 7kc with Q's up to 500. (Harris Transducer Corp.).

Human Measurements (p 36) The average measurements of the American male and female and their children are shown here to aid designers of electronic devices.

Glass-Teflon Dielectric (p 38) This firm known as Fiberfilm has all of the excellent electrical properties of teflon and is stretchable and easily handled. (American Machine and Foundry Co.).

Swing Coil Compensator (p 40) Sensitive meter which produces output of 5ma consists of a moving coil, a swing coil, an E-magnet and an electronic amplifier with compensating resistors. Operates as a closed-loop system. (AEG of Germany).

Selecting Miniature Bearings, by H. M. Dardani (p 42) Nomographs, charts, and techniques for the correct selection of miniature bearings for electronic instruments are presented.

Potted Resistor Networks (p 46) Encapsulated precision wire-wound resistors to save space and provide hermetic sealing protection. Designed for good heat transfer. (ITE Circuit Breaker Co.).

Range-Finding VTVM (p 48) When the probe of this meter is applied to a test point, the range switch automatically turns to the proper range. (Bergen Labs).

Gas-Diode Memories (p 50) An unusual use for gas-diodes memories is discussed in this "Ideas for Design" article.

Miniature Step-Up Vibrator (p 52) Flashlight cell operated device which functions as a vibrator and transformer to produce high voltage. (Edko Electronics Engineering Co.).

Magnetic Plastic Core (p 54) This high temperature stable core has a positive coefficient of Q with temperature and is impervious to humidity (no loss in performance to 20mc or higher). (Polymer Corp.).

Miniature Magnetic Clutches (p 56) Signal clutch body which can be combined in various clutching and drive combinations. (Electronic Manufacturing Engineers Co.).

Precision Phase Shift Measurements, by R. Rothschild (p 58) Accuracies of precision multiplying devices for measuring phase are discussed. Process described eliminates the effect of noise and harmonics.

June

Power Transistor Temperature Rating, by L. A. Griffith (p 22) Examines power dissipation possible without exceeding maximum junction temperature rating of power transistor.

"Flat" Display Tube (p 26) Numbers, patterns or letters can be displayed on this comparatively flat gas discharge tube. (National Union Electric Corp.).

Transformer Case Size Table (p 28) This table aids in selecting the proper case size for military power transformers according to specification MIL-T-27.

Extended-Range VTVM (p 30) Lower full scale ranges are achieved with this stable VTVM which develops feedback across only the meter multiplier resistor. A small value multiplier resistance permits low ranges. (Technology Instrument Corp.).

Reliability of Hermetically Sealed Transistors, by C. H. Zierdt, Jr. (p 32) The results of techniques to improve the reliability of junction transistors are described in this "Background for Designers" article.

Standard-Base Silicon Rectifiers (p 36) These silicon rectifiers are exact replacements for vacuum tube types. They do not require filament power, of course. (Bogue Electric Mfg. Co.).

Using Glass in Electronic Designs: 2—The Forms of Glass, by W. H. McKnight (p 38) The uses and specification of a prime material in electronic devices is extensively discussed and illustrated.

Data Converter (p 42) Two application diagrams are given for this analog-to-digital, digital-to-analog converter. (Norden-Ketay Corp.).

Postage-Stamp Storage Battery (p 44) These thin 1-1/8" miniature rechargable cells have a uniform output suitable for running recorders in missiles, etc. (Yardney Electric Corp.).

Punched-Card Tube Tester (p 46) Uses a punch card to determine required circuit connections for a particular tube. Operation requires only a singe rotary switch.

Network Synthesizer (p 48) Selectivity curves expressable by Fourier cosine or transient response functions in the video frequency range can be synthesized with this device. (Wickes Engineering and Construction Co.).

Lighted Push-Button Switch (p 50) Panel space is saved by making the push-button light up on these switches. (Minneapolis Honeywell Regulator Co.).

Audio-Frequency Instruments (p 52) Two precision instruments for possible development and marketing are described in this "Ideas for Design" article.

Plug-In Logic Unit (p 54) Logical operations, digital computation, and control functions can be performed with this plug-in digital gating package.

Stable Communications Receiver (p 56) The mechanical engineering aspects of an electronic development are emphasized in a "Design Forum" discussion. (Hammarlund Mfg. Co.).

July

Using Contour Curves in Transistor Circuit Design, by K. A. Pullen, R. G. Roush (p 22) Includes area-type representation of transistor small-signal parameters as well as static characteristics. Charts for *2N43* are *RR-14*, *HA-1* and *904* transistors are included.

Transformers in Teflon (p 26) Weight and volume reductions of 50% are possible by using these teflon enclosed transformers. (Ultra-Temp Transformer Co.).

Class B Operation of Transistors: 1—Design Considerations, by K. E. Loofbourrow (p 28) The design considerations in Class B operation of junction transistors in the output stages of battery operated portable amplifiers is discussed.

Multi-Step Standard Resistance (p 32) This standard resistance can be used for digital-to-analog conversion. (Julie Research Labs).

Silicon Or Germanium?, by N. B. Saunders (p 34) Compares silicon and germanium transistors according to operating requirements, transistor coefficients, diode voltages for forward current and coefficient variation with temperature.

Transistorized Transistor Analyzer (p 36) This transistorized transistor analyzer measures H_{21} and I_{co}. Small signal gain measurement accuracy is 5% or better. (Quantum Electronics, Inc.).

Field Effect Transistor Circuit Design: 1—Characteristics, by Chaang Huang, M. Marshall, B. H. White (p 38) The electrical characteristics of field effect transistor are discussed preparatory to using them in circuits.

Commutatorless D-C Motor Using Transistors, by H. D. Brailsford (p 40) These motors use transistors for commutation for increased service life.

Trimmer Resistors for Transistors (p 42) Production and maintenance of transistor equipment is simplified by using these compact trimmers. (Centralab).

Operating Transistors at Higher Voltages, by G. H. Didinger (p 44) The advantages of operating transistors at higher voltages are given in detail.

Single Transistor Frequency Standard (p 46) This transistorized frequency standard which can be held in the palm of the hand is crystal controlled and supplies frequency markers every 100kc up to 30Mc.

Tube-Transistor Radio (p 48) The design of a hybrid radio is compared with its all-tube predecessor in this "Design Forum" article.

Automatic Microwave Measurements (p 50) This equipment helps overcome the shortage of trained technical assistants.

Tandem-Tuned Transformer (p 52) Subminiature double tuned i-f transformers that are intended for transistor radios are described. (Vokar Corp.).

British Transistor Applications, by D. D. Jones (p 54) The number of circuits equalizing transistors are analyzed in this article from overseas.

Design Procedures for Power Transistors: 1, by H. T. Mooers (p 58) This part discusses circuit analysis and the limits and characteristics of power transistors. Limits of maximum voltage, total power dissipation and current are described.

August

Technical Translations from the USSR (p 20) Includes a semiconductor radio receiver for amateurs, a new generator for noise voltages, based on a variable speed recording and a table on the effectiveness of shielding rooms.

Magnistor Circuits, by R. L. Snyder (p 24) Gate and amplifier circuit design fundamentals using transient Magnistors are discussed. Characteristics and circuit schematics are given.

Operational Amplifier (p 28) This precision electronic device replaces mechanical all-disc integrators and analog computers. (Airborne Instruments Laboratory, Inc.).

Miniature Bias Supply (p 30) Essentially a regulated power supply, this unit supplies a bias voltage for plate-to-grid coupling. (Marine Electric Corp.).

Analog-to-Digital Translator (p 32) Describes a device for converting an oscillogram recording to digital outputs. Human operator adjusts reading line to coincide with graph amplitude to produce digital output. (Benson-Lehner Corp.).

Class B Operation of Transistors: 2—Basic Circuits, by K. E. Loofbourrow (p 34) An analysis of the two basic types of Class B push-pull transistor circuits is presented and well illustrated.

Material for Stamped-Out Printed Circuits (p 38) Another technique for producing printed circuits is presented. There is no wastage of copper. (Rogers Corp.).

Multiple Pushbutton Switches (p 40) Channel switching electric process controls and laboratory test set ups are some of the uses for these switches. (Switchcraft, Inc.).

Transistorized Power Supply (p 42) This plug-in unit produces up to 1500v from a single 1-1/2v flashlight cell. Uses transistor and blocking oscillator circuit. (Universal Atomics Corp.).

Discrete-Position Servomechanism Applications, by M. Haberman (p 44) Rotating in steps rather than continuously, the discrete-position servo is a simple and inexpensive control device.

Pure, Metallized Ceramic (p 48) High aluminum-type ceramic for making vacuum-tight ceramic to metal seals. Has high purity and mechanical strength. (Raytheon Mfg. Co.).

Noise Voltmeter (p 50) Measures rms signal-to-noise ratio from 20cy to 200Mc directly. Diode operates in square-law region so that both signal and noise are amplified proportionally. (Millivac Instrument Corp.).

Cascading Magnetic Core Units (p 52) Interchangeable shift registers that snap together to form any length of register desired. (Butler Mfg. Corp.).

Printed Circuit Delay Line, (p 54) Conventional capacitors and a separate switch have been replaced by a unique printed circuit wafer which serves as both capacitor plates and switch segments. (Control Electronics Co., Inc.).

September

Conductance Curve Design of Relaxation Circuits, by K. A. Pullen (p 24) Shows how to use plate-conductance data from conductance curves to aid in the analysis of design of relaxation circuits. Blocking oscillator and multivibrator circuits discussed.

Analog Field Plotter (p 28) Shows method of plotting equipotential lines plotting which are analogous to electrostatic and electromagnetic fields and current flow. (Sunshine Scientific Instrument).

Epoxy Resins in H-F Inductor Design, by D. Lichtman (p 30) An unusual use of epoxy resins to construct variable inductors for use at high frequencies is described in this compact article.

Touch-Control Switch (p 32) This switch operates by touching two adjacent metal areas. It could be used as a safety device in electronic equipment. (General Electric Co.).

Electrostatic Speakers (p 34) Two forms of these inexpensive imported speakers are available for use with dynamic speakers in high quality sound equipment. (Arnhold Ceramics).

Magnetic Modulator (p 36) A highly sensitive magnetic converter, which operates from weak bipolar d-c, has low null amplitude. (General Magnetics, Inc.).

Compact Oscilloscope (p 38) The design of a compact scope for use in aircraft is analyzed in this "Design Forum" article.

Transistor Servo Amplifiers (p 40) Ultra-fast type of magnetic amplifier acts as a converter to change amplitude-modulated signals to pulse time modulation. Power transistors are used in the output stage. (Librascope).

Design Procedures for Power Transistors: 2—H. T. Mooers, (p 42) Discusses external behavior of transistors as it affects circuit design. Discusses change with temperature, gain, change with collector current and current stability.

Perspective-Sketch Template (p 46) Template aids engineer to sketch in perspective by providing a starting point, horizontal and vertical reference planes and guide lines. It defines the proper proportions and shows proper relationships. (California Visual Aids Co.).

Lab-Built Standard Source (p 48) This article explains how to build a standard voltage source for laboratory use.

Tape Potentiometer (p 50) Resistance wire mounted to the edge of a numeral-embossed tape gives direct-reading calibration and slide-wire potentiometer advantages. (Howell Instrument Co.).

Digital Meter with Recorder (p 52) This digital-reading VTVM can be attached to a recording device to aid design and development engineers in these times of scarce technical assistance. (Laboratory for Electronics, Inc.).

Easily Operated Preamplifier (p 54) The controls and unusual construction technique of this home preamplifier are analyzed in "Design Forum" manner.

Thumb Size Servo (p 56) This tiny 2-phase servo can be utilized in many aircraft applications. (General Electric Co.).

Miniature Circuit Breaker (p 58) Describes tiny magnetic circuit breaker no larger than power on-off switches for electronic equipment. (Airpax Products Co.).

Dielectric Breakdown Properties of Thermosetting Laminates, by N. A. Skow (p 60) Analyzes dielectric breakdown of laminates for short and long times as a function of temperature.

The Effect of Heater Coating Thickness on Warm-Up Time, by R. L. Pear, A. Szilasi (p 64) The results of an extensive investigation of the effect of heater coating thickness on warm-up time in the design of the new series—string tubes are presented.

October

Designing Transistor Flip-Flops, by R. E. McMahon, (p. 24) A group of formulas and nomograph that facilitates the design of a reliable transistor flip-flop with the desired properties.

Tiny Ceramic Tube (p. 28) Low noise and high gain make this tiny tube particularly valuable for u-h-f/v-h-f tuners. (General Electric Co.)

Broad Band Sweep Generator (p. 30) Panoramic displays of several hundred megacycles in the 200-2000Mc range can be generated with these broad band sweep generators. (Applied Research, Inc.)

Components Needed for Digital Computers, by R. C. Kelner (p 32) Future component needs for digital computers are discussed and their expected performance indicated.

Hermetically Sealed Rechargeable Battery (p. 34) Compact nickel-cadmium alkaline cells which require little maintenance and can be stored indefinitely. (Dynaseal Lighting Corp.)

Needed Analog Computer Components, by F. Klimowski, Jr. (p 36) Component needs for both direct-current and electromechanical analogs are detailed.

Multi-Layer Turret Socket (p. 38) Compact electronic devices can be designed using these sockets. Groups of connections can be made simultaneously by dip-soldering. (Victor Electronic Co.)

Ideas for Computer Designers (p. 40) Includes suggestions from computer users as to what is needed in the way of equipment to make computers more useful and easier to use.

Field Effect Transistor Circuit Design: 2—Applications by Chaang Huang, M. Marshall, B. H. White (p. 42) A number of circuits utilizing the field effect transistor are discussed and analyzed by means of graphs and nomographs.

A-C/D-C Digital Voltmeter (p. 46) This a-c/d-c digital voltmeter consists of a self balancing d-c bridge in combination with a feedback rectifier system. (Electro Instruments, Inc.)

Hybrid Radio, by K. E. Loofbourrow (p.48) This hypothetical radio uses push-pull transistor output combination with subminiature tubes. Its performance and effect on battery life is discussed.

Self-Insulated Aluminum Conductor (p. 50) The insulation in this aluminum stripping conductor is the metal's own oxide coating. (Reynolds Metals Co.)

Design Procedures for Power Transistors-3 by H. T. Mooers (p. 52) Design procedures for Class-A resistance loads, transformer loads and push-pull circuits. Power converter oscillator circuit design is described. Various interstage coupling methods and switching circuits are suggested.

Digital Printer with Magnetic-Core Memory (p. 56) This digital computer output prints 24,000 alpha numerical characters per minute. (Potter Instrument Co.)

Servo Analysis with Analog Computers by J. D. Strong (p. 58) Computer methods for analyzing simple and precision servo system design.

Resistance-Pad Design Chart, by Milton H. Crothers (p. 60) A slide-rule type nomograph that speeds design of resistance matching pads.

Subminiature Relay with Permanent Magnet (p. 62) High contact ratings are gained by incorporating a permanent magnet in the magnetic circuit of this tiny relay. (Luther Mfg. Co.)

Components and Building Blocks for Computers (p. 64) These separate tabular presentations covering components and components assembled to building blocks for analog computers; components, subassemblies, and equipment for digital computers; and analog-to-digtal and digital-to-analog converters. Manufacturer's index is included.

November

Needed Electronic Devices for the Atomic Industry, by V. L. Parsegian (p 20) Electronic devices could solve many of the research and processing problems of the growing atomic industry. This article outlines these needs.

Standard Modular Wafer Circuits (p 24) Modulized standard circuits available for circuit-characteristic and production-process evaluation are described. Breadboard units to aid interconnection of modules for experimental work are included. (Aerovox Corp.)

Foaming Potting Compound (p 26) This potting compound foams around components during polymerization. (Eastern Precision Resistor Corp.)

Electronic Organ, by G. H. Hadden (p 28) The problems involved in designing a device that produces music is just as challenging as the design of equipment that reproduces music.

Pulse-Aging Gas-Diodes (p 30) In this "Background for Designers" article, the techniques for aging gas diodes so that they can be used in computers are discussed.

Accurate Pocket Sized Resistance Decade (p 32) Extremely small in size and highly accurate, this unit includes a thermometer for measuring temperature rise of its 24 individual resistors. (Consolidated Resistance Co. of America, Inc.)

Transistor Clock (p 34) Transistor ring counter actuates lamps to show time as a digital display which can be read in darkness. (Saunders & Co.)

Analog Computer Kit (p 36) Designers of control systems will find this inexpensive analog computer of value in the expeditious development of new control systems. (Heath Co.)

Socket Adapter with Permanent Probe (p 38) Circuit checking of tubes with hard to reach terminals is made easy by using this adapter. (Vector Electronic Co.)

Small Multi-Deck Switch (p 40) Miniaturization of portable test equipment and mobile control and communications gear is aided by using these switches. (International Instruments, Inc.)

Miniature Transponder (p 42) The design of a transponder much smaller than those now in use is discussed with reference to the needs for this device.

Useful Plots of Transmission Line Relations, by E. Tahan (p 44) Presents a number of the more frequently used transmission line equations in a graphical form. Reflection coefficients, power reflected, attenuation, etc. can be solved for quickly.

Tiny Trimmer Potentiometer (p 48) This potentiometer is so small it can be mounted in a diode clip. (Carter Mfg. Co.)

Push-Pull Volume Control Switch (p 50) Volume control with push-pull on-off action for simpler operation and longer volume control life. (Mallory & Co., Inc.)

December

Using An Electronic Analog Memory by R. N. Close and G. O. Thogerson (p 26) A number of applications for this precision electronic integrator are presented in block diagrams.

Printed Circuit Machine (p 28) This complete unit includes all facilities required for producing printed circuits in the laboratory. (Printed Electronics Corp.)

How to Make a Function Generator by C. A. Belsterling (p 30) This useful function generator for analog computer applications can be assembled from easily available laboratory equipment.

Modular Sub-Circuits (p 32) These little units are competitive with other modular sub-circuits like the "tinker-toy" units. (Erie Resistor Corp.)

Dielectric Absorption at High Temperatures by R. J. Silbiger (p 38) Dielectric ratings of capacitors do not hold for all temperatures. Typcial time constant curves for various temperatures are given.

Plug-Board Design by G. F. MacKenzie (p 42) This "Design Forum" article shows how cooperation between an industrial designer and the electronic design engineer helps produce better equipment.

Induction Modulator (p 44) Employing a D'Arsenval movement, this new modulator has no contacts. (Weston Electrical Instrument Corp.)

Automatic Assembly of Electronic Equipment—How Soon? (p 46) Stresses importance of standards that must be established before the automatic factory can come about.

Magnesium Wave Guides (p 48) Lighter than aluminum and brass, these magnesium waveguides equivalents offer significant weight savings. (Model Engr. & Mfg. Co.)

Antenna Matching with Controllable Inductors by A. L. Kaufman (p 50) Matching antennas with widely varied reactance is expedited with controllable inductors. The technique is explained by example.

Designing a Self-Biased Video Amplifier for Printed Circuit Techniques by M. H. Crothers (p 54) Describes a low frequency compensating network so that bypass capacitors may be decreased in size for printed circuit techniques.

Foam-Potted Plug-In Circuits (p 56) Considerable savings in weight over similar potted plug-in circuits are gained by encapsulating with a silicone foam. (Topper Mfg. Co.)

Typewriter with a Memory (p 58) The growing shortage of skilled secretaries may lead to the market of this typewriter with a memory of phrases that are used over and over again. (IBM)

Background
for
Designers

Dielectric Absorption at High Temperatures

Richard J. Silbiger, Systems Div. Engineer,
Fairchild Camera and Instrument Corporation, Hicksville, New York

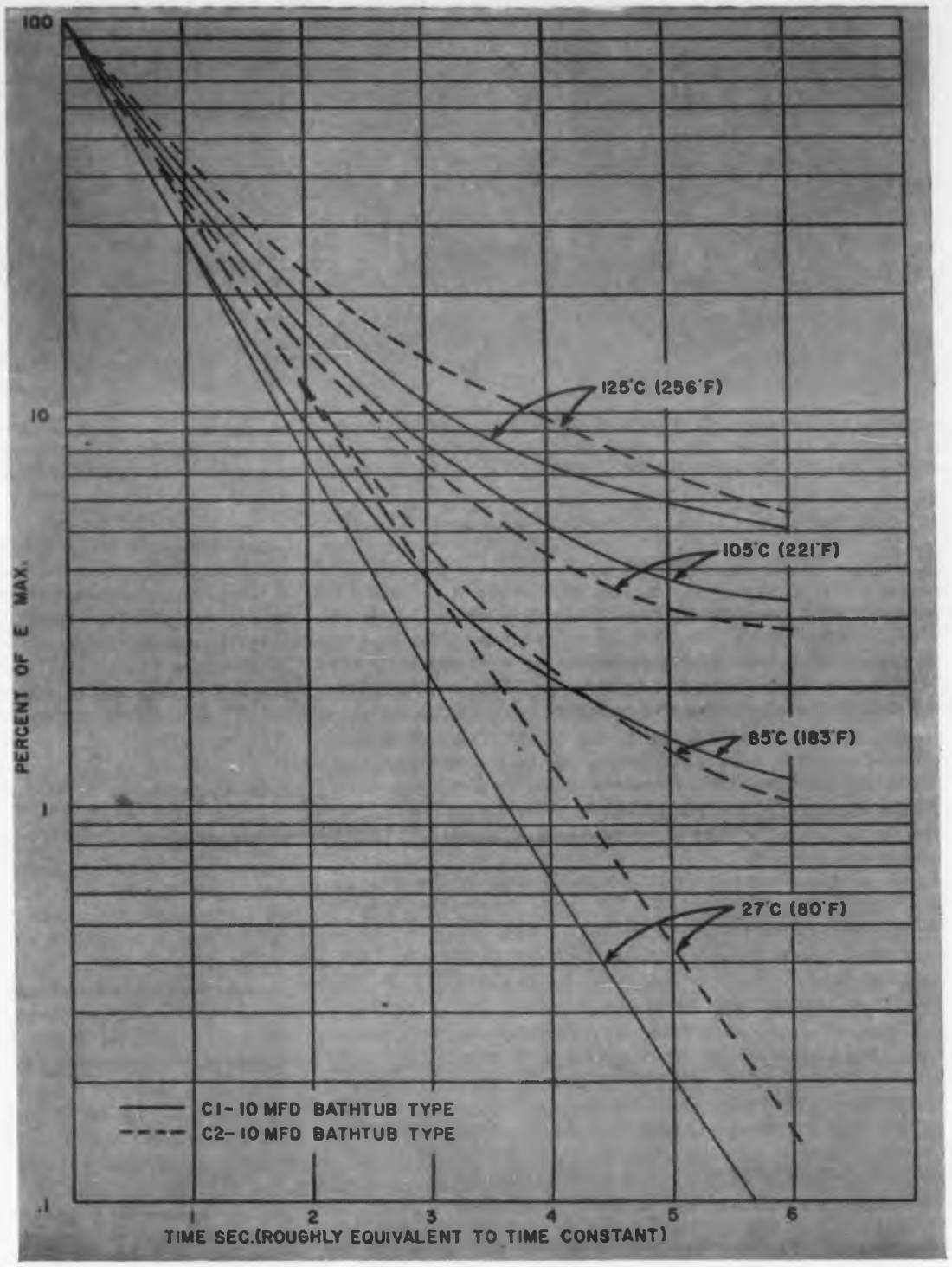
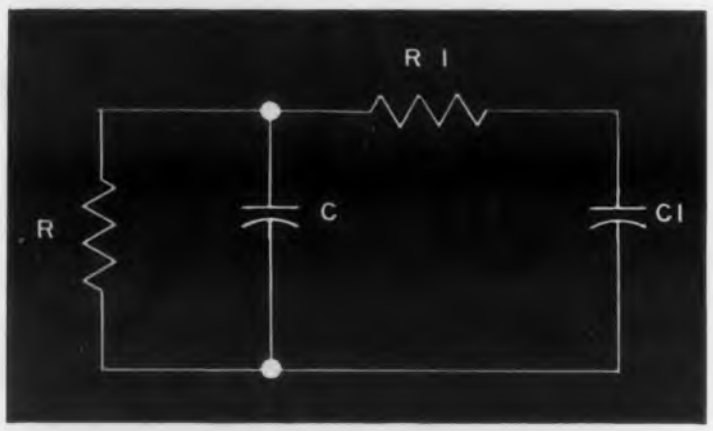


Fig. 2. Variation of capacitor discharge with temperature for different bathtub capacitors.



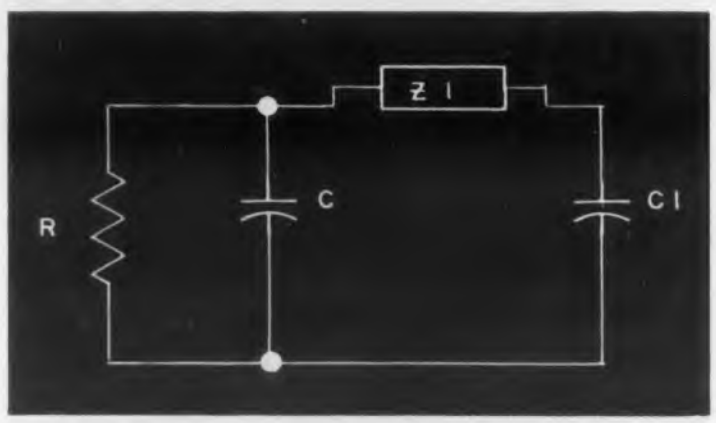


Fig. 1. Equivalent circuit of capacitor. RI (or ZI) and CI refer to resistance and storage effect of dielectric.

ALTHOUGH capacitor manufacturers presently describe dielectric absorption in terms of a residual percent of charging voltage, the rate of absorption, may be a more significant characteristic in certain applications. A comparison of the total absorption for different capacitors may be derived from the transient data. This effect on rate of charge or discharge affects timing circuits or circuits operating on d-c levels derived from capacitor storage.

The statement that a capacitor has one percent dielectric absorption is of only limited accuracy since it is not descriptive of the general condition, which, in most current developments, encompasses a wide range of temperatures. This article will point out some of the practical consequences in ordinary engineering design work, and describe simple test procedures within the realm of the average development laboratory which will assist in evaluation of compo-

Although dielectric absorption is exhibited by solid dielectrics and certain waxes and resins, it is a property to a greater or lesser degree of all dielectrics. No generally accepted explanation of the physical mechanism has been thus far established, but there appears to be more than one type of phenomenon producing approximately the same result. In one instance the molecules of the dielectric have received a moment due to their displacement in the electrostatic field of the capacitor. Since each molecule of the dielectric is conceived as having two poles which rotate about a center an amount dependent on the strength of the electrostatic field, the moment is called the dipole moment. When the polarization lags behind the externally applied field, dielectric absorption occurs. Like the hysteresis effect in iron cores, this condition is reversible.

In another instance, wandering ions within the dielectric, unable to discharge at the electrostatic poles, build up space charges leading to the formation of electric moments which persist sometime after the external field has been reduced to zero.

It is known that charges opposite to those appearing on the plates of the condenser appear on the proximate surfaces of the dielectric. Recent work on electrets, such as carnauba wax, has produced further experimental evidence. An electret is a substance that retains an electric moment after the externally applied field has been reduced to zero. Work in the field has been mostly theoretical, and a large body of experimental data remains to be determined.

nent performance at elevated temperatures. Results of tests already undertaken will be presented along with the discussion. Brief explanations of the phenomenon of dielectric absorption are included.

Dielectric absorption is defined as "the effect which allows a small current to flow for a short time into a capacitor after the first rush of charging current and [conversely, the effect] which causes the instantaneous discharge of the condenser to be followed by a continuously decreasing current." It is a function of the dielectric, of the previous charging or discharging time, of the charging voltage, and of temperature. The effect becomes pronounced above 160° F.

The physical effect in a d-c circuit is to delay the time required for a capacitor to charge or discharge to the steady state condition and to alter the charging or discharging curves to conform to the impedances of the equivalent circuit shown in Fig. 1. In

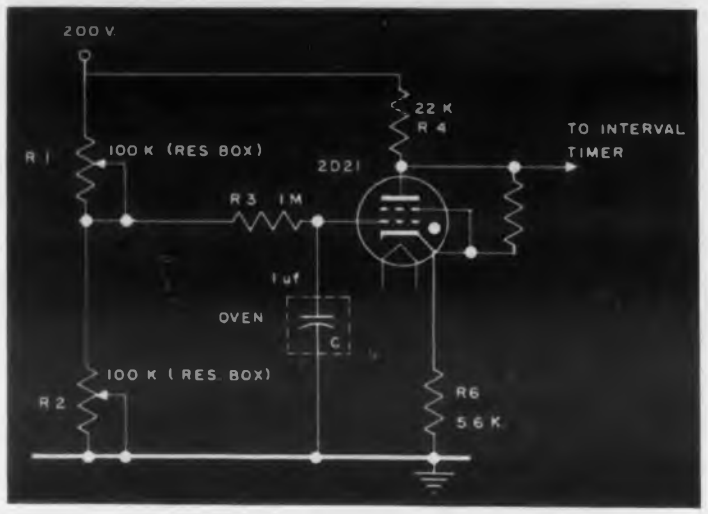


Fig. 4. Schematic for measuring charging curve of capacitor. Result shown in bottom graph.

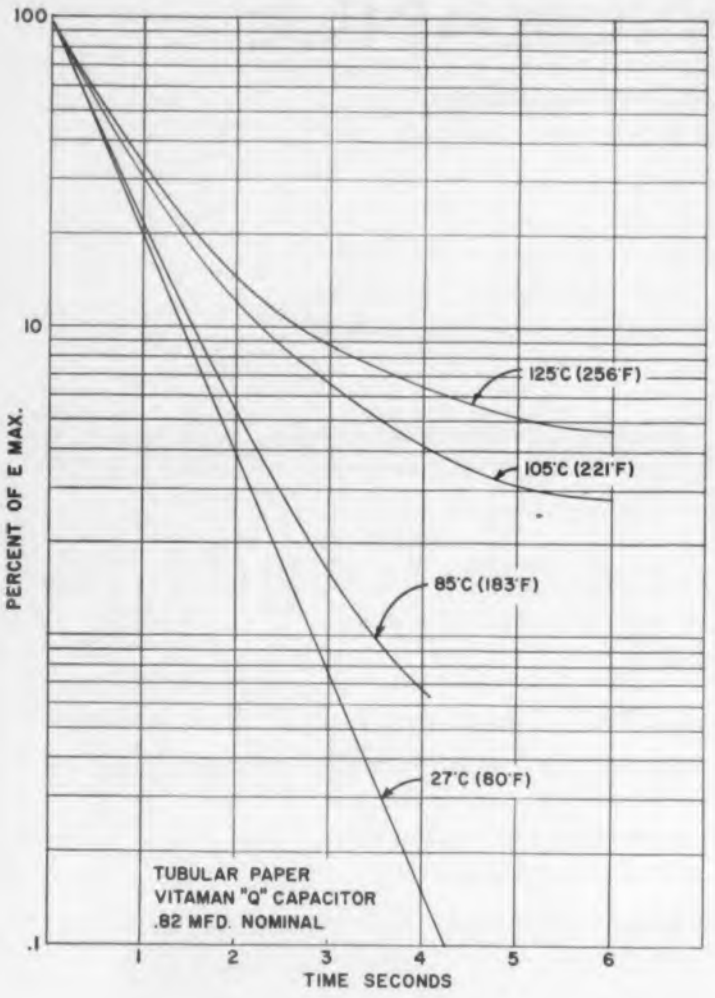


Fig. 3. Variation of capacitor discharge with temperature for different paper capacitors.

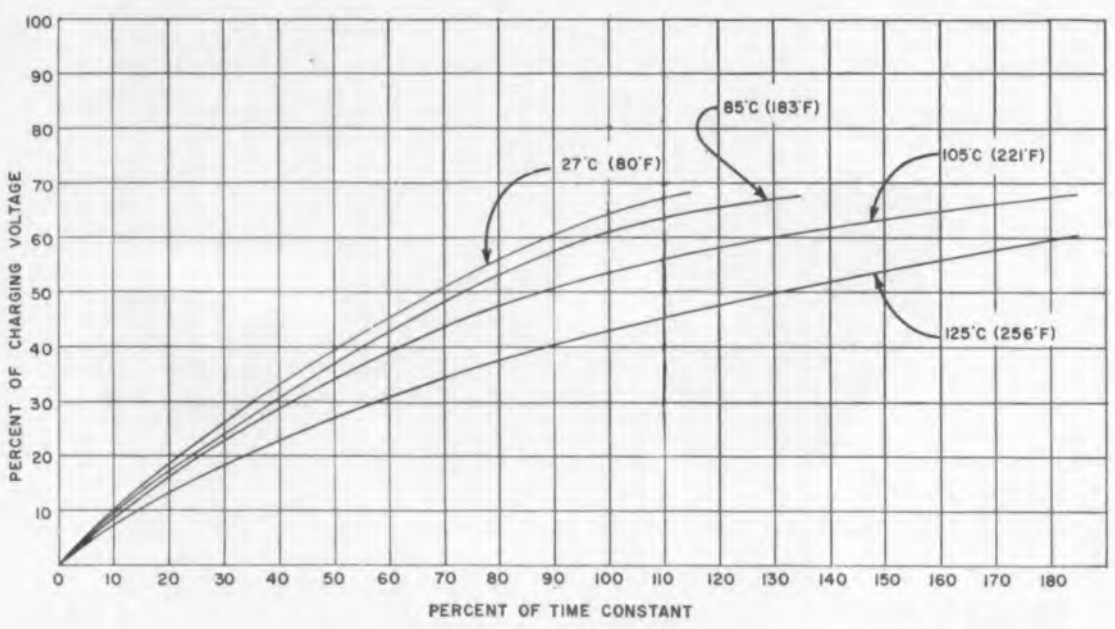


Fig. 5. Charging curves for 1.0mfd Vitamin Q capacitor at various temperatures.

an ultra high frequency circuit, the reluctance of the molecules of the dielectric to reorient themselves with sufficient rapidity results in a power loss manifested as additional heat dissipation. The energy required for orientation is called the dipole moment and varies directly as a function of temperature. When the period of the externally applied field is in the same order, or less than, the relaxation time of the molecular dipoles, the effect becomes pronounced. In transient phenomena, an attempt to discharge a capacitor instantaneously will cause a rise in temperature of the capacitor due to its internal resistance, increasing the absorption effect and resulting in a deviation from anticipated voltage levels.

It is important to differentiate between dielectric absorption and the effect due to the normal temperature coefficient. The latter may be observed on an impedance bridge by measuring capacitance at the nominal 1000cy frequency for successive temperatures. The capacitance will increase slightly with temperature depending on the dielectric. On the other hand, a capacitor measuring 1.0mfd on a bridge at 260°F may look like 10.0mfd in a timing circuit.

It has been shown that, although the total amount of absorption in heterogeneous dielectrics is independent of temperature, the rate of absorption increases greatly with elevations in temperature. In experiments on commercial capacitors using high temperature dielectrics such as polystyrene, polyethylene, and certain mineral oils, the amount of absorption current increased with charging time until a saturation point was reached. A saturation time of fifteen minutes was observed for a Sprague *Vitamin Q* capacitor.

The total charge Q appears to be actually equal to the sum of two integrals: $\int i dt$ and $\int J(\tau.)\, d\tau$ [limits o and ∞], where $J(\tau)$ is a function of relaxation time. Curves obtained from observations of capacitor charge or discharge obey the general expression $A\epsilon^{-bt}$ only when the dielectric absorption current is small. The effect may be made more clear by a glance at Fig. 1. Circuit *a* is an equivalent circuit based upon the Debye equations for dielectric constant. Circuit *b* is similar except that R' is now a complex function Z', as suggested by K. S. Cole[2]. R in both instances is leakage resistance.

Figs. 2 and 3 illustrate the effect of temperature

on dielectric absorption as measured in two bathtub type capacitors and a tubular paper capacitor impregnated with *Vitamin Q* mineral oil. Results were obtained by stabilizing the units in an oven at the stated temperature, charging for 30 seconds at the output voltage of a well regulated power supply and then discharging through a 1 megohm resistor situated outside of the oven. A Sanborn d-c recorder connected across the resistor produced a permanent record of the discharge curve.

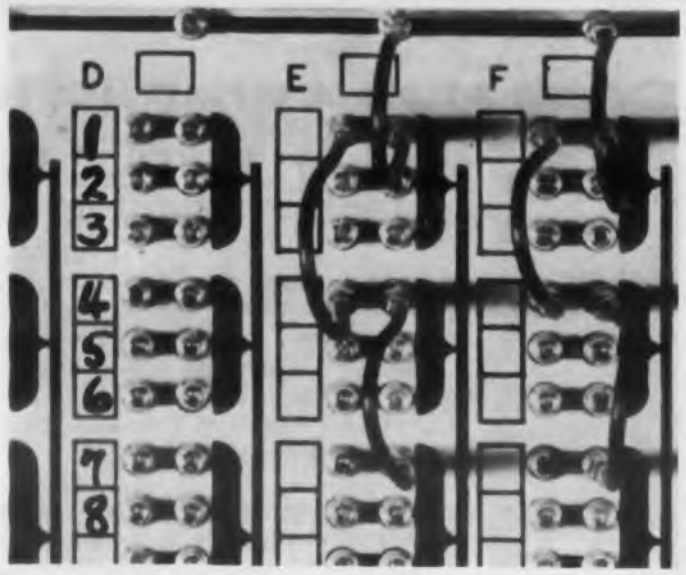
A schematic of the method of measurement of the charging curve is shown in Fig. 4. By varying R_1 and R_2 and observing the time interval between application of the charging voltage and firing of the thyratron, a series of points on a family of charging curves was obtained. This data was then translated into the curves shown in Fig. 5 with a *Vitamin Q* capacitor as the unit being tested. The capacitor was discharged for one minute before each observation.

It is evident that highly precise and accurate equipment is not necessary to obtain the broad results shown and an evaluation of a capacitor as to its dielectric absorption properties may be made in this manner without undue strain. The technique of using a comparatively long time constant permits simple procedures and does not cause an internal temperature rise of the dielectric above the ambient temperature.

Components are available which do not exhibit, to a significant degree, dielectric absorption. A most interesting result was obtained by subjecting a Balco high-temperature capacitor employing a Teflon-Mylar dielectric to the test procedure just discussed. In this instance, within the limits of accuracy of the equipment, no dielectric absorption was observed up to the highest test ambient 125°C.

References

1. Drake's Encyclopedia of Radio and Electronics, edited by H. P. Monly; The F. J. Drake Co., Wilmette, Ill. 1950.
2. Cole, K. S., "Dispersion and Absorption in Dielectrics", *Journal of Chemical Physics*, February 1942, pp. 98-105.
3. Gross, B., "Dielectric Absorption and Temperature Effects in Carnauba Wax", *The Physical Review*, April 1945, pp. 253-259.
4. Encyclopedia Britannica, Volume 8, pp. 212, Electricity: Dielectric Displacement Currents.

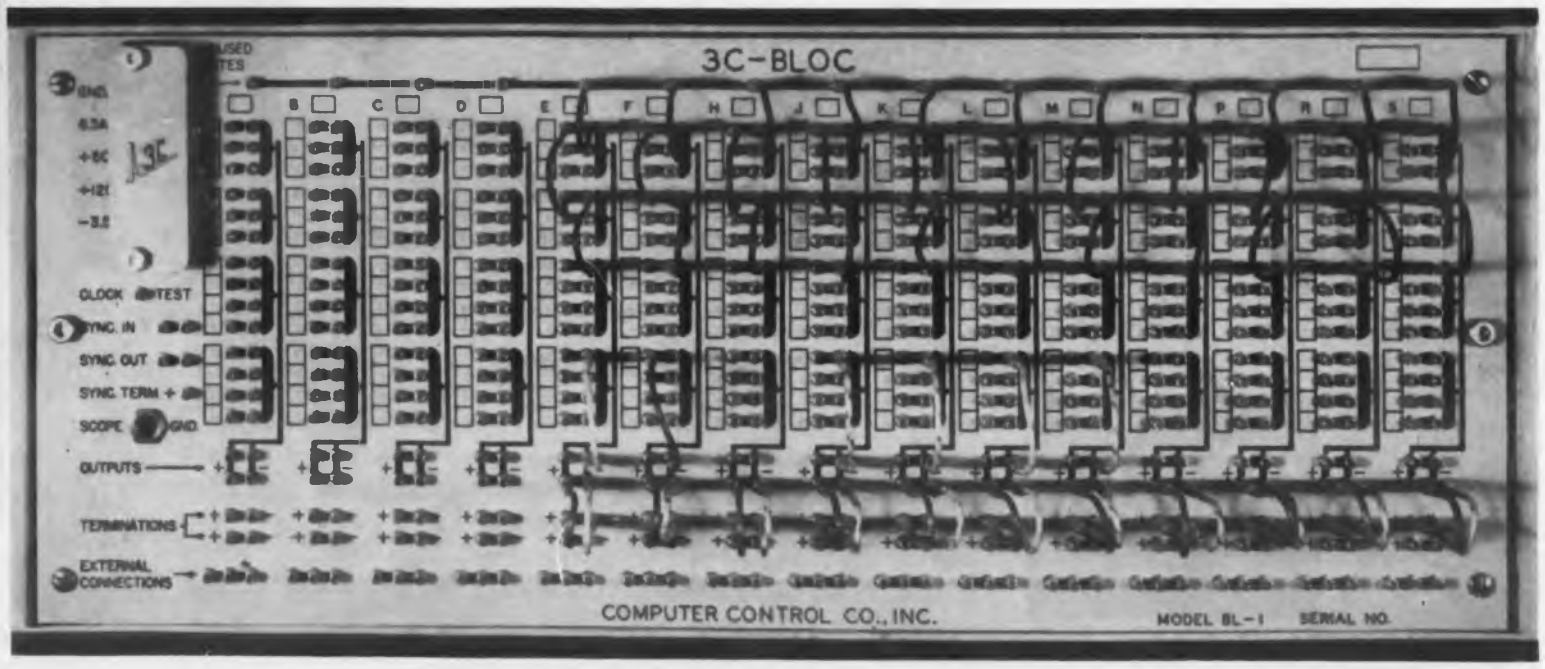


Numbers can be written directly on the panel with a pencil, and then erased.

Design Forum

Plugboard Design

George F. MacKenzie, Vice-president and Director of Design
Technical Marketing Associates, Inc., Concord, Mass.



COOPERATION between an industrial designer and the electronic design engineer can often lead to equipment that is more attractive, easier to operate, and less costly to fabricate. This article deals with the cooperative design of the plugboard for a computer building block previously discussed in this magazine*. The logic followed in the panel layout, the use of visual aids, the selection of a special panel material, the choice of colors, and the special construction of the plugboard jacks are features that can be used in a wide range of electronic devices.

The unit accommodates 15 digital gating packages and one synchronizing "clock" package. Input and output connections for each of the gating units are made at the front of the equipment. The equipment can be used to perform logical operations, digital computations, and control functions of many varieties. The specific operations performed are determined by simple plug-in jumper connections joining the gating packages. From one to 100 or more blocks may be interconnected, depending on the complexity of the analyses or computations to be performed.

Plugboard Layout

Over 600 closely-spaced terminals are mounted on each front panel, which measures 7" by 17". To simplify interconnection of these terminals, a strict, functional logic is followed in the layout of the plugboard. Flow of information is from left to right. Terminals are grouped in front of each gating package, and are superimposed on a symbolic diagram of the gate and buffer circuits, as illustrated. The visualization of complex computer hookups is thus simplified. The panel diagram uses standard logic symbols, and space is provided for identification of each terminal of the gating circuits by pencil marks.

The material used for the plugboard panel meets several special requirements. Because of the large number of terminals required, structural strength and easy machineability are important. The use of a metallic panel stock is avoided, because of the need to insulate the separate terminals. A 1/8" panel thickness is also required to achieve flush-mounting within the 1/8" panel recess provided in the standard relay-rack mounting frame.

The selection of Formica laminated plastic for the

* "Plug-In Logic Unit", ELECTRONIC DESIGN, June, 1955, pp. 54-55.

panel is a versatile solution to these requirements. Available in suitable colors for the panel background, two 1/16" sheets of decorative-grade material are bonded back-to-back to achieve the necessary 1/8" thickness. This material is easily machined at low cost and has more than adequate structural strength for the application. Its electrical insulation characteristics eliminate the cost of special grommets around terminals.

Additional benefit from the use of Formica is obtained by the choice of a dull finish. This texture lends itself well to the silk-screening of the front panel terminology and schematic diagram. In addition, the matte finish allows terminal designations to be marked in pencil, directly on the panel surface. This procedure eliminates the cost of labels or label holders. The pencilled designations are erasable and easily changed to fit new terminal hookups.

Colors used on the panel are carefully chosen to provide a distinct, but non-fatiguing contrast, and are equally suitable for laboratory and office use of the computer. A solid, light-tan color serves as the panel background and eliminates the cost of a painting operation. A dark brown is used as the silk-screen printing color for terminology and schematic flow-of-information diagrams. Silk-screening provides a low cost method of panel marking for present production. The panel design can be laminated within the Formica for added wear resistance and further cost reduction when large quantity production is undertaken.

Miniature Jack Construction

A new type of terminal is used in the device to permit over 600 terminals to be crowded into the 7" by 17" space. This special jack and mating plug were developed by the Cambridge Thermionic Corp. Positive gripping force results from use of a special beryllium-copper collar, clipped around the jack sidewalls. As the jumper plug is forced into the jack the slotted sidewalls expand, but are restrained by the presence of the copper collar. Sidewall deflection is limited so that no permanent "set" occurs, and low contact resistance is maintained during plug life.

The special copper collar permits the gripping section of the jack to be scaled down to 1/8" diam. In addition to its small size, the unit can be fastened to the panel with an ordinary swaging tool. The added cost of special retaining nuts is thus eliminated.

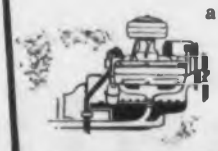
SANBORN
OSCILLOGRAPHIC RECORDING SYSTEMS

"ON THE JOB"
PROVIDE VALUABLE
DYNAMIC ANALYSIS DATA

PRODUCTION TESTING
of components is accomplished by a Servo Component manufacturer by means of a Sanborn Single-Channel Recording System with a Sanborn Servo Monitor Preamplifier.

DYNAMIC PERFORMANCE
of valves when equipped with a certain pneumatic Valve Positioner is determined by the manufacturer with a Sanborn Two-Channel System and Sanborn Carrier Amplifiers.

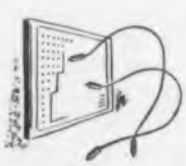
ACCELERATION and TORQUE
are recorded simultaneously by an oil company in their study of fuels and lubricants as they relate to engine performance.



DRONE MISSILE
manufacturer can simulate the flight of the missile and derive information concerning its behavior under certain conditions by means of an analog computer and a Sanborn Four-Channel System with four Sanborn AC-DC Preamplifiers.

ATOMIC REACTOR
to be used for power generation in prototype plant is studied with the help of a Sanborn Eight-Channel System which records the output of thermocouples, strain gage pressure pickups, and resistance devices.

ANALOG COMPUTING
center uses Sanborn Eight-Channel Systems to record the solutions of problems having six or eight variables. Sanborn systems specially designed for this type of work utilize Dual-Channel DC Amplifiers.



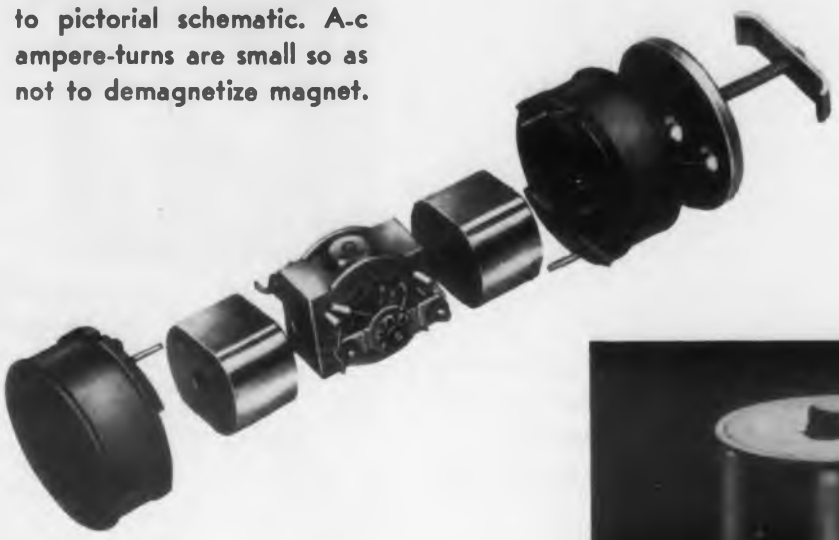
Sanborn 150 Features Include:

Inkless Recording in True Rectangular Coordinates
Preamplifier Interchangeability
Eleven Types of Preamplifiers
Improved Over-all Linearity
Accessibility of Chart During Recording

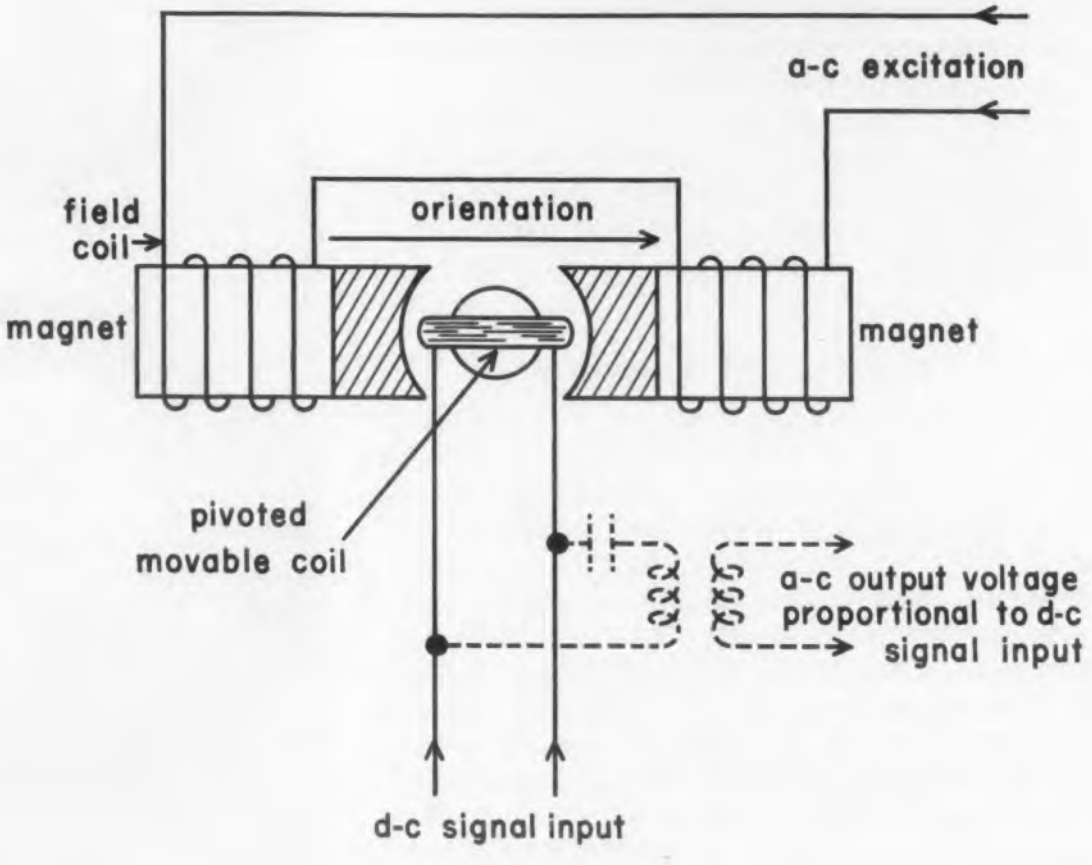
INDUSTRIAL DIVISION
SANBORN COMPANY
CAMBRIDGE 39, MASSACHUSETTS

CIRCLE 31 ON READER-SERVICE CARD FOR MORE INFORMATION

Exploded pieces correspond to pictorial schematic. A-c ampere-turns are small so as not to demagnetize magnet.



Induction Modulator

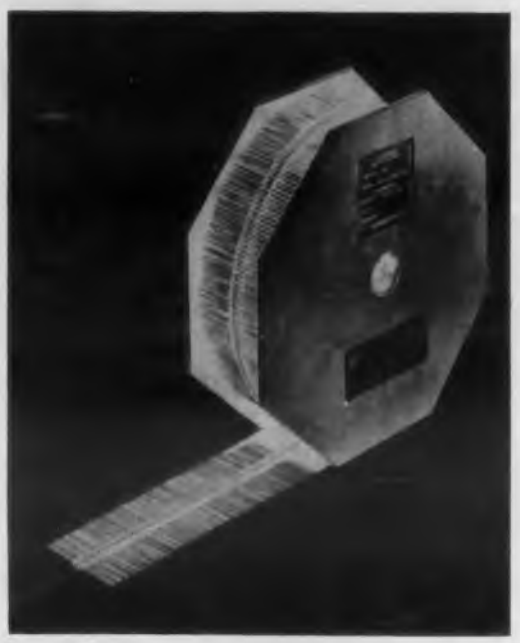


CONVERTING d-c to a-c, this induction modulator is entirely different in principle than choppers and saturating core devices. Essentially a D'Arsonval mechanism, the movable coil is positioned by a d-c signal current through it. A-c field coils, mounted directly on the magnets, produce additive fluxes in the axial direction. This induces an a-c voltage in the movable coil proportional to its position as determined by the d-c signal. Cover illustrations show additional detail. There are no contacts that may fail unexpectedly. The induction modulator presents a constant resistance to d-c signal input.

In contrast to other modulators, the induction unit, manufactured by Weston Electrical Instrument Corp., Newark, N. J., has a conversion gain expressed as the db ratio of a-c power output to d-c power input. It is in the order of 28db. The unit may also be operated as a function multiplier. The voltage out is a product of the a-c excitation and the d-c signal. The movable coil has a zero center position and rotates as much as 50° both clockwise and counterclockwise. The most sensitive design is rated at about 30-0-30μamp producing an output of 1.9v, 400cy. Linearity is within 2-1/2% of full scale deflection. If better linearity is required, deflection angle may be restricted to 40-0-40°.

The movable coil is frameless so as not to present a short turn to a-c and, therefore, the device is basically underdamped. If a fixed response time is desired, an external circuit to the movable coil can be added. The undamped natural period is about 0.37sec. The current flowing through the field coil lags the voltage about 45°. Due to hysteresis and eddy current effects in the iron path, ideal quadrature is not achieved and the output leads the input voltage approximately 22°. Capacitors can be used to make the output in quadrature with the input, if desired.

Balance has been accomplished by means of the balance cross and movable weight system. The modulator can, therefore, be operated in any position. For more information, turn to the Reader's Service Card and circle number **32.**



Automatic Assembly of Electronic Equipment—How Soon?

LACK of standards will continue to annoy designers who are trying to achieve a greater degree of automatic assembly of electronic equipment. Although at least three companies have commercially-available machines for automatic insertion of components into printed wiring boards, and other companies use automatic techniques to build completely five-tube, a-c—d-c radios, component manufacturers and designers are obviously concerned about unstandardized shapes and sizes. Components such as most capacitors, volume controls, etc., are far more easily handled manually than by machine. One speaker at the RETMA Symposium on Automation entitled "Automation for Electronics and Electronics for Automation" held September 26 and 27 at the University of Pennsylvania, facetiously showed a slide in which all components, resistors, capacitors, tubes, I-F's etc., were identical in shape; but he was applauded when he hopefully suggested that all components have similar-type leads in given locations and that machines use the leads as handles irrespective of body shapes. The machine should not care what the body configuration of the component is. RETMA Committees on Automation are aware that the speed at which automatic assembly takes over depends on how soon they can get industry to agree to such things as capacitor lead spacing and hole spacing in printed wiring boards.

Complete Automatic Factory

More than one person discussed their companies' progress towards realizing a complete automatic factory. Programming the automatic assembly of printed circuit sub-assemblies is possible now, and holes for component leads can be punched automatically, corresponding to their X-Y location on the grid reference system made up of discreet incremental X-Y distances. It is not an over-simplification to say, however, that until the electronic industry agrees as to what the best increment is (currently increments being proposed are 1/10 or 1/4 inch or multiples thereof), there will be no uniform, industry-wide progress but only spotty growth by those willing to gamble their scheme will not become incompatible as new components are developed.

The importance of this simple dimension can be appreciated by realizing that not only must punched-tape manufacturing machines be compatible for future building blocks but that automatic material handling machines must be built to draw parts out of inventory and feed them without manual manipulation to manufacturing or processing machines. Parts must be coded for all such machines. The necessary requirement for efficient handling is to have standard sub-assemblies rather than individual circuit elements. Some companies are deciding now what standards for sub-assemblies are to be preferred. F. C. Collings of RCA at Camden described his company's efforts to systematize development of sub-assemblies. RCA's breakdown includes sub-modules of both active and passive types. These items go into functional circuits. Functional circuits are made in functional sub-assemblies (this stage is comparable in complexity to today's printed wiring boards with individually mounted components). Functional sub-assemblies are combined to make specific equipments and equipments in turn are building-blocks of systems. This approach is intended for small production. Mass production problems are often simpler. Since, for example, 98% of all resistors used are of the 1 watt size or below and 40% of all capacitors fall within a specific size using pig-tail leads, the sub-modules are prepared using mainly only these elements. An automatic component inserting machine with two heads produces pieces comprising 88% of all R-C elements used in an equipment. A seven head machine will pre-assemble 72% of all components found in products of this division. Awkward i-f's, volume controls, etc., make up only 28% of the component complement.

M. R. Johnson of General Electric foresaw in the not too far away future, the complete elimination of conventional drawings. At present, their practice of dimensioning to 0.1" increments means they do not have to add dimension figures but can rely on the grid reference lines of drawings. Such drawings can be punched on tape for automatic control of machines.

Better Soldering

Optimum dimension increments depend on best area utilization, clearance to prevent leakage, solder creep, easy lay-out of the circuit, machine tolerances, etc. Questions from the audience showed many manufacturers and designers are searching for reliable dip soldering techniques; failures of almost all sorts have been experienced. D. F. Pennie of Minnesota Engineering Co. reported on some of their progress in getting rid of oxidation of copper by pre-tinning circuits with solder. They feed the boards between solder-carrying rollers to "print" a layer of solder. Experiments of electroplating a solder coating also looks promising. Eastman Kodak's R. J. Roman was questioned eagerly about their investigation of effects of impurities in solder pots. Interesting also was this company's findings indicating that solder strength was not due so much to hole size as the diameter of the lead. The Signal Corps, according to R. H. Gerholdt, is studying contamination and is working on superior protective coatings for printed wiring boards.

Component Costs Key to More Automation

Regardless of the ideal situations desired, cost is always a factor and here automatic assembly progress must be orderly so as to meet today's demands. Although new thinking is vital, it appears changes will, because of economics, be transitional rather than revolutionary in nature. The component cost of electronic equipment is far greater than labor cost. If component cost is increased in making it adaptable for automatic inserting machines, the real gains made would not be as great as expected. Real progress thus lies with component part manufacturers. The bright

Design Trends from Meetings

note is that RETMA Automation Committees are energetically tackling the problem.

Other Trends

In spite of the fact that changes will, no doubt, come about gradually based on the printed wiring approach, effort is still being directed to wafer techniques where components as well as conductors are printed. For example, Professor Crother's article "Designing a Self-Biased Video Amplifier for Printed Circuit Techniques", p 54-55 of this issue, makes it clear that circuits can be re-designed to accommodate printing techniques. Not to be dismissed by automation engineers is another approach which uses a machine to automatically wire electronic chassis with conventional insulated wire. This process was reported by Dr. S. J. Begun of the Clevite Brush Development Company and was described in detail in ELECTRONIC DESIGN, October, 1955, page 5.

Improved Quality

In addition to increased production and lower cost, one decided advantage of automatic assembly is that the quality and uniformity of the product is better. There are fewer rejects. Reliability of automatic machines including data processing equipment was reported from several sources as being exceptionally good. When costs for achieving reliability take into account down time for repair, higher priced reliable components often prove more economical. Professor James Bright of Harvard Business School reported in his survey of 50 automated plants (not all electronic) that in contradiction to popular theory, there was no evident upgrading of labor necessary to keep equipment operating. Although there is no lessening of the demand for engineers and technicians, to date automatic factories appear to be doing well with present personnel. The entire proceedings of the symposium is available from Engineers Publishers, GPO Box 1151, New York 1, N. Y.

The digital computer part of the Ramo-Wooldridge Data Processing Center

BUSINESS AUTOMATION and MILITARY ELECTRONICS

The problem confronting many company managements today in deciding what course to follow in applying the new techniques of automation and data processing is similar to the problem faced in recent years by the leaders of our military organizations in arranging for efficient application of the same powerful tools of electronics to the art of war.

At Ramo-Wooldridge the difficult demands of major military systems responsibility have been met successfully by the placing of heavy dependence upon teams of unusually well-qualified, mature and experienced scientists, operational procedures experts, and engineers. These teams deal with the technical and non-technical portions of a project as inseparable and interrelated aspects of a single problem.

Similarly, work has been done in the last two years by this company on systems problems of non-military clients from such diverse fields as manufacturing, banking, transportation and public utility. The results strongly support the conclusion that many of the difficult problems in automation that face business and industry today can be economically solved by teams that include a breadth of technical and non-technical competence which permits them to conduct a highly objective, scientific analysis of a client's operations and requirements.

One important advantage to the client of such a broad and objective approach to his problems is the possibility of recommendations that realistic operational needs can be met without the necessity for investment in any additional machines or equipment. Nevertheless, the technical strength of The Ramo-Wooldridge Corporation, provided by its hundreds of scientists and engineers, is such that it can also undertake successfully the development of entirely new equipment and techniques, if required. As an example, major programs are currently under way on the development of an advanced type of digital computer and control system, and on the automation of large-scale data processing activities.

To a surprisingly great extent, military electronics experience has charted the course for non-military automation. A major objective of The Ramo-Wooldridge Corporation is to assist business and industry in moving rapidly, yet realistically and economically, to take advantage of the great benefits of the new techniques.

The Ramo-Wooldridge lecture hall during a lecture on Operations Research, as applied to the solution of management problems.

PACIFIC SEMICONDUCTORS, INC., *a subsidiary devoted to the development and manufacture of advanced types of semiconductor devices such as diodes and transistors... of great importance in the future apparatus of automation.*

The Ramo-Wooldridge Corporation

8820 BELLANCA AVENUE • LOS ANGELES 45 • CALIF.

Magnesium Waveguides

Waveguide in this feed horn is bent in both planes, and twisted 90°, from one length of seamless extruded magnesium tube. Electrical function is not impaired by structural weldments.

Twists, and E and H bends, mounted to any type of flange are possible with magnesium.

LIGHTER than aluminum by 25% and brass by 75%, these magnesium waveguides offer significant weight savings and higher strength to weight ratios. Strength is 25% over aluminum for equal weights. The government approved magnesium fittings are equivalent respectively to RG-68U and RG-67U (both aluminum), and RG-91U (brass). They conform to MIL-T-85C. Waveguides and components of magnesium have nearly identical VSWR characteristics to those of other materials. Attenuation is intermediate, between aluminum and brass.

In addition to these three standard sizes, the Electronics Div., of Model Engineering & Mfg., Inc., Huntington, Ind., is also making special Tru-Guide magnesium waveguides for non-standard or custom applications. Complex designs are fabricated from extruded pieces or cast in configurations requiring short radius bends, twists, and difficult structural members. A special welding technique has been perfected for use as needed. Rigid rectangular magnesium waveguides are available for the most widely used frequency bands in lengths up to 10 ft, mounted to any type flange. Standard sizes include E and H bends and twists. Flanges are made to comply with present specifications.

A special approved coating process gives maximum resistance to corrosion and electrolytic action without impairing physical or electrical performance. For more data, turn to the Reader's Service Card and circle number **36.**

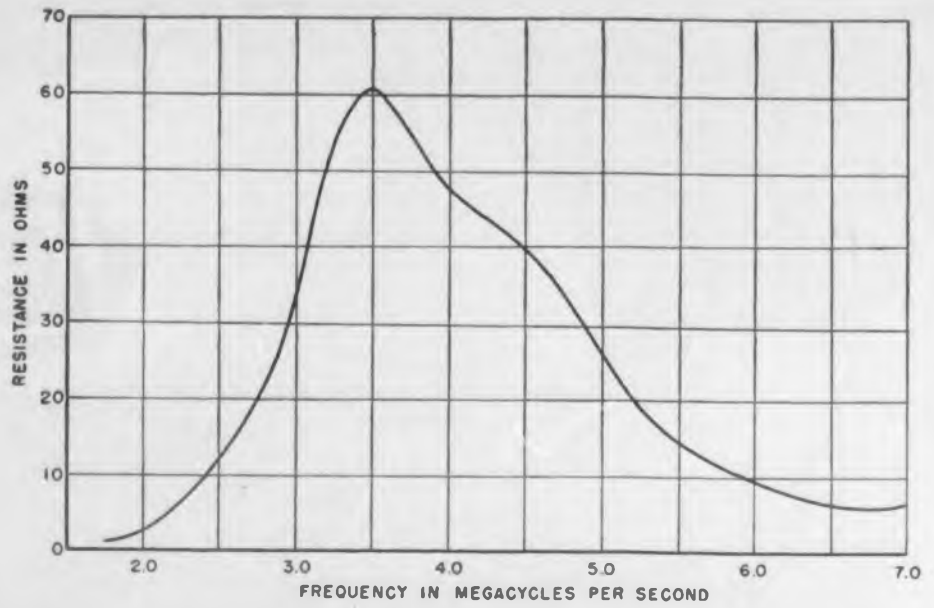


Fig. 1. The resistance of the antenna vs. frequency is plotted here.

Antenna Matching with Controllable Inductors

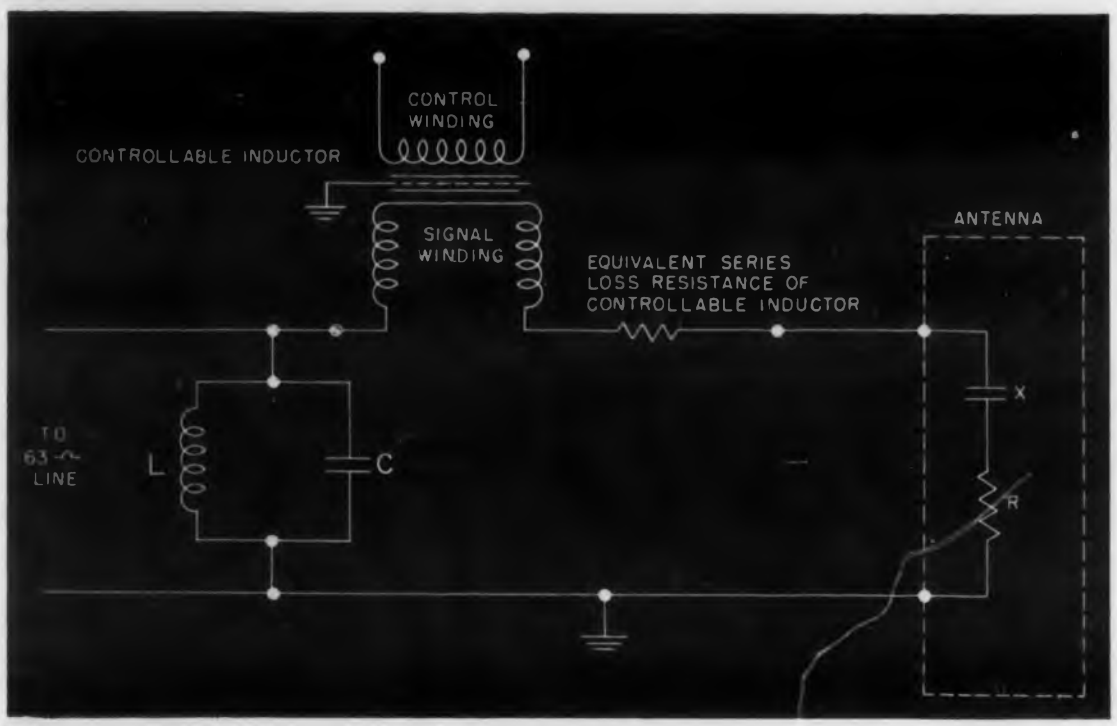


Fig. 2. Matching circuit and antenna. *L* and C are equal to 0.955μh and 2160$\mu\mu$fd, respectively, for the 2 to 4Mc band, and 1.455μh and 1420$\mu\mu$fd, respectively, for the 3 to 7Mc band. The signal winding inductance varies from 14.7 to 58.9μh for the lower band, and from 4.37 to 23.6μh for the 3 to 7Mc band.

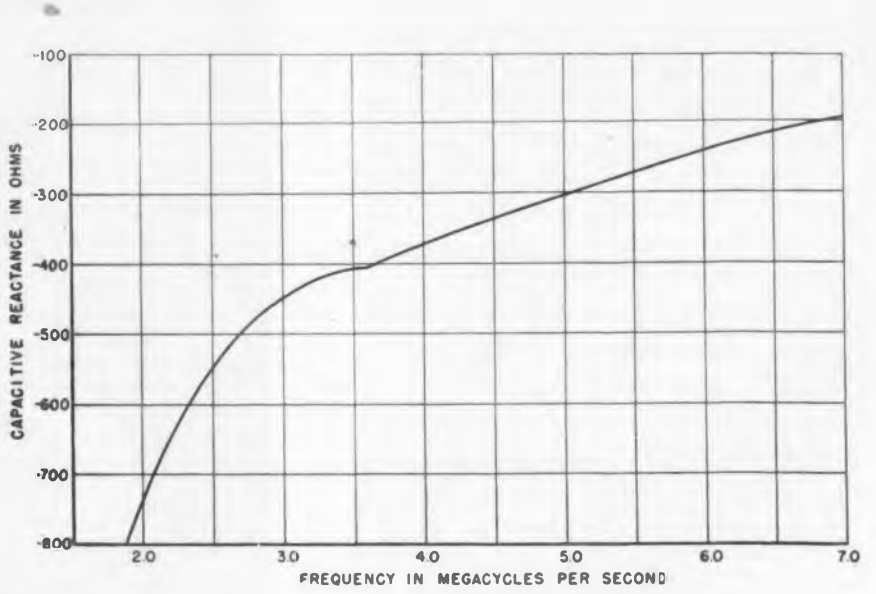


Fig. 3. The antenna reactance curve closely approximates that of a fixed capacitance of 110$\mu\mu$fd.

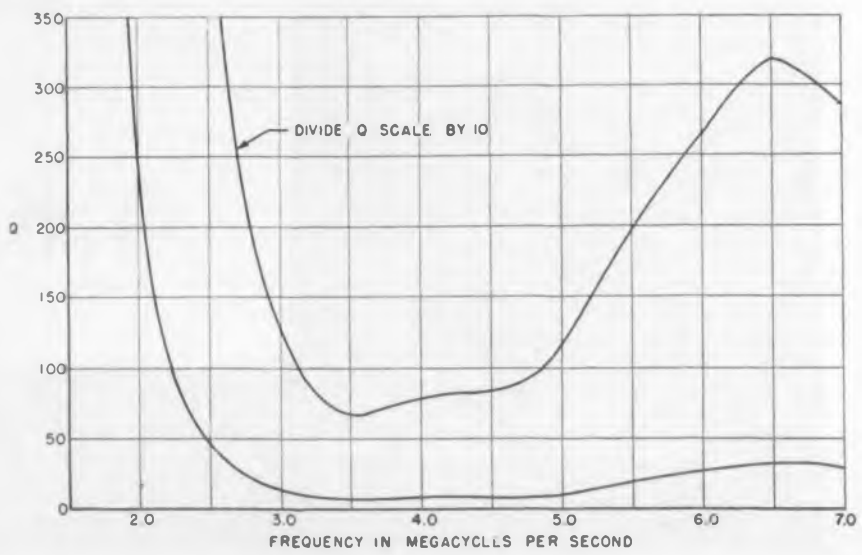


Fig. 4. The upper curve of antenna Q is the same as the lower curve, but magnified 10 times.

Arthur L. Kaufman, Consultant
CGS Laboratories, Inc., Stamford, Conn.

MATCHING antennas, whose resistance and reactance vary widely with frequency, to the characteristic impedance of feeder cables is readily accomplished with the "Increductor" controllable inductor, an r-f saturable reactor. The use of this device in antenna matching will be demonstrated by an actual example. The Increductor features a high Q, wide inductance range, rapid tuning with no moving parts, and ease of remote control. A discussion of the characteristics of this circuit element and nine applications for it were previously published in ELECTRONIC DESIGN (*April, 1954, pp 12 and 13, and May, 1954, pp 24 and 25, respectively*).

Sample Problem

The characteristics of the antenna in question are shown in Figs. 1, 3, and 4. This antenna must be matched to a 63 ohm line. At 2Mc the radiation resistance of the antenna is only 2.5 ohm and it has a Q of 225. If the line were connected directly to the antenna at 2Mc, the result would be a power loss of 29.2db over that of a perfect match of 63 ohm resistance into 63 ohm resistance. By means of the Increductor, loss due to mismatch at 2Mc is reduced to less than 0.25db and the loss due to heat in the controllable inductor is less than 3.25db for a total loss of only 3.5db with the matching circuit as compared to 29.2db without it, as shown on the next page.

For reasons of application, the problem was split into two bands: 2 to 4Mc and 3 to 7Mc. The r-f

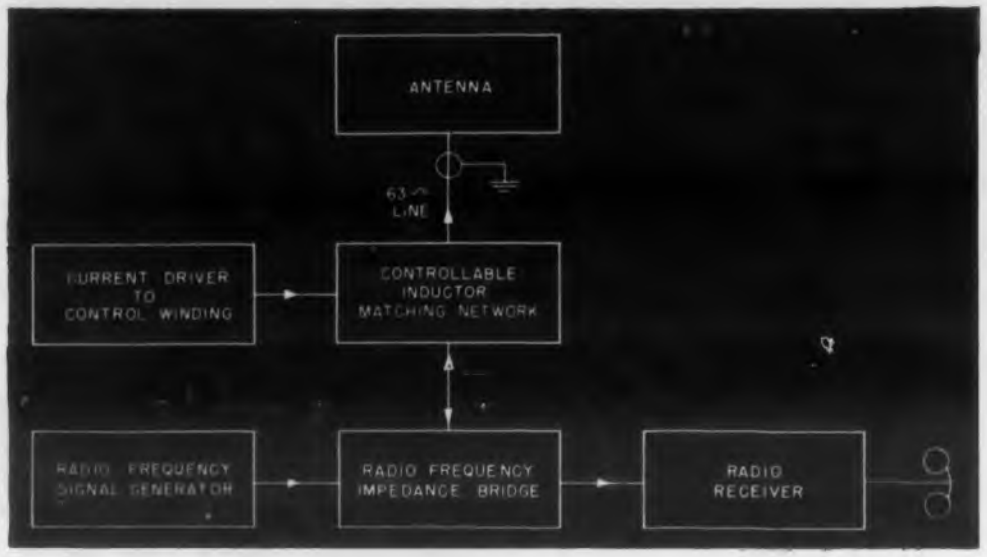


Fig. 5. The current driver in this measuring circuit is varied to make the matching circuit present a 63-ohm resistance to the r-f bridge.

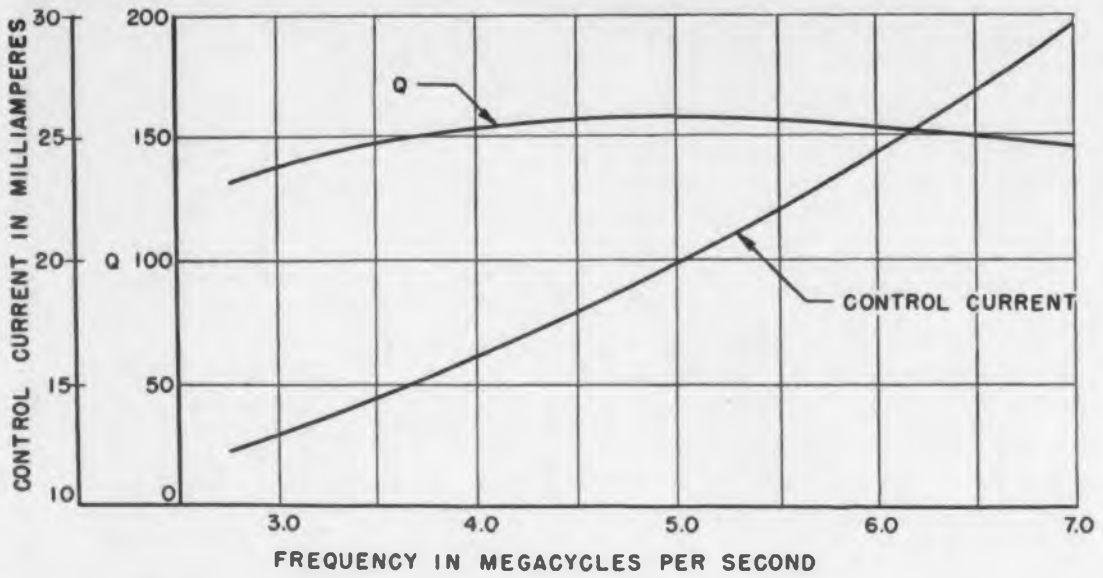


Fig. 6. The inductor for the upper band is designed for max Q at 6.6Mc, where the Q of the antenna peaks again.

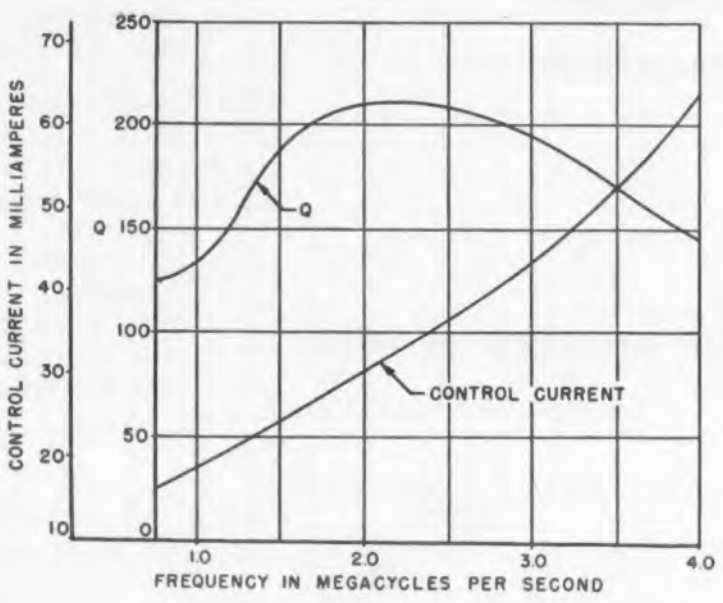
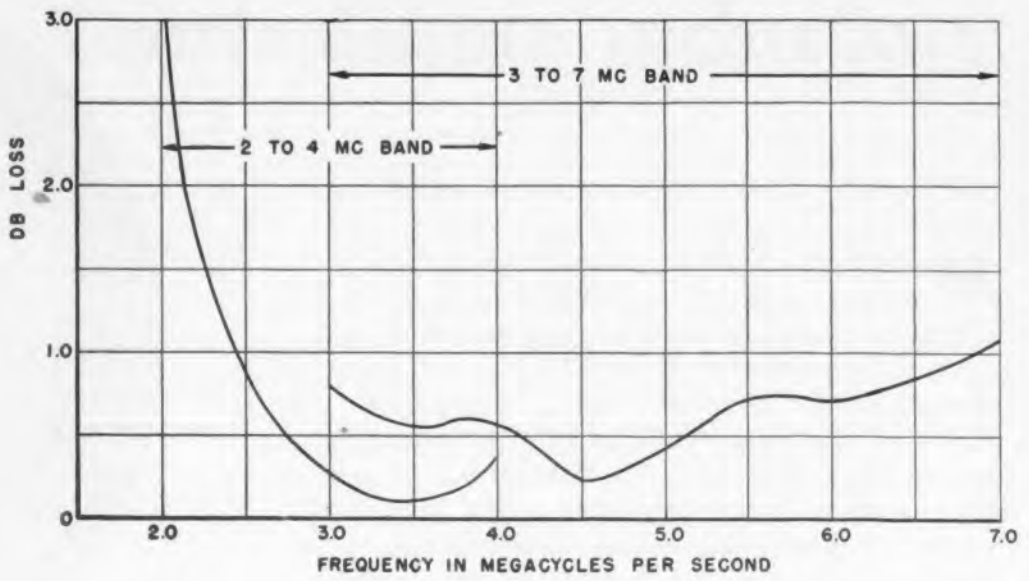


Fig. 7. The Q of the controllable inductor for the 2 to 4Mc band is highest at 2Mc, where the Q of the antenna is highest.

Fig. 8. Except for the region near 2Mc, the loss due to inductor equivalent resistance is low.



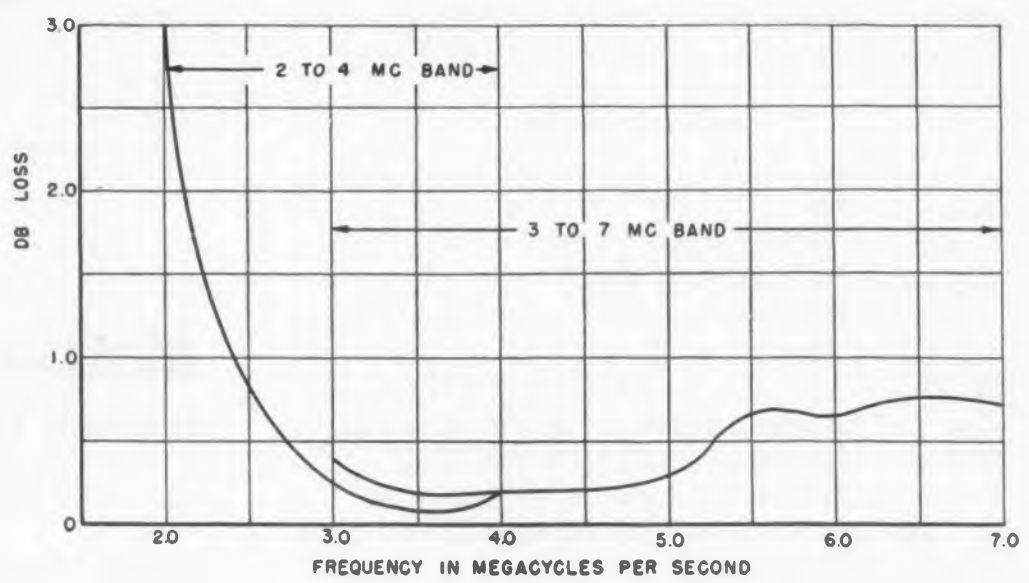


Fig. 9. Compare these plots of total circuit loss with those of Fig. 8, above.

saturable inductor is adjusted to almost resonate with the antenna capacitance. The difference between exact resonance and the actual setting is made so that the antenna resistance in series with the equivalent loss resistance of the controllable inductor at each frequency is effectively transformed up to 63 ohms. This procedure, in addition to matching the resistance, tunes out the major portion of the antenna reactance. The small remaining reactance is then almost completely balanced out by the fixed L-C tank placed across the line. Note that at 3.5Mc, where the antenna resistance peaks to 61 ohms, is the one place that the controllable inductor is set to exact series resonance with the antenna capacitance. This basic matching circuit can be used to match to resistances higher than 63 ohms by merely tuning the controllable inductor further off series resonance, thereby getting greater resistance transformation step-up. If this is done, the fixed tank reactances must be readjusted to balance out the additional residual reactance. The circuit may also be used to match resistances lower than 63 ohms by merely tapping down an appropriate amount on the fixed tank inductance.

The set-up for measuring the overall performance of the matching networks is shown in Fig. 5. The current driver is varied to make the matching circuit present 63 ohm resistance to the r-f bridge. Any residual reactance across the 63 ohms produces the mismatch loss. The loss due to mismatch is less than 0.5db over both bands.

Special circuitry can be designed to make the controllable inductor in these and other matching circuits match the antenna automatically as the frequency is changed, even at very rapid rates. The unit used in this case was designed to handle maximum signals of 1w. It has a volume of 10 cubic inches and a weight of 10 oz. More recent developments made after the above tests allow a size and weight reduction to 6.6 cubic inches and 5.2 oz respectively, in a hermetically sealed can meeting MIL-T-27 specifications. The volume and weight will increase proportionally to maintain the same Q's at higher signal levels in this frequency range. However, size and weight will decrease proportionally for the same signal level with increasing frequencies.

Designing a Self-biased Video Amplifier for Printed Circuit Techniques

Milton H. Crothers, Assistant Professor
Electrical Engineering Dept., University of Illinois

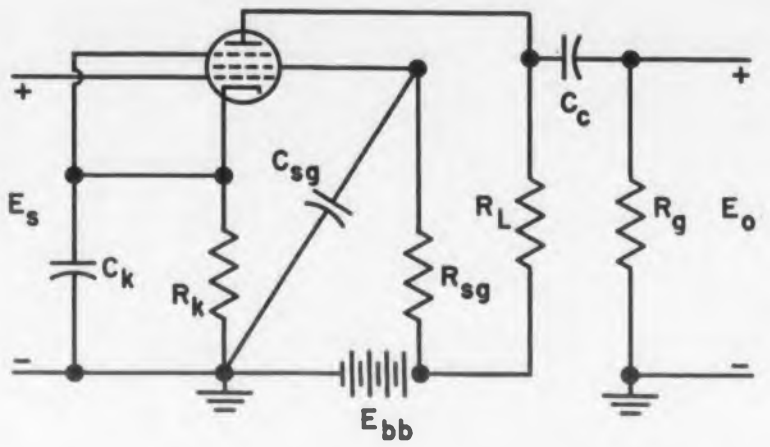


Fig. 1. Conventional-type video amplifier stage.

PRINTED circuit amplifiers may have many advantages over conventional types using standard components, but there is a limiting value of capacitance that may be printed. The largest capacitor value used in the video amplifier is in the self-bias circuit. This article presents a new concept of using a low-frequency compensating network which makes it possible to ignore the value of the by-pass capacitor as a factor in the low-frequency response.

The circuit diagram for one stage of a typical video amplifier (without compensation) is given in Fig. 1. Looking at the function of each circuit element and their range of values, the plate load resistor R_L is selected from the required band width, the relative value of g_m and total shunt capacitance C. The value of R_L is thus limited by the high frequency response desired; this restriction is removed for lower frequencies normally associated with the low frequency response region of the amplifier. Typical values are thousands of ohms.

The cathode self-bias resistor, R_k, is selected from the operating point of the vacuum tube and is generally of the order of hundreds of ohms. The cathode by-pass capacitor, C_k, is selected so that the low frequency response of the amplifier is not limited by the impedance, Z_k of the self-bias circuit elements. A typical value for C_k is many microfarads; this means that electrolytic capacitors are generally used for this purpose.

The other elements of the video amplifier circuit will not be discussed because they do not enter into the modified circuit. It is assumed that their values are adequate for good low frequency response.

Effect of Z_k on low frequency response—A study of the effect of Z_k upon the low frequency response is given here because this is fundamental to understanding the operation of the modified circuit. The equivalent circuit for midband and low frequency ranges is given in Fig. 2. Coupling capacitor C_c and grid resistor R_g are not used because they do not enter into the discussion. If E_g is replaced by other variables, the second form of equivalent circuit results.

The midband voltage gain is $A_{mid} = \dfrac{-\mu R_L}{r_p + R_L}$

The voltage gain in the low frequency region is

$$A = \frac{-\mu R_L}{r_p + R_L + (1+\mu)Z_k}$$

$$= \frac{-\mu R_L}{r_p + R_L + \dfrac{(1+\mu)R_k}{1 + j\omega C_k R_k}}, \text{ where } Z_k = \frac{R_k}{1 + j\omega C_k R_k}$$

and separating terms:

$$A = \frac{-\mu R_L}{r_p + R_L + (1+\mu)R_k} \times \left[\frac{1 + j\omega C_k R_k}{1 + j\omega C_k R_k\left[\dfrac{r_p + R_L}{r_p + R_L + (1+\mu)R_k}\right]}\right]$$

The low frequency response is plotted from this last equation by using the corner plot methods. The response is plotted with respect to the midband gain and decibel relative level. It should be noted that the frequency at which the response starts to fall from the midband level is not the corner frequency expressed by the bias elements C_k and R_k alone. This fact requires that the bias circuit element values "time constant" be much larger than the coupling circuit "time constant" if the self-bias circuit is not to interfere with low frequency response. This fact is often overlooked.

Example Problem—Assume that a video amplifier is to have good response down to 30 cy. with the element values indicated below. If the low frequency response of the cathode self-bias elements is not to enter the 30 cy. region, the corner frequency indicated at ω_1 should be less than 15 cy. A margin of two octaves is selected from the 30 cy. region and ω_1 is assumed as 2π (7.5 cy.) for $R_L = 5K$, $g_m = 5{,}000$ μmhos, $r_p = 500K$, and $R_k = 250$ ohms

$$\text{then } \left[\frac{r_p + R_L + (1+\mu)R_k}{r_p + R_L}\right] = \frac{1133K}{505K} = 2.24 \text{ and}$$

$$C_k = 2.24/\omega_1 R_k = 2.24/2\pi(7.5)250 = 190 \text{ mfd.}$$

The Modified Video Amplifier Circuit—Addition of a capacitor and resistor element to the basic equivalent circuit of Fig. 2 produces low frequency compensation which results in flat low frequency response independent of the self-bias elements. Fig. 4 shows the new amplifier and the equivalent circuit with R' and C' added in series with R_L.

The impedance of the added elements is $Z' = R'/1 + j\omega C'R'$ and the voltage gain is

$$A = \frac{-\mu(R_L + Z')}{r_p + R_L + Z' + (1+\mu)Z_k}$$

This voltage gain expression may be made independent of frequency if the two following conditions are observed:

$C'R' = C_k R_k$ establishes the same corner frequencies for these two impedances Z' and Z_k.

$\dfrac{Z'}{R_L} = \dfrac{Z' + (1+\mu)Z_k}{r_P + R_L}$ establishes a constant ratio in the voltage gain expression.

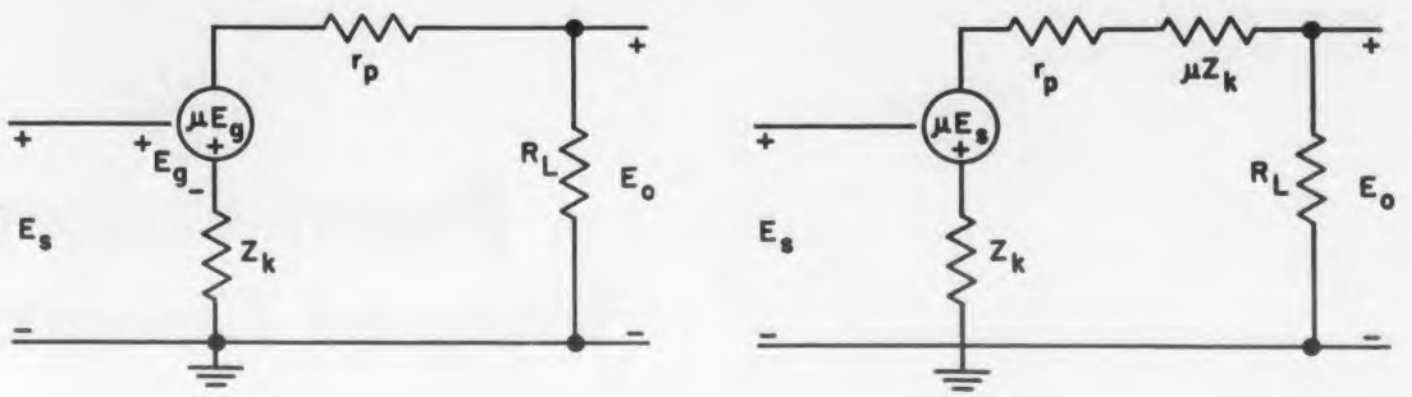


Fig. 2. Equivalent circuit for low frequency response, left. When E_g is replaced by other variables, circuit at right applies.

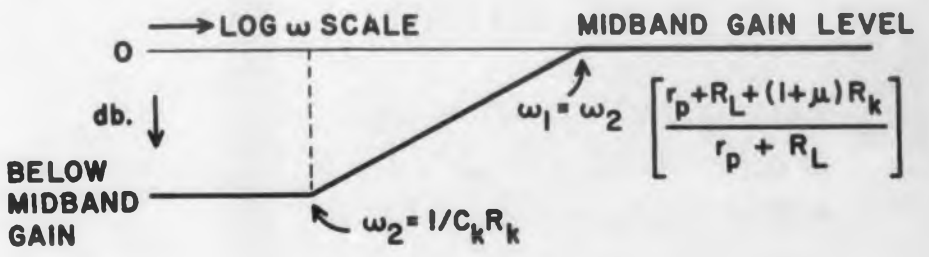


Fig. 3. Corner plot to show l-f response with Z_k.

Solution of these conditions leads to the following design relations for the compensating network element values:

$$R' = \left[\frac{R_L(1+\mu)}{r_p}\right] R_k \quad \text{and} \quad C' = \left[\frac{r_p}{R_L(1+\mu)}\right] C_k$$

The value of C_k is no longer selected in terms of the low frequency response required of the amplifier because the compensating network gives flat response over the entire range of frequencies where Z_k might be involved. The effect of the compensating network is to introduce two additional corner frequency factors in the voltage gain expression; when the proper element values are selected, the corner frequency factors introduced by the compensating network cancel out those of the self-bias elements.

The restriction upon the value of $(R_L + Z')$ with respect to high frequency response still applies; the corner frequency associated with Z' must be well below the high frequency response region of the amplifier. The typical video amplifier has a very wide midband region and the corner frequency of Z' (and thus the corner frequency of Z_k) may be placed within this midband region with a large margin from the high frequency response region. The element R_L alone should represent the net impedance in parallel with C_s for the high frequency response region.

Assume that the value of C_k is selected as 0.1 mfd while using the same values for R_L, r_p, g_m, and R_k as given in the first example. The values of R' and C' are calculated and the corner frequencies located as follows:

$$R' = \frac{5\text{K}\ (2501)}{500\text{K}}\ 250 = 6.28\text{K} \quad \text{and} \quad C' = 0.1/25.01 = 0.004\ \text{mfd}$$

$\omega_2 = 1/C_kR_k = 1/C'R' = 1/250 \times 10^{-7} = 4 \times 10^{+4}$ or $f_2 = 14.3$kc.

$\omega_1 = 2.24\ \omega_2 = 6.37 \times 10^{+4}$ or $f_1 = 14.3$kc.

Summary

A low frequency compensating network is added to the basic video amplifier to free the self-bias by-pass capacitor from consideration as a factor in the low frequency response. The resulting element values thus are within the range of printed circuit capacitors. The high frequency response of the amplifier is still a matter of the load resistor R_L and the shunt capacitance C_s. High frequency compensation may still be added in the usual manner.

New requirements are suggested for the element value tolerances so that the voltage gain is actually flat across the frequencies involved in the compensation. Tolerances may be expressed in ratio forms because the design relations are in ratio forms. Printed circuits can often hold ratio tolerance better than absolute value tolerance.

The local feedback provided in the region below ω_2 may actually be a help because this type of local degeneration tends to reduce tube nonlinearity.

The final economic measure of the modified amplifier circuit in terms of space, weight and cost should compare well with the standard amplifier circuit. Two disadvantages must be noted; the d-c resistance in the anode circuit is larger and two additional elements are required for the new circuit.

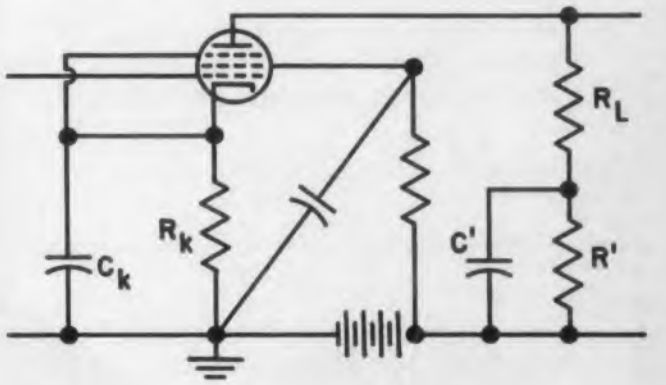
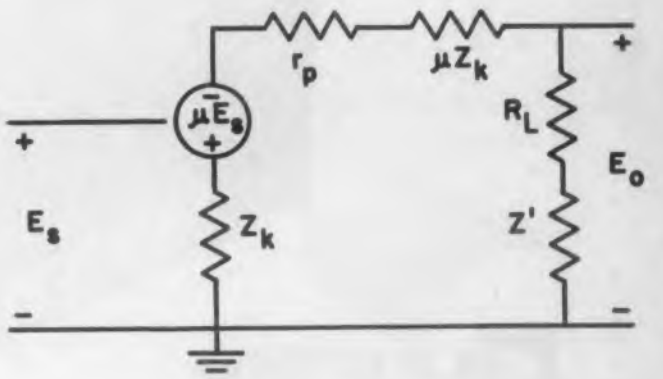


Fig. 4. Modified video amplifier, top, with its equivalent circuit, lower.



Reference

"Elements of Television Systems" by George E Anner, 1951, Prentice-Hall Electrical Engineering Series.

Foam-Potted Plug-In Circuits

The units look like this prior to potting.

These plug-in circuits stand 4½" off the chassis, including tube.

CONSIDERABLE savings in weight over similar potted plug-in circuits are gained by encapsulating with foam plastic. These units are available in a group of vacuum-tube and transistor circuits, each made in a number of variations. The plastic is a unicellular, silicone foam.

The units have a very high component-to-potted-weight ratio. The vacuum-tube types weigh 42gr prior to potting and only 45gr afterwards. For improved moisture resistance, the units are vacuum-impregnated with a silicone resin while still hot from the curing process. The vacuum-tube types can be operated over a temperature range of −100°F to +600°F. These units are available from Topper Manufacturing Co., Inc., 43 Roselle St., Mineola, N. Y.

Among the circuits in which these plug-ins are made are: triode and pentode amplifiers; phase inverters; and cathode followers. The transistor types are potted around a 16-pin Amphenol connector. They are 2″ long x 1″ high off the chassis x 3/4″ thick. All of these circuits are of particular interest to designers of military equipment. For more information turn to the Reader's Service Card and circle **41.**

Typewriter with a Memory

A plugboard memory is being inserted into the Wordwriter. Although no attempt was made to develop a compact commercial equipment, the memory apparatus easily fits into one-half of a standard desk.

October 21, 1955

Mr. George Enwright
Enwright Manufacturing Company
Martinsville, Iowa

Dear Mr. Enwright:

In response to your request of October 20, we have enclosed literature concerning the IBM Electric Typewriter. We hope you will find the booklets of interest.

The brochure titled, "The Secret of the 'Letter Perfect' Letter", describes the IBM Executive Electric Typewriter which features a revolutionary typing principle, exclusively IBM's, giving each character the amount of space it requires according to its width.

From a wide variety of specially-designed type styles, you may choose the one best suited to express the personality of your company.

If we can be of further assistance, please do not hesitate to contact us.

Yours truly,

H. W. Wilson
Sales Department

HWW:ns
Attachments

The underlined phrases are the ones that have been memorized and typed by the memory.

ELECTRIC typewriters with memories may be a standard business machine of the future as a result of the development of an experimental version. This typewriter has a "memory" containing 42 18-character phrases, one for each key. The device would make a typists' work easier, faster, and more accurate. It would also make every typist a potential legal or medical stenographer, both scarce skills.

The device is a modification of the standard electric typewriter. In addition to the memory apparatus, a number of solenoids have been attached to the keys and some other operational parts of the typewriter. The typewriter can still be used in the conventional manner. In use, a letter is set up in the usual way. After the heading is typed, the operator types away until she comes to a frequently employed phrase, one that has been memorized. After depressing a foot pedal that connects the memory to the typewriter, the typist strikes the key associated with the phrase. The memory then operates the typewriter at the rate of 150 words per minute, writing out the phrase and inserting hyphenation where needed. The operator then removes her foot from the floor pedal and continues typing until the next remembered phrase is reached and inserted in the above manner.

The device was initially developed five years ago by R. R. Seeber, Jr., of the Watson Computing Laboratory of International Business Machines Corp. The laboratory is located at Columbia University in New York City. The typewriter, called the "Wordwriter" is a sideline for Mr. Seeber, who is a computer designer. His initial concept called for a magnetic drum memory. Phrases to be inserted in the device would simply be "typed" in. The drum would have had a capacity of about 800 phrases. Due to the cost and limited availability of drums, Mr. Seeber turned to a simple plugboard memory. The board consists of holes for each typewriter key plus alphabets. There are additional holes for other operations such as spaces, hyphenation, optional capitalization, and moving to the next line on the letter.

It only takes a few minutes to learn how to plug a phrase into the board. It takes about six hours to completely wire a board for 42 phrases. In use, the typist plugs in a few phrases at a time as she notes those that occur most frequently in her work. She can also easily remember the key associated with each phrase when they are inserted at this pace.

Since the plugboards are mounted in the conventional sliding-frame, a number of them can be used with one Wordwriter. Therefore, a number of secretaries can use one device. Mr. Seeber has found that one secretary remembered the phrases plugged into two different plugboards, depending on which one was

connected to the device at the time. Therefore, the Wordwriter can be used by the same secretary for a few different functions, such as ordinary correspondence, billing, or technical reports. Mr. Seeber believes that a secretary can remember many times 42 phrases if a larger capacity memory were employed in the Wordwriter.

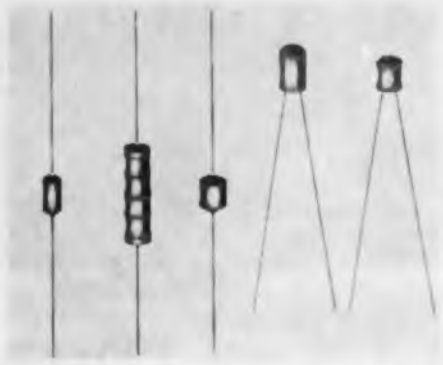
IBM has no present plans for marketing the Wordwriter. However, since the device was first developed, a number of typewriter manufacturers have introduced electric typewriters. Any of them could modify standard units with memories. Mr. Seeber's plugboard is not the only type of memory that could be employed. In addition to the expensive magnetic drum, he has suggested a plugboard on which connections are made by drawing lines with conductive-lead pencils. Printed circuit plugboards are another possibility. If the memory has a greater phrase capacity than the number of keys on the typewriter, then two keys could be depressed at the same time to trigger the additional phrases over 42.

Mr. Seeber estimates that his comparatively simple device would cost about four times as much as an electric typewriter. At that price there may be only a small market for it. However, if the present shortage of skilled secretaries continues to grow worse, a market for this device may develop before long.

New Products

Encapsulated Resistors

Operate at 125°C Continuous



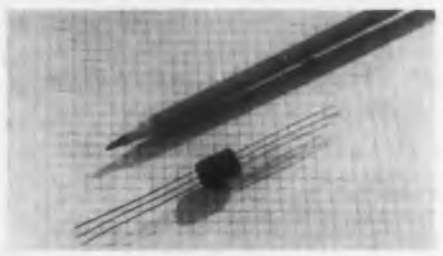
These subminiature units use extremely fine sizes of resistance wire to obtain two or three times the resistance value previously supplied on miniature bobbins. They are fully encapsulated and operate at 125°C continuous power without derating. They meet and exceed all humidity, salt water immersion, and cycling tests of MIL-R-93A, amendment 3.

The resistors can be obtained in tolerances as close as ±0.05% and have a standard temperature cofficient of ±20ppm/°C. Special coefficients can be supplied. Five types are offered in ratings from 400K to 1.0 megohm, in wattages from 0.1 to 0.75w. The Daven Co., Dept. KL, 530 W. Mt. Pleasant Ave., Route 10, Livingston, N. J.

CIRCLE 44 ON READER-SERVICE CARD FOR MORE INFORMATION

Pulse Transformers

Weigh Only 4Grams



The M Series of Pulse Transformers measure 0.44" diam x 0.56" long and weigh only 4gr. These units can be wound to cover a range of pulse widths from 0.05 to 2.0μsec. They are completely encapsulated for protection. Specially designed ferrite cup cores make it possible to wind transformers of this size covering a wide range of applications in transistor and vacuum tube circuits. Technitrol Engineering Co., Dept. ED, 2751 N. 4th St., Philadelphia 33, Pa.

CIRCLE 45 ON READER-SERVICE CARD FOR MORE INFORMATION

X-Y Recorder

8-1/2" x 11" Flat Bed Unit

This 8-1/2" x 11" X-Y recorder gives flat-bed presentation, permitting the plot to be visible during the entire plotting operation. This feature also permits the plot to be marked or identified in place. Pen speed of the new instrument is 1/2sec full scale. "Jitter" is effectively eliminated through the use of circuits which eliminate 60cy and 120cy pick-up. Controls are recessed.

The instrument is provided in 11 scale ranges, from 5mv to 500v full scale. Cable drive systems are used for both axes. Input impedance is 200,000 ohms/v. Potentiometer input is by switch control. Electro Instruments, Inc., Dept. ED, 3794 Rosecrans, San Diego 10, Calif.

CIRCLE 46 ON READER-SERVICE CARD FOR MORE INFORMATION

Wire-Wound Resistors

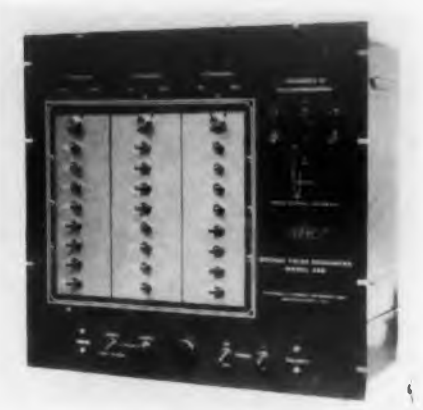
Only 1/4" Long and 3/32" Diameter

Designed especially for subminiature and transistor requirements where physical size, weight, and simplicity are of prime importance, these precision subminiature wire-wound resistors are offered in a choice of standard tolerances of ±1%, 1/2%, 1/4%, and 1/10%. They are supplied in either inductive or noninductive windings in varying sizes from 1/4" up to 3/4" long x 3/32" diam in any resistance values desired from 0.10 ohm through 0.50 megohm. All units have a temperature coefficient of resistance of 20ppm/°C. Precision Resistor Co., Inc., Dept. ED, 107 U. S. Highway No. 22, Hillside 5, N. J.

CIRCLE 47 ON READER-SERVICE CARD FOR MORE INFORMATION

Square Pulse Generator

Milliμsec to μsec Range



Model 300 is for use in the milliμsec to μsec range with fast pulse systems, oscilloscopes, wideband amplifiers, delay lines and other equipment employed in nuclear, radar, TV, u-h-f and other related fields. It generates square pulses of one milliμsec rise time and widths varying from 0.001 to 0.1 μsec. There are three or more separate pulse outputs each of which can be independently varied in amplitude in high precision 1db steps over the range of 100 to 0.006v into low impedance cables (50 to 200 ohms). Electrical and Physical Instrument Corp., Dept. ED, 42-19 27 St., Long Island City, N. Y.

CIRCLE 48 ON READER-SERVICE CARD FOR MORE INFORMATION

Silicone Diodes

Peak Inverse Ratings 3.0 to 225v

Eight new bonded silicon crystal diodes have been added to this line, providing a group of 12 hermetically sealed units having peak inverse voltages ratings from 3.0 to 225v. Four of the new units are designed for use as voltage references or regulators at voltages ranging from 3 to 11v. The diodes offer excellent stability and low reverse current at ambient temperatures from −55 to +150°C. Raytheon Manufacturing Co., Dept. ED, 55 Chapel St., Newton 58, Mass.

CIRCLE 49 ON READER-SERVICE CARD FOR MORE INFORMATION

Aluminum Foil Tape

Moisture Vapor Barrier

A new pressure-sensitive aluminum foil tape used as a moisture vapor barrier in communication cable splices is the "Scotch" brand electrical tape No. 49. The tape's 3-mil, dead soft, aluminum foil backing has a tensile strength of 33 lb/inch. Total thickness including adhesive is 5mils and adhesion is 25 oz/inch. It is recommended for use in taping operations on plastic insulated-plastic sheathed cable splices and also where such cable is spliced to conventional paper insulated-lead sheathed telephone cable. Available in 2″ x 20 foot rolls. Minnesota Mining & Manufacturing Co., Dept. ED, 900 Fauquier St., St. Paul, Minn.

CIRCLE 50 ON READER-SERVICE CARD

Embossed Circuits

No Resist Required

Another source for printed circuits, using a new manufacturing technique, is now available. The "resist" addition step in the making of the circuit is eliminated by this method, which is called "embossing". The manufacturing steps call for making a copper-plate die, just like an engraver's line cut, from the master circuit drawing. This die stamps the circuit into the copper-clad insulator, creating a series of valleys and ridges. Erie Resistor Corp., Dept. ED, 640 W. 12th St., Erie 6, Pa.

CIRCLE 51 ON READER-SERVICE CARD

Repeat Cycle Timer

For Life Testing

Model No. 4 electronic repeat cycle timer is designed for applications which include life testing, sign flashing, refluxing, and automatic weighing. Suitable for design into automatic machines or for process control, Model No. 4 utilizes an electronic circuit with two cold-cathode triodes. No warm-up is required and no filament power is consumed. G. C. Wilson & Co., Dept. ED, 1915 Eighth Ave., Huntington, W. Va.

CIRCLE 52 ON READER-SERVICE CARD

CIRCLE 53 ON READER-SERVICE CARD ➤

Vinyl Sleeving
Dielectric Strength 750v/mil

Designated "Resinite EP-69A", the new sleeving exceeds all requirements of specification MIL-I-631B (Type F, Form U, Grades A and B, Class I and II, Category I and 2). It provides a working temperature range from −48 to +90°C and a dielectric strength of 750v/mil. The sleeving is also suitable for general purpose use because of its good dielectric characteristics, wide, effective temperature range, and oil resistance. Available in sizes from No. 20 AWG to 2-1/2" ID. Colors are transparent, black, white, red and blue. Resin Industries, Inc., Dept. ED, Santa Barbara, Calif.

CIRCLE 54 ON READER-SERVICE CARD

Teflon Test Point Jacks
Press-Fitted in Chassis

Teflon-insulated jacks press-fitted by means of a drill-press, arbor-type or hand tool, into a chassis hole facilitate tests manufacturing. On the chassis surface, the jack presents a white bushing only 0.218" in diam by 0.046" deep. The jack takes a test prod or plug measuring from 0.080" to 0.089" in diam. Teflon body extends through hole to rear of chassis for desired type of connecting lug. Brass contact is silver-plated and gold-flashed for low-resistance contacts. Sealectro Corporation, Dept. ED, 186 Union Ave., New Rochelle, N. Y.

CIRCLE 55 ON READER-SERVICE CARD

F-M Telemetering Receivers
New I-F Amplifier Strip

The 1670 line of special purpose receivers has several design improvements over the old 167 line. The i-f amplifier strip has been completely redesigned, providing greater stability and easier alignment. Both the i-f and discriminator transformers are temperature compensated to a high degree. The sensitivity of the 1670 line has been improved by the use of better limiters. The front end and dial gear assembly are now a single unit. Nems-Clarke, Inc., Dept. ED, 919 Jesup-Blair Drive, Silver Spring, Md.

CIRCLE 56 ON READER-SERVICE CARD

◀ CIRCLE 57 ON READER-SERVICE CARD

Connector

For Airborne Applications

The Series "CCC 20" is a compact, lightweight, miniature connector available in 37 contacts (15 and 25 contacts also available on special order). It is miniature design, especially adaptable to airborne electronics. Overall length is 2.71", and weight is 0.97 oz (plug and receptacle combined). Shells are stainless steel, passivated for extra strength and anti-corrosive properties. The flange provides a means of rack, panel, wall, or box mounting.

The insulated body is Orlon filled Diallyl Phthalate (MIL-P 4389) for high dimensional stability and high dielectric properties. This material is non-hygroscopic and recommended for high-altitude applications. Contacts are gold plated. The "angle" end shape of the shells assures positive polarization. DeJur-Amsco Corp., Dept. ED, 45-01 Northern Blvd., Long Island City 1, N. Y.

CIRCLE 157 ON READER-SERVICE CARD FOR MORE INFORMATION

Selector Switch

With Low Torque Feature

This switch is available with several different brush and circuit combinations. The item illustrated is a selector unit with 10 input circuits and one output (break before make). It consists of a rotating element and stationary brushes. The rotating element is actually a slip-ring assembly with a series of commutator segments interconnected to the individual rings. Precision instrument bearings are used to minimize the driving torque of the rotor. Low contact resistance has been achieved by the use of gold alloy brushes for input and output. The entire assembly is housed in a No. 10 synchro case. The overall size is less than 1" diam x 2-3/8".

Excellent wave shape has been retained using this unit for chopper applications after more than 12,000,000 cycles with variable speeds up to 1500 rpm.

Other models are available in several sizes and are offered with or without housings. They are designed for ambient temperatures in excess of 350°F. Electro Tec Corp., Dept. ED, South Hackensack, N. J.

CIRCLE 158 ON READER-SERVICE CARD FOR MORE INFORMATION

Thermo-Voltage Compensator

Operates from Standard Cell

The AEG (Allgemeine Elektricitaets-Gesellschaft) Thermo - Voltage Comparator is a millivolt potentiometer which operates with continuous small drain from the standard cell. Until now, it has been the usual opinion that a standard cell would not operate as a standard if a current were being drawn. Donald C. Seibert, Importer, Dept. ED, Box 281, Wilmington, Del.

CIRCLE 63 ON READER-SERVICE CARD FOR MORE INFORMATION

Germanium Transistor

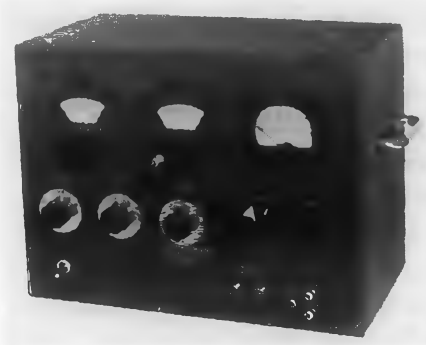
For Push-Pull Audio Output

The 2N138 is a p-n-p fused-junction germanium transistor for push-pull class B audio output applications. It is sold only in pairs matched for optimum output and minimum distortion. In a typical class B application using a 4.25v supply, the average power output is approximately 50mw with a power gain of 30db. The small physical dimensions are identical to those of the 2N130 series of miniature transistors. Raytheon Manufacturing Co., Dept. ED, 55 Chapel St., Newton 58, Mass.

CIRCLE 65 ON READER-SERVICE CARD FOR MORE INFORMATION

Capacitance Bridge

Measures 0.001 mmfd



The precision wide-range Capacitance Bridge, Model 74B, is capable of making either direct or grounded capacitance and conductance measurements from 0.001 to 11,000-mmfd. Conductance range is from 0.01 to 1000μmho. Accuracy is $\pm 0.25\%$ for capacitance and 10% for conductance. Boonton Electronics Corp., Dept. ED, Boonton, N. J.

CIRCLE 64 ON READER-SERVICE CARD FOR MORE INFORMATION

Receptacles

Make Hermetic Seals on Panels

The 5049 Series Hermetically Sealed Receptacles are designed to mate with 50 ohm screw-type Microdot coaxial cable plugs. Hermetic seals are obtained by a glass bead section in the dielectric and by soft soldering each receptacle to the panel.

Where aluminum or magnesium panels prohibit soft soldering, hermetic seal ratings may still be obtained with other of this firm's coax receptacles in 50 ohm, 70 ohm, and 93 ohm versions. These utilize sealed dielectric and Neoprene O-rings in their mounting flanges. Microdot, Dept. ED, 1826 Fremont Ave., South Pasadena, Calif.

CIRCLE 66 ON READER-SERVICE CARD FOR MORE INFORMATION

Audio Level Indicator

Remote Monitoring of Many Stages

Developed by packaging monitor circuitry, Model 5514 vacuum tube. VU meter can be used anywhere in any audio system from preamplifier to speaker or recording head. Input impedance is one megohm and reference level (3/4) scale is adjustable from 0.7v to 350v peak. Feedback stabilization makes the indication independent of line and tube fluctuations. Unit may be placed up to several hundred feet from the signal source. Available in three types: 3-1/2″ panel mounting (not shown), a 4-1/2″ panel mount, and a 4-1/2″ portable. Kilpatrick Electronic Laboratory, Dept. ED, Box 61, Norristown, Pa.

CIRCLE 67 ON READER-SERVICE CARD FOR MORE INFORMATION

THE ELECTRONICS INDUSTRY LOOKS AHEAD in DESIGN '56

Aluminum Solders

For Use in Capacitor Industry

Alloys 175 and 101 aluminum solders were developed specifically for use in the capacitor industry. No. 175 is a free flowing, fast acting alloy whereas No. 101 is less fluid and can be used at higher operating temperatures. It has been found possible to increase soder spread on aluminum, improve corrosion resistance and reduce drossing by addition of small controlled quantities of several metals. Reduction of drossing alone has resulted in a saving of as much as 5% by several leading capacitor manufacturers. Both alloys are available in approximately 1/4 lb, 1/2 lb, and 3/4 lb bars. Hi-Grade Alloy Corp., Dept. ED, 7101 S. Stony Island Ave., Chicago, Ill.

CIRCLE 80 ON READER-SERVICE CARD

FM Transmitter

With Double Modulation Circuitry

Designed for airborne use, Model R-3011-1 is a crystal controlled, subminiaturized unit with high linearity gained through double modulation circuitry. Operating specifications are: power output 3w; frequency range 215-235Mc; frequency deviation ±125kc; modulation frequency range 100-100kc; size 3.6″ x 5.4″ x 1.65″; weight 1.7 lb. Designed for use with standard RDB sub-carrier oscillators. Radiation, Inc., Dept. ED, Melbourne, Fla.

CIRCLE 81 ON READER-SERVICE CARD

Symmetrical Type Transistor

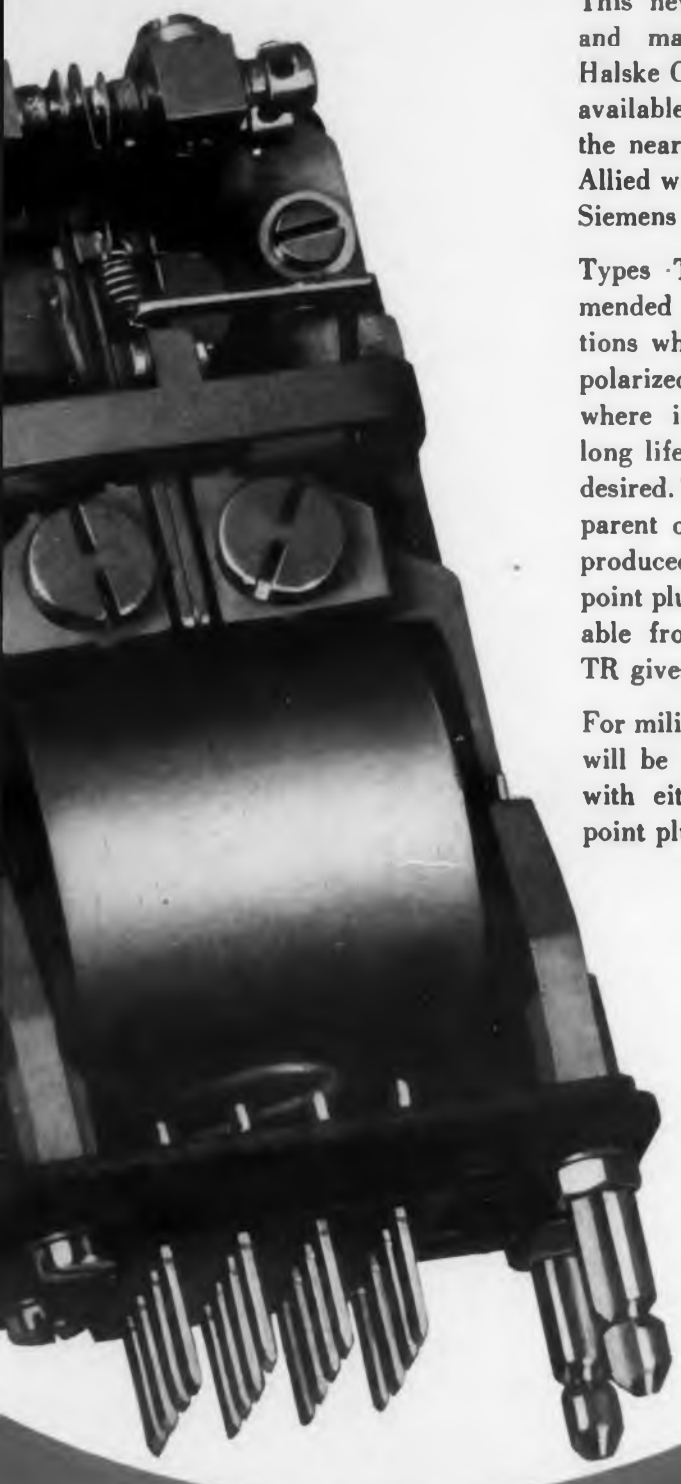
Used as Bi-Directional Switch

Type *GT-34S* is a new diffused p-n-p junction symmetrical type transistor for applications as a bi-directional switch. Double sealed, encapsulated in plastic, and hermetically sealed in a can, the *GT-34S* can also be used for clamp, modulator and detector circuits. Unit functions with a minimum number of components and with an efficiency considerably surpassing tube circuits. General Transistor Corp., Dept. ED, 95-18 Sutphin Blvd., Jamaica, N. Y.

CIRCLE 82 ON READER-SERVICE CARD

CIRCLE 83 ON READER-SERVICE CARD ➤

's NEW



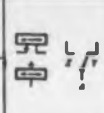
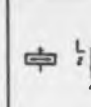
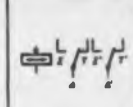
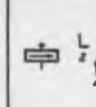
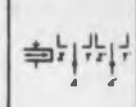
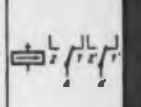
This new polarized relay, designed and manufactured by Siemens & Halske Company of Germany, is now available from Allied Control, and in the near future will be produced by Allied with the technical assistance of Siemens & Halske.

Types Trls 63 to 69 are recommended for use in industrial applications where the special features of a polarized relay are required, or where its inherent high sensitivity, long life and precision operation are desired. They are available with transparent or metal dust covers and are produced with solder terminals or 16 point plug-in bases (sockets are available from Allied Control). Bulletin TR gives complete details.

For military applications, these relays will be available hermetically sealed with either solder terminals or 16 point plug-in base.

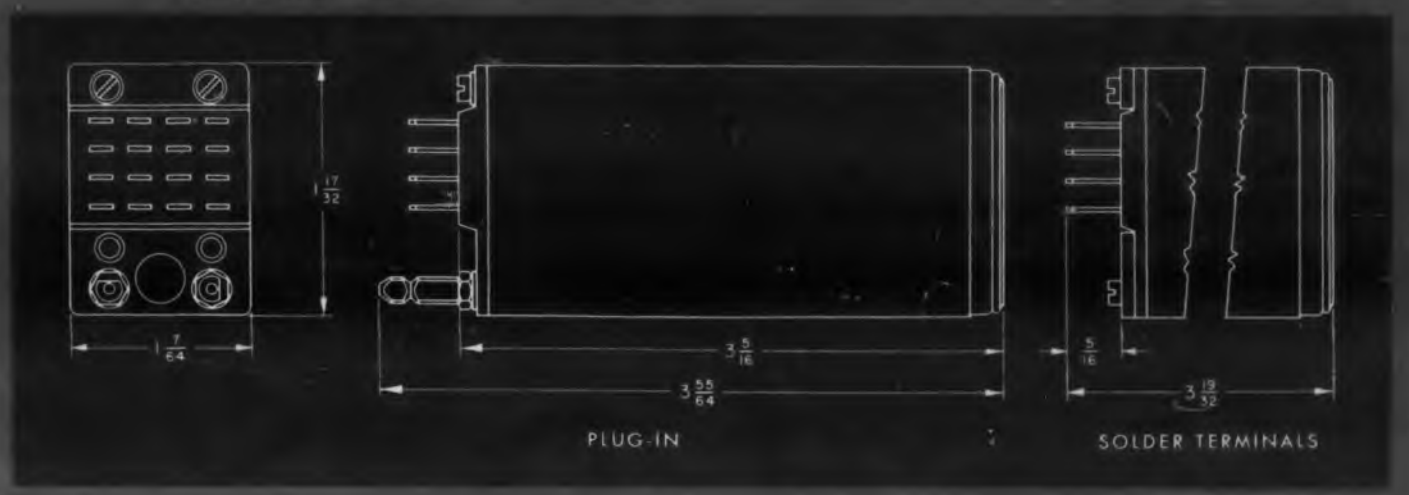
POLARIZED RELAY

Specifications For Allied's Types Trls 63-69

Type Number		Trls 63	Trls 64	Trls 65	Trls 66	Trls 67	Trls 68	Trls 69
Description	Positions	2		3	2	2	3	2
	Operation	Magnetic Latch		Null-Center	Magnetic Latch	Spring Biased	Null-Center	Spring Biased
		High Contact Pressure	High Sensitivity					
Contact Arrangement		SPDT		SPDT	DPDT	SPDT	DPDT	DPDT
Circuit Symbols	for telegraphy							
	other purposes							
"Operate" Excitation	Amp. Turns	7	2	2.2	5.5	5	4	15
"Operate" Power	μ Watts	500	40	50	300	250	160	2250
Working Excitation	Amp. Turns	15	4	6	10	10	10	25
Working Power	μ Watts	2250	160	360	1000	1000	1000	6250
"Release" Excitation	Amp. Turns			2.2		2.4	4	5
Max. Rate of Operation	Oper./Sec.	200	200	200	200	100	200	100

Contacts:	Silver, General Purpose	Dielectric Test Voltage	Coil to Frame	500v rms.
	2 amp., 28v d-c resistive load		Contact to Contact	350v rms.
	Platinum Alloy A. Low-Level		Contact to Frame	500v rms.
	Applications up to 1 amp.		Coil to Coil	150-500v rms.
	Platinum Alloy B. Heavy Duty	Standard Coils	Resistances from 1.1 to 18,000 ohms	
	Applications above 1 amp.		Max. number of windings	8
	Max. Continuous Current 5 amps.		Max. Continuous Loading	1 watt
		Temperature	Max. Ambient	85°C

DIMENSIONS



ALLIED CONTROL

ALLIED CONTROL COMPANY, INC., 2 EAST END AVENUE, NEW YORK 21, N. Y.

Luster-On Aluminum Sealer

Low Electrical Resistivity

No. 222-M Luster-On Aluminum Sealer is suitable for applications in the electrical and electronic manufacturing fields because of its very low electrical resistivity. It produces a chromate film on aluminum which keeps the product from corroding or oxidizing indefinitely in protected applications. It makes an excellent paint base and can be easily applied in one dip at room temperature. The sealer has good adherence, does not leach easily, and can be dyed in many attractive pastel colors. It conforms to government specification MIL-C-5541. The Chemical Corp., Dept. ED, Springfield, Mass.

CIRCLE 84 ON READER-SERVICE CARD

Shielded Enclosures

For Microwave Applications

These new "Microshield" enclosures for microwave and r-f interference applications have achieved additional absorption characteristics by incorporating two new materials into the basic structure. Lightweight McMillan hair-net Type 8 is used on walls, doors, and ceiling. Floor absorption is provided by McMillan plastic foam block Type B, which can be walked on without any loss of electrical characteristics. Ace Engineering & Machine Co., Inc., Dept. ED, 3644 N. Lawrence St., Philadelphia, Pa.

CIRCLE 85 ON READER-SERVICE CARD

Epoxy-Based Adhesive Bond

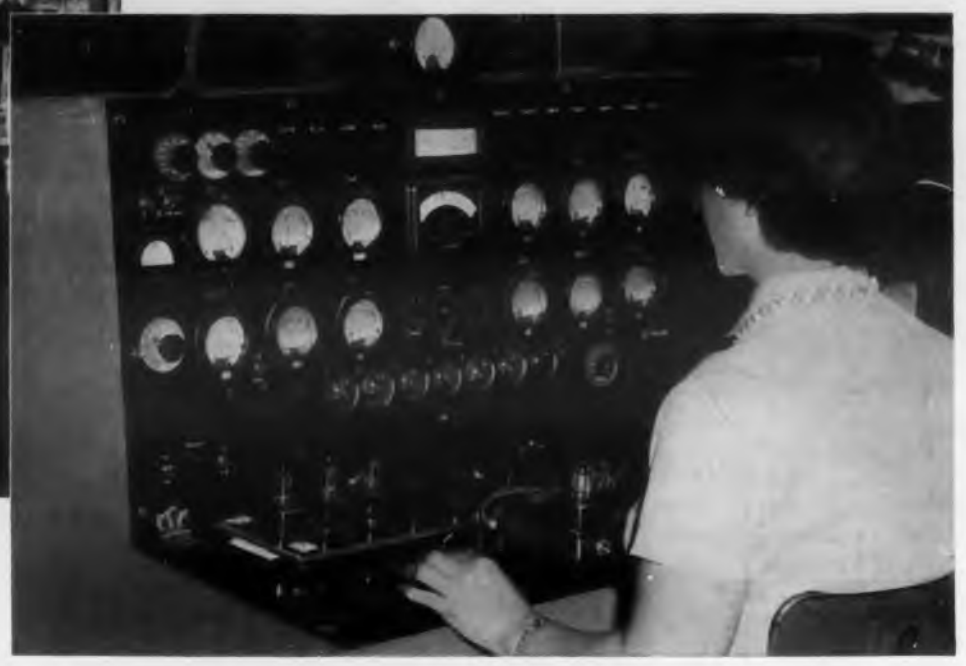
One-Part Paste

Bondmaster M620 is a high strength one-part paste, thixotropic, epoxy-based adhesive for bonding metals to metals or to rigid plastics. Elimination of the mixing of a separate resin and hardener allows this adhesive bonding to be used directly in the mass production joining of metals, rigid plastics, and other rigid materials. It is offered in a wide choice of curing cycles ranging from approximately 7min at 535°F down to approximately 1-1/2hr at 350°F. Rubber & Asbestos Corp., Dept. ED, 225 Belleville Ave., Bloomfield, N. J.

CIRCLE 86 ON READER-SERVICE CARD

◀ CIRCLE 83 ON READER-SERVICE CARD

LEFT: G-E computer tubes undergo a cut-off life test. The tubes are operated for long intervals with their grids biased to cut-off. Periodically the tubes are given a cathode interface check, to make sure no "sleeping sickness", or failure to respond to changed grid voltage, has developed during inactivity.



RIGHT: extensive instrumentation is used to test tube electrical qualities that closely affect operation in computer circuits. Zero-bias plate current; cut-off performance; any difference in cut-off between twin-triode sections—these are three of many characteristics checked.

G-E Computer Tubes are specially tested for qualities that safeguard computer reliability!

General Electric pioneered special tubes for computers . . . also developed tests such as those above, which assure that G-E tubes in your computer circuit can be relied on to meet designers' aims in all respects.

The tests are specific in purpose. Each covers one or more tube characteristics important in computer use, and which closely influence the accuracy and reliability of the equipment.

There is no substitute for G-E computer-tube quality, which starts with special tube design—extends through precision manufacture—concludes with exhaustive tube tests that relate directly to computer service.

Also . . . there is no counterpart to G.E.'s range of special computer tubes *now in production.* You have a choice of proved G-E types available for your present circuit needs, with new tubes constantly being added.

Ask for "G-E Computer Tubes And Their Applications" (ETD-1140). 54 pages—just off the press. A book every designer and builder will find useful! *Tube Department, General Electric Company, Schenectady 5, New York.*

* * *

● G-E computer-tube development is a continuing process, with new types being added regularly for faster, more advanced equipment, or to meet special customer requirements where volume warrants. Five types—proved, popular—already are in full production:

GL-5844 **GL-6211**
GL-5965
GL-5915A **GL-6463**

Progress Is Our Most Important Product

GENERAL ELECTRIC

162-1C1

Stainless Brazing Alloy
In Easy-to-Fuse Paste Form

The new Nicrobraz Paste is recommended for use in all types of brazing applications involving stainless steels, nickel-base, cobalt-base, and similar alloys as well as low alloy steels, carbon steels and copper.

Easily applied, it produces a heat and corrosion resistant brazed joint and provides a thin corrosion resistant overlay in the area surrounding the joint where protection is frequently required for low alloy steels. Stainless Processing Div., Wall Colmonoy Corp., Dept. ED, 19345 John R St., Detroit, Mich.

CIRCLE 73 ON READER-SERVICE CARD

Pressure Sensitive Cloth Tape
To Replace Friction Tape

Permacel 64 sticks better to its own backing and application surfaces than the old friction tape, and averages twice the insulating resistance of friction tape. The adhesive is applied only on one side of Permacel 64.

The new tape is available in 3/4" width and 60' or 90' lengths on 1-1/2" diameter cores, and is packaged 96 rolls per bulk carton. Permacel Tape Corp., Dept. ED, New Brunswick, N. J.

CIRCLE 74 ON READER-SERVICE CARD

Miniaturized Toroids
More Inductance in Smaller Space

A new winding technique has been developed for winding the finest wires available (AWG 30 to 50) and giving an exact count of the number of turns wound. Advantages are: more inductance in smaller space; further miniaturization of the product; an end to time-consuming hand winding of tiny cores. Present limitations are: minimum finished inside diameter, 0.0110" with a one-piece wire capacity of 0.6-grams of H. F. wire in AWG sizes 38-50; minimum finished inside diameter of 0.160" with a one-piece wire capacity of 7.5grams of H. F. wire in AWG sizes 30-50. Mectronics, Dept. ED, Box 807, Ridgecrest, Calif.

CIRCLE 75 ON READER-SERVICE CARD

◀ CIRCLE 76 ON READER-SERVICE CARD

Shaker System
5 to 5000cy

Designated Series 8000 wide-band shaker system, the new equipment extends the range of vibration testing over the 5 to 5000cy frequency range and operates with either single frequency, sweep cycling or a complex waveform input signal. Full rated output of the electrodynamic unit can be maintained over the entire frequency range without power factor correction or use of changeable impedance matching taps. Frequency response values guaranteed by manufacturer are ±1db, 7 to 2000cy; ±3-1/2db, 5 to 5000cy, with bare table. Four adjustable circuits and a tunable low-pass filter are provided to compensate for decrease in transfer function (g output/volts input) caused by increase in shaker impedance as frequency increases. The Calidyne Co. Dept. ED, 120 Cross St., Winchester, Mass.

CIRCLE 77 ON READER-SERVICE CARD

Iono-Chamber Test Chambers
Simulates High Altitudes

Model 5500 test chamber designed for environmental testing of missile components simulates pressure conditions corresponding to altitudes as high as 350,000′.

The unit is designed to operate between sea level and 0.1micron of Hg. One version of this chamber currently produced provides a change from sea level to 150,000′ (approx 100microns) within 60 sec and from 150,000 to 350,000′ in an additional 60sec.

The working space is a cylindrical chamber 18″ ID by 30″ deep. The unit is built into a cabinet 41″ wide by 72″ long by 84″ high. The cabinet houses all operating equipment and controls. Hudson Bay Co., Div. of Labline Inc., Dept. ED, 3070 W. Grand Ave., Chicago, Ill.

CIRCLE 78 ON READER-SERVICE CARD

WHAT'S NEW IN AUDIO?
SEE
DESIGN '56

CIRCLE 79 ON READER-SERVICE CARD ➤

Clutches and Brakes

Diameter Less Than One Inch

Size 100 Electro-Magnetic Clutches and Brakes are valuable for miniaturization applications where a simple disconnect or non-chattering brake is required. The clutches can also be used for intermittent duty in slip applications. The units weigh only 2-1/2 oz, measure less than 1″ diam, consume only about 2w, yet deliver 30 in-oz of torque. They can be used at speeds to 4000 rpm, and response time ranges from 10-15millisec, depending upon the power input and load characteristics.

The clutches and brakes are available for operation at 28v or 100v d-c; other voltages can be specified on special order. The units are "Parkerized" for protection against corrosion as per MIL-C-12968, Type B, Class 1; the coils are fungus-proofed to meet the requirements of MIL-T-10513. Dial Products Co., Dept. ED, 9 Avenue E., Bayonne, N. J.

CIRCLE 71 ON READER-SERVICE CARD FOR MORE

Precision Resistors

For Mechanized Production

Series "A" encapsulated resistors are for use in printed circuits. They are designed to conform to specifications proposed by RETMA for components to be used in automatic assembly equipment.

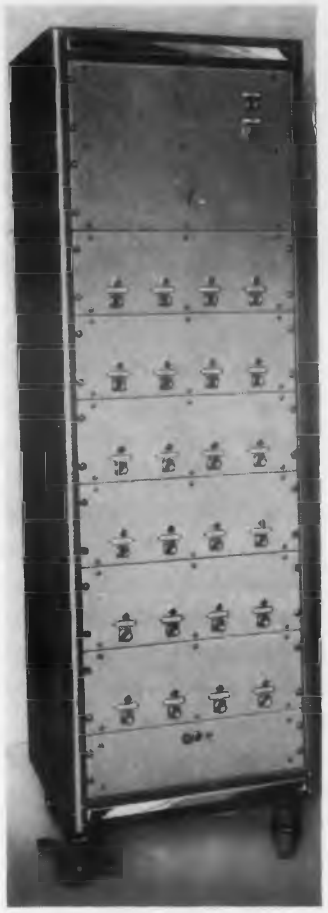
The resistors are encapsulated in a tough epoxy compound for protection against extreme humidity and mechanical and thermal shock. The plastic is filled with a heat-conducting mineral which dissipates the heat and equalizes "hot spots" in winding. Sealed-in terminal connections are welded.

The units satisfy requirements of MIL-R-93A and JAN-R-93. Temperature coefficient is ±0.0022%/°C. Temperature range is −65 to +125°C. Wattage range is from 0.25 to 1w with tolerances to 0.1%. Other sizes and wattage ranges are available. Hycor Co., Inc., Dept. ED, 11423 Vanowen St., N. Hollywood, Calif.

CIRCLE 72 ON READER-SERVICE CARD FOR MORE

Data Reduction Filter

Analyses Vibration Frequencies



This data reduction filter set is for analyzing vibration frequencies in aircraft and missiles. In use, a tape recorder containing the complex wave form is fed into the unit which separates the component frequencies into 24 components. The unit consists of 24 cathode follower amplifiers which feed 23 band-pass filters ranging progressively from 30 to 2000cy, and one 20cy low-pass filter. The output of each filter appears on jacks on the front panel. A channel level control is provided for each filter.

A set of jacks is also included on the front panel for oscilloscopic viewing of the complex wave form at the input. The individual frequencies may be analyzed separately to determine the exact nature of the mechanical vibration. The entire unit, including power supply, is contained in a standard enclosed 5′ cabinet rack. Hycor Co., Inc., Dept. ED, 11423 Vanowen St., No. Hollywood, Calif.

CIRCLE 69 ON READER-SERVICE CARD FOR MORE INFORMATION

Mechanical Differential

Weighs Only 1/3 Ounce

This low-cost mechanical differential has an overall work diameter of only 19/32″, yet the input shaft diameter is a full 1/8″. Weight is approximately 1/3 oz. (10 gr) with typical end gears. Breakaway torque is 0.01 oz-in (0.8 gm-cm). The unit employs subminiature ball bearings. Pitometer Log Corp., Dept. ED, 237 Lafayette St., New York 12, N. Y.

CIRCLE 70 ON READER-SERVICE CARD FOR MORE INFORMATION

ARE NEW TRENDS IN INSTRUMENTATION AFFECTING COMPONENT DESIGN?
see DESIGN '56

Variable Delay Lines

For Computer and Radar Systems Design

A series of custom-built Variable Delay Lines is available for use as laboratory test equipment to facilitate the design and development of advanced computer and radar systems, or for use as components. The lines come completely enclosed in dust-proof cases with coarse and fine controls. Delays are proportional to the angular position of the respective control shaft. Delay time, impedance, and bandwidth are designed to meet individual specifications.

Typical of the series is a line with variable delay from 0-7μsec in increments of 0.01μsec; a coarse control which covers 0-7μsec in increments of 0.15μsec, and a fine control which covers 0 to the coarse control increment in steps of 0.003μsec. Rise time for maximum delay is 0.35μsec. Attenuation is 3db. Impedance is 1000 ohms. The unit meets all applicable MIL Specs. ESC Corp., Dept. ED, 534 Bergen Blvd., Palisades Park, N. J.

CIRCLE 88 ON READER-SERVICE CARD FOR MORE INFORMATION

Oscillograph

Records Up to 71 Variables

The PM-20 is a general - purpose oscillograph for static or dynamic testing of all types of industrial or aircraft equipment and is available in d-c and a-c models. It will record up to 71 individual variables on one oscillogram when combined with suitable transducers and amplifiers for the measurement of pressure, vibration, strain, flow, etc. This makes it possible for users to record simultaneously the many variable factors encountered in dynamic testing of machinery.

A wide choice of galvanometers, usable up to 6000cy, provides flexibility of measurement. There are two separate galvanometer mounts, permitting simultaneous use of both wound coil and bifilar galvanometers. Speed is 4 to 500fpm. General Electric Co., Instrument Dept., Dept. ED, Lynn, Mass.

CIRCLE 89 ON READER-SERVICE CARD FOR MORE INFORMATION

Operational Amplifier

For Various Analog Operations

By using this plug-in type high-gain Operational Amplifier (Model K2-X) as a base subassembly, feedback computing devices of all speeds may be assembled with only the simplest of wiring. Featured are balanced differential inputs for minimum drift, maximum utility, and economy of operation. Among the many feedback operations which can be performed are: addition, subtraction, integration, differentiation, proportioning, inversion, impedance-conversion, and the injection of current.

Specifications include a gain of 30,000 d-c open-loop; power requirement of 7.5ma at +300v d-c 5.2ma at −300v d-c; a voltage range of −100v to +100v d-c for output (max). The unit has an octal plug; a height of 4-1/2″ overall; and a weight of only 3 oz. George A. Philbrick Researches, Inc., Dept. ED, 230 Congress St., Boston 10, Mass.

CIRCLE 90 ON READER-SERVICE CARD FOR MORE INFORMATION

Radio Field Strength Meter

Measures in the Range of 19-125Mc

The Model 728 Radio Field Strength Measuring Set, suitable for fixed and portable use, makes field strength measurements in the range of 19-125Mc and will accurately measure field intensities ranging from 2μv to 2.5v per meter. It can be used to measure the field intensities of both AM and FM transmitting stations.

Provisions for linear or logarithmic output indications for recording meter use are included. Readings in decibels above 1μv per meter are made by the simple addition of three values. Measurement of noise intensities can be made by means of accessory probes. The meter is designed to meet the requirements of military specifications for field use. Telectro Industries Corp., Dept. ED, 35-16 37th St., Long Island City 1, N. Y.

CIRCLE 91 ON READER-SERVICE CARD FOR MORE INFORMATION

WHAT'S NEXT IN SIGHT FOR COMPONENTS IN RADIO AND TV? SEE "DESIGN '56"

Amplifier-Voltmeter

A High-Sensitivity Unit

The Type 346 Sensitive Amplifier - Voltmeter can make precise measurements of a-c signals from 100μv to 300v at frequencies from 10cy to 2Mc. It also has an output connection permitting use as a broadband amplifier. Decibel readings are provided from —72 to +52db (1mw into 600 ohms reference). Calibration is in two linear voltage scales (0-1 and 0-3v) and a decibel scale (—12 to +2dbm). The rectifier is of the full-wave average type to offer greatest accuracy when dealing in complex wave forms.

Accuracy is ±3%, 20cy to 1Mc; ±5%, 10cy to 2Mc. Stability is ±1% at any line voltage between 105 and 130v. Amplifier maximum voltage gain is 1000; maximum output voltage is 1v; output impedance is 600 ohms; and hum and noise are 40db below 1v. The unit is only 6-1/2" x 4-1/4" x 7-1/2" deep and weighs 6-1/2 lb. Power supply is 105-130v 50-400cy 40w. Technical Products Div., Allen B. Du Mont Laboratories, Inc., Dept. ED, 760 Bloomfield Ave., Clifton, N. J.

CIRCLE 170 ON READER-SERVICE CARD FOR MORE INFORMATION

Servo Amplifier

For Industrial Control Systems

The Model 1120 servo amplifier is designed specifically for application in industrial control systems. A 60cy 2-phase motor control, it has a built-in summing network which will accept from one to three a-c inputs. It will drive any 10w 2-phase servo motor. It may be used either in a position servo system (providing tachometer stabilization to minimize overshoot and hunting) or a velocity system (with linearity and extended proportionality range of control motor speed).

Also available are two new servo amplifiers, Models 1123 and 1124, for use in high-altitude servo systems. They comply with MIL-E-5400 requirements. Servo Corp. of America, Dept. ED, 20-20 Jericho Turnpike, New Hyde Park, N. Y.

CIRCLE 171 ON READER-SERVICE CARD FOR MORE INFORMATION

Germanium Rectifier Stacks

With Improved Heat Dissipation

These germanium rectifier power stacks are smaller than previous designs by about one-third, as a result of improved convection and cooling. Despite this smaller size, a special base plate design makes the stacks mechanically interchangeable with types now on the market; in addition, they are rated to permit full electric interchangeability.

Improved heat dissipation is achieved by eliminating the conventional center assembly bolt and insulating doughnuts. In the new construction, the plates are held at the sides; thus the full area of the plate is available for cooling. Light weight results from use of two laminated fiberglass side strips for assembly of the stack. Connecting terminals are stamped out as part of the plate corners; thus external connections may be soldered directly to the plate, eliminating terminal lugs.

Electrically, the stacks permit a flexible range of ratings, from low values of 15v 0.35amp, to high values of 888v, 2amp, in over 100 combinations. Components Div., Federal Telephone and Radio Co., Dept. ED, 100 Kingsland Road, Clifton, N. J.

CIRCLE 96 ON READER-SERVICE CARD FOR MORE INFORMATION

Power Supply

For Klystron Tubes

The Type 809 Klystron Power Supply is a complete and inexpensive source of power and modulation for low and medium - voltage klystron tubes. It provides beam voltages from 250v to 600v at 65ma, reflector voltages from 0 to −900v at 50μamp, square wave modulation between 400cy and 2000cy, and sawtooth modulation at line frequency.

A special feature is the ease of changing from cw to square wave modulation for peak power measurements, because the top of the square wave is automatically clamped to the previously chosen reflector voltage. Polytechnic Research & Development Co., Inc., Dept. ED, 202 Tillary St., Brooklyn 1, N. Y.

CIRCLE 97 ON READER-SERVICE CARD FOR MORE INFORMATION

Electronic Scaler

Does Both Counting and Timing

The EKCO Model N-530A six-decade automatic scaler is a combined scaler and timer. It may be used to time a predetermined count, count for a predetermined time, or as a manually-operated scaler.

The unit will stop automatically upon reaching the desired elapsed count which can be present at any of nine intervals between 100 and 1,000,000. Similarly, it will stop automatically upon reaching the present elapsed time interval of from 100 to 100,000sec. Counting rates of 60,000/sec are easily achieved in field work, and stopping time is approximately 2millisec.

Both counting and timing are accomplished through Dekatron tube circuits which involve no mechanical mechanisms and permit direct reading of results. Input resolution time is only 5μsec, resulting in unusually low coincidence loss. Power requirement is 100-250v, 50/60cy, 130w. The power supply has two continuously variable ranges: 250-1000v and 500-2,000v with a stability of $\pm 0.5\%$ for voltage variations up to $\pm 10\%$, and unusually low drift and ripple. A 5-50v pulse height discriminator in the circuitry permits use with G-M, scintillation, flow, or proportional counters. American Tradair Corp., Dept. ED, 34-01 30th St., Long Island City 6, N. Y.

CIRCLE 94 ON READER-SERVICE CARD FOR MORE INFORMATION

Capacitor Leakage Tester

Makes In-Circuit Measurements

The In-Circuit Capacitor Leakage Tester, Model 383, shows the presence or absence of leakage in virtually all paper, mica, or ceramic capacitors while connected in the circuit, eliminating disconnecting and resoldering. It checks capacitors ranging from 1mmfd to 0.25mfd for leakage from a few ohms to hundreds of megohms, and also detects breakdowns, shorts, and intermittents. Checking is done at full rated working voltage, in the circuit. Simpson Electric Co., Dept. ED, 5200 W. Kinzie St., Chicago 44, Ill.

CIRCLE 95 ON READER-SERVICE CARD FOR MORE INFORMATION

Voltage Breakdown Tester

With Range to 100kv

The Type PA-50 High Voltage A-C Breakdown Tester permits tests from 0v to a maximum of 100,000v, continuously variable. It can provide automatic rate of rise with any ASTM rate, and hold breakdown voltage on a meter. It is rated at 5kva available at breakdown. A wide variety of testing jigs is available, including ASTM models, as well as special jigs to specifications. Industrial Instruments, Inc., Dept. ED, 89 Commerce Rd., Cedar Grove, N. J.

CIRCLE 103 ON READER-SERVICE CARD

Numbers and Letters

From 1/2 to 5 Inches High

Individual self-sticking numbers and letters are available in six sizes from 1/2 to 5" high and sold in two colors: black on white and black on yellow. The six sizes are: 1/2", 3/4", 1-1/2", 2-1/4", 3-1/2" and 5", the alphabet numbers 0 to 9 and dashes. Made of Brady No. B-500 all-temperature impregnated cotton cloth with a temperature-resistant pressure-sensitive adhesive. W. H. Brady & Co., Dept. ED, 727 W. Glendale Ave., Milwaukee, Wisc.

CIRCLE 104 ON READER-SERVICE CARD

Printed Circuit Kit

For Experimental Engineers

The new kit is especially useful in the early stages of research and development work in the electronic field since it enables the engineer to evaluate his printed circuit designs before passing them along to a production planning department. The new package contains a sheet of copper-clad laminate measuring 8-1/2" x 5" and all other materials required to make etched or printed circuits. Also included is a helpful booklet on printed circuit design hints. Control Circuits, Inc., Dept. ED., 24 Broad St., Middletown, Conn.

CIRCLE 105 ON READER-SERVICE CARD

CIRCLE 106 ON READER-SERVICE CARD ➤

NEW XLR
...an important addition to the XL Series

STANDARDIZE WITH CANNON

P series

X series

for simplified **AUDIO** *circuitry!*

BRS series

UA series

D series

U series

K series

Standardize with Cannon Audio Connectors . . . designed to meet all audio equipment interconnect needs. Simplify circuitry and cabling. Get quiet, continuous operation with the standard connectors of the industry—Cannon Plugs.

You'll find exactly the type you need in 14 extensive series expressly designed for radio, sound, TV and related fields . . . in cord, rack or panel chassis, audio and low-level, portable, hermetic sealed, miniature and subminiature, and power-supply types. Standard equipment with leading manufacturers of electronic equipment. The old reliable "Latchlock" feature on Cannon microphone connectors . . . standard on top-selling microphones.

Complete Audio Connector Bulletin is yours for the asking . . . D Series in separate bulletin coded D-4.

CANNON PLUGS

40th YEAR

Please refer to Dept. 44

CANNON ELECTRIC DEVELOPMENT COMPANY
3209 Humboldt St.
Los Angeles 31, California

Factories in Los Angeles, San Diego, Toronto, Canada; London, England and Licensees in Paris, Tokyo, Melbourne
Representatives in all principal cities.
Distributors everywhere

Lattice Mountings

Isolate Vibration, Noise

These rubber lattice mountings bonded to steel plates provide a high degree of vibration and noise isolation, particularly in the low-frequency, high-amplitude range. A complete line has been developed with capacities ranging from 250 lb to 3000 lb and static deflections from 1/4" to 1-1/2". The construction permits the shock load to be carried by the rubber in shear, providing a high degree of horizontal stability. Lord Manufacturing Co., Dept. ED, 1635 W. 12th St., Erie, Pa.

CIRCLE 107 ON READER-SERVICE CARD FOR MORE INFORMATION

Pressure Transducer

For Flight Work

A line pressure rating of 250psig, together with high natural frequency and relative insensitivity to acceleration, are features of the Model P 134 Differential Pressure Transducer. Recommended for flight work, it is temperature compensated and small in size, with transduction by means of the Statham unbonded strain gage. Ranges are from ±2.5 to ±25psid and 0-5 to 0-150psid. Staham Laboratories, Dept. ED, 12401 W. Olympic Blvd., Los Angeles 64, Calif.

CIRCLE 108 ON READER-SERVICE CARD FOR MORE INFORMATION

Ball Bearings

Flanged, Separable Miniatures

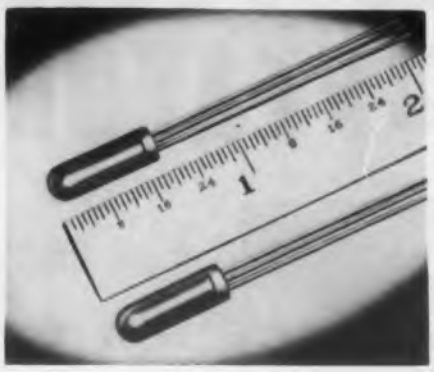
This series of separable miniature ball bearings is designed specifically for easy assembly and high-speed applications. Flanged to facilitate assembly without counterboring, the magneto-type bearings are designed to support both radial and thrust loads in blowers, gyros, spin motors, and other mechanisms. Miniature Precision Bearings, Inc., Dept. ED, Keene, N. H.

CIRCLE 109 ON READER-SERVICE CARD FOR MORE INFORMATION

◀ CIRCLE 110 ON READER-SERVICE CARD

P-N-P Junction Transistors

For Applications Up to 200mw Output



Matched-pair Type 2-OC72 high-current low-voltage power transistors are designed for such applications as portable phonographs and radios, and similar mass-produced devices. Efficiency is unusually high, so that battery drain is considerably reduced, and the transistors are particularly suited to applications requiring up to 200mw output. They can deliver 200mw on a 6v battery supply. A high-efficiency emitter is incorporated in these push-pull units.

A single member of the pair, designated OC72, is also recommended for driving the Amperex power transistor type 2N115, with a single OC72 in Class A furnishing sufficient power to drive two 2N115's in push-pull. Amperex Electronic Corp., Dept. ED, 230 Duffy Ave., Hicksville, L. I., N. Y

CIRCLE 112 ON READER-SERVICE CARD FOR MORE INFORMATION

Potentiometer

With Linearity of ±0.15%

The Type 747-E Potentiometer provides a resistance range of 50 to 70,000 ohms with a standard linearity of ±0.15%. A special clamp band provides an unrestricted tapping area, allowing up to 19 taps, and presents a means of phasing units in a ganged assembly without disassembling them.

The low noise level and high resolution of these units make them particularly desirable for computer assemblies, calibration controls, servo-mechanisms, and other, similar applications. Diameter is 2.100", and cup width is 0.984". Up to six units can be ganged on a single shaft. Starting torque is only 1.0 oz-in per cup section. Potentiometer Div., Fairchild Controls Corp., Dept. ED, Robbins Lane, Syosset, N. Y.

CIRCLE 113 ON READER-SERVICE CARD FOR MORE INFORMATION

HAS APPLIED RESEARCH AFFECTED COMPONENTS IN THE COMPUTER FIELD?
Read it in DESIGN '56

Condense  and Save!

plastic condenser block capacitors save you Space, Labor, Money!

Multiple capacitors in **one** block! Now you can install one capacitor case and use 125% less space as before at a saving in labor costs of up to 300%.

Available with polystyrene or MYLAR* dielectric to tolerances as close as 1%

NOW!

Precision Decade Capacitors

with attached rotary switch or completely boxed.

CAPACITANCE . . . FROM .001 TO 10 M F D

CHECK THESE OUTSTANDING FEATURES:

- STANDARD VOLTAGE RATING 200 V D. C
- VERY HIGH INSULATION RESISTANCE
- LOW DISSIPATION FACTOR
- LOW DIELECTRIC ABSORPTION
- SMALL SIZES

Available with polystyrene or MYLAR* dielectric to tolerances as low as 1%

*DuPont T.M.

Join America's leading electronic equipment manufacturers in specifying Southern Electronics' precision polystyrene capacitors for your most exacting requirements. Write for complete catalog today!

SOUTHERN ELECTRONICS

SEC *Corporation*

239 West Orange Grove Ave., Burbank, Calif.

CIRCLE 114 ON READER-SERVICE CARD FOR MORE INFORMATION

Black Nylon Screws and Nuts

Also Serve as Insulators

The important advantage of these black nylon screws and nuts is that they are insulators in themselves, and therefore require no insulating sleeves, bushings or washers. They are non-magnetic, non-corrosive and light in weight. Black nylon used is hardest grade and may be used to 250°F. Both internal and external threads are molded with smooth, glossy outside surfaces, with no sharp cut at the bottom of threads. Available in ten sizes 6/32, 8/32, and 10/32. Weckesser Company, Dept. ED, 5261 N. Avondale Ave., Chicago, Ill.

CIRCLE 115 ON READER-SERVICE CARD

Soldering Iron

Saves Current, Tin and Tips

The Pico Special weighs only 6 oz and comes equipped with 4 interchangeable heating elements, 20, 30, 50, and 80w, and several different soldering tips. This iron saves current, tin and tips and is being widely used on production and assembly line work.

Made from a new type alloy and covered with a special coating which prevents oxidation, the tips are clean at all times and are freely removable from the heating element because they are not burnt in or corroded. Sound Apparatus Co., Dept. ED, Stirling, N. J.

CIRCLE 116 ON READER-SERVICE CARD

Hi-K Disc Capacitor

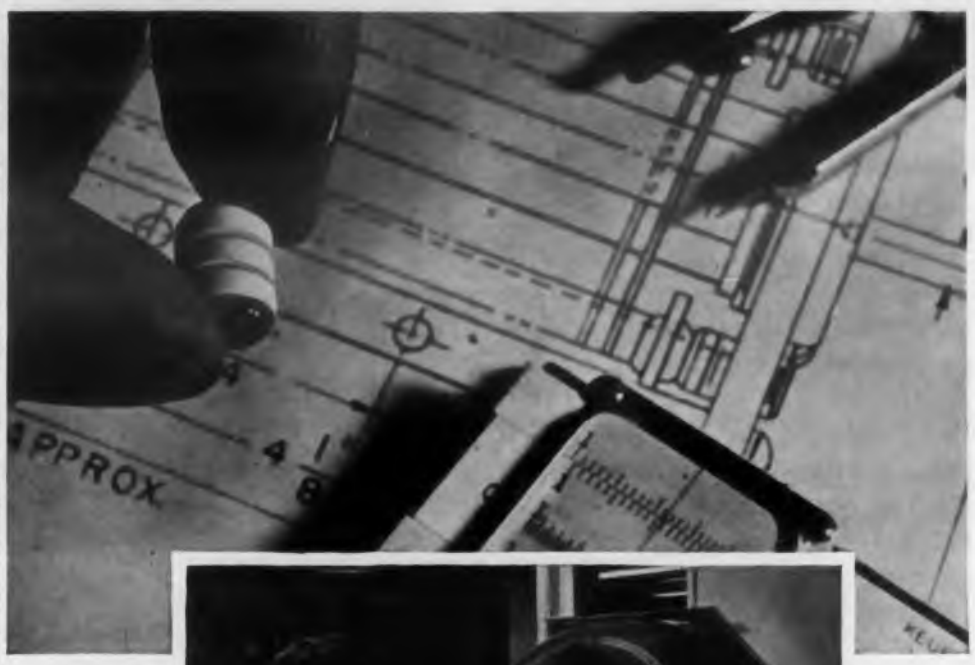
Flat Temperature Characteristic

Type "H-A" Hi-K disc ceramicon exhibits a maximum capacity change of only 3% over temperatures ranging from 10 to 85°C. They are available in any normal capacitance value from 150 to 4250$\mu\mu$fd with tolerances of $\pm$10% and $\pm$20%. Diameters range from 5/16 to 3/4". Maximum thickness on all units is 5/32". They are available with 22 gauge wire leads; also with 20 gauge wire or spade leads for automatic insertion in printed circuit boards. Erie Electronics Div., Erie Resistor Corp., Dept. ED, Erie, Pa.

CIRCLE 117 ON READER-SERVICE CARD

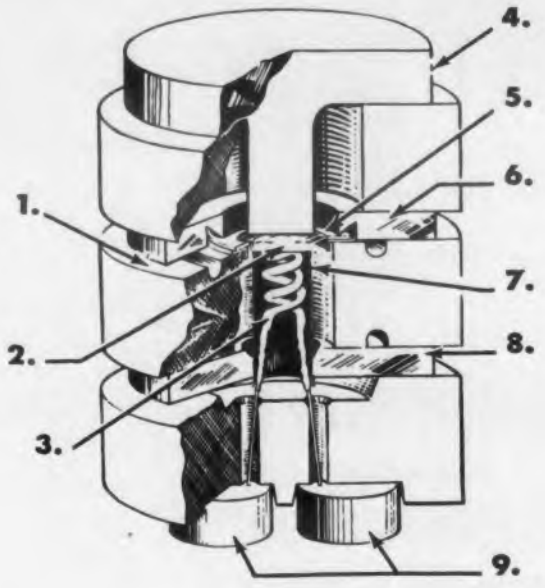
CIRCLE 118 ON READER-SERVICE CARD ➤

ADVANCED DESIGN OF NEW FEATURES METAL-



Above: metal parts for G-E micro-miniatures are fired in a high-vacuum furnace. Titanium is employed—this substance has the unique advantage of freeing virtually all its own gases when fired to 700 C. Result of using pre-fired titanium parts: there is no subsequent vacuum contamination from metal-liberated gases when tubes operate at high temperatures. Instead, titanium serves as a gas absorber!

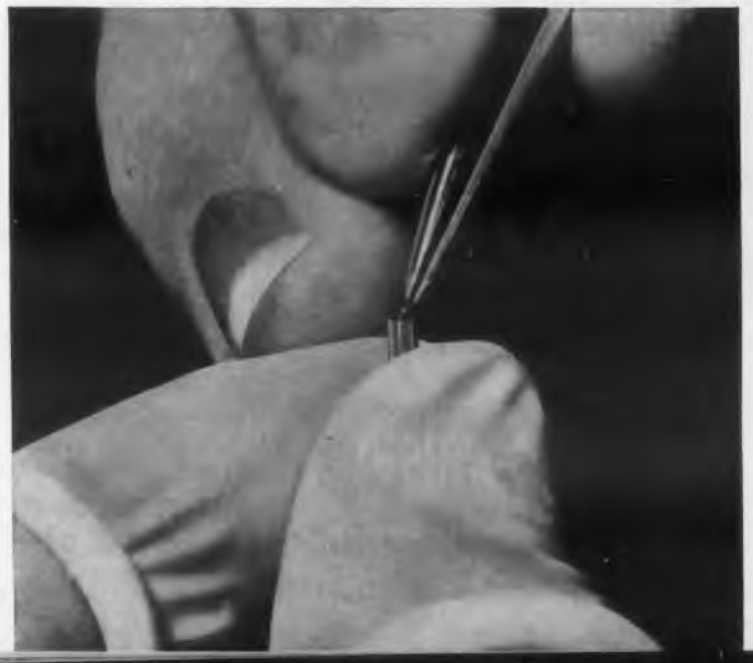
Right: in an operation calling for utmost delicacy, the tube's cathode disc is fitted into the support cylinder. Note rubber finger cots on the fingers holding the tiny cylinder! Changed hourly, these finger cots help ward off dirt and moisture—are worn when handling all micro-miniature tube parts, to keep the parts scrupulously clean. Other G-E aids to cleanliness are air-pressuring, air-conditioning, and lint-free Nylon and Dacron uniforms.



ONLY 3/8" HIGH! THE 6BY4 IS G.E.'S ULTRA-COMPACT NEW METAL-CERAMIC R-F AMPLIFIER TRIODE FOR UHF-VHF TV TUNERS.

Installs in a fraction of the space required by other tuner tubes—yet out-performs them! At 900 mc operation with 10 mc bandwidth, new tube has the low noise factor of approx 8 db, and a power gain of approx 15 db. Filament and plate voltages, 6.3 v and 200 v . . . amplification factor, 100. The metal-ceramic, parallel-plane design as illustrated in the cutaway, gives the new 6BY4 short electron transit time and an extremely low r-f loss; also high structural rigidity. In type 6BY4 this rigidity is employed to attain minimum microphonics rather than maximum tube resistance to shocks and vibration, since TV circuits do not undergo the same physical hazards as military and commercial airborne and mobile equipment.

1. Reference plane
2. Oxide-coated cathode
3. Heater
4. Anode
5. Grid
6. Grid ring
7. Support cylinder
8. Cathode ring
9. Heater buttons



Beryllium Copper Tubing
For Waveguides

Rectangular beryllium copper tubing used for fabricating waveguides is furnished in a completely soft annealed condition to prevent cracking of the wall (0.007″) during the severe operation which forms the flexible waveguide. The waveguides fabricated from the tubing are used to transmit microwaves along desired paths in radar systems. Since close size tolerances are required for uniform microwave transmission characteristics, the 1.025″ by 0.400″ID rectangular tubing is held to a tolerance of ±0.003″ on the ID and ±0.0005″ on the wall. Superior Tube Co., Dept. ED, Norristown, Pa.

CIRCLE 119 ON READER-SERVICE CARD

Electrical Insulating Panel
Transparent to H-F Waves

Lamicor is an electrical insulating panel made of fiberglass with an insulating value equal to or better than wood, yet is stronger than many alloys of steel. It is transparent to h-f waves and radar signals and has also been used by the U. S. Army for radar shacks. Lamicor has a low power factor 0.03 at 60cy or 0.01 at 1Mc. At the same time, it offers high arc resistance and resists penetration by heat and moisture. Now available in sizes over eight feet long. Strick Plastics Corp., Dept. ED, P. O. Box 5037, Philadelphia, Pa.

CIRCLE 120 ON READER-SERVICE CARD

Piston Capacitor Kit
For Electronic Experimental Use

PK85 kit offers an assortment of 85 quartz and glass piston capacitors of the 10 basic types now in use. Designed for electronic experimental purposes, these piston capacitors have been engineered to meet the rigid requirements of government departments and top electronic industrialists. They are individually packaged affording positive protection and swift, easy selection. The kit lists for $313. JFD Electronics Div., JFD Mfg. Co., Inc., Dept. ED, 6101-16th Ave., Brooklyn, N. Y.

CIRCLE 121 ON READER-SERVICE CARD

◀ CIRCLE 118 ON READER-SERVICE CARD

Potentiometer

Gangable to a Total of 14

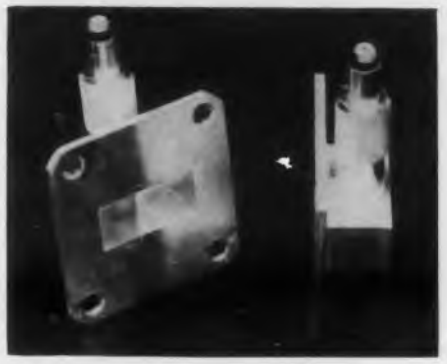
The S1-9000 is a single-turn continuous mechanical rotation potentiometer with high resolution and low noise level. It is gangable to a total of 14. Mechanical stops can be provided.

The unit has a housing diameter of 1/2" x length of 5/8". Shaft diameter is 1/8". Mechanical rotation is 360° and electrical rotation 352° ±5°. Resistance range is 5 ohms to 25K. Standard resistance tolerance is ±10%. Standard linearity tolerance is 10%. Wattage Rating is 0.8w. Ambient temperature range is —55° to +85°C. Weight per section is 0.5 oz. Starting torque is 0.75 oz-in, and running torque (max) 0.7 oz-in. General Scientific Div., San Fernando Electric Manufacturing Co., Dept. ED, San Fernando, Calif.

CIRCLE 123 ON READER-SERVICE CARD FOR MORE INFORMATION

Crystal Holder

For Sylvania IN369 Microwave Crystal



This crystal holder is specifically designed to house a new microwave crystal recently released by Sylvania Electric Products Co., the IN369. The crystal and holder combination have valuable characteristics over a wide frequency range. The combination will operate over the entire waveguide range of the holder (8200-12,400Mc) as either a video detector or as a mixer crystal unit. It can be provided with either a BNC type output fitting or a Microdot output fitting. The holder is designed to cover the entire X-band in 1 x 1/2 size waveguide. Sage Laboratories, Inc., Dept. ED, 30 Guinan St., Waltham 54, Mass.

CIRCLE 124 ON READER-SERVICE CARD FOR MORE INFORMATION

RADIO & TV
COMMUNICATIONS
COMPUTERS
AUDIO
INSTRUMENTS & CONTROLS
AIRCRAFT ELECTRONICS

YOUR CUSTOMERS LIST THEIR REQUIREMENTS

DESIGN '56

NOW... Noise Free A.C. Power!

NEW CURTISS-WRIGHT DISTORTION ELIMINATING VOLTAGE REGULATOR

- Reduces typical power line distortion to less than 0.3%
- Furnishes 1.4 KVA of distortion-free power
- Electronically regulates 115 V output to ±1%
- Recovery time less than 1/50 cycle
- Provides additional 4 KVA of ±1% electromechanically regulated power
- Electromechanical time constant only 0.6 seconds
- Electromechanical regulator, unlike usual magnetic voltage stabilizer, introduces no distortion or phase shift

Here at last is the ideal solution to the disturbing problem of harmonics and low frequency noise appearing in 115 V., 60 cps power sources. In one compact package, every laboratory can now obtain *both*

1) distortion-free, regulated power when needed, and simultaneously

2) a large supply of electromechanically regulated power for applications where normal line distortion is tolerable.

In addition to its general laboratory utility, this instrument is ideally suited for preventing instability and inaccuracy in a.c. computer system nulling operations. Many other applications. 230 V. model also available. Immediate delivery. $1,689 f.o.b. Carlstadt, N. J. Write for details.

Component & Instrument Department

ELECTRONICS DIVISION
CURTISS-WRIGHT
CORPORATION · CARLSTADT, N. J.

CIRCLE 126 ON READER-SERVICE CARD

Magnetic Null Indicator

Low Noise Level and High Stability

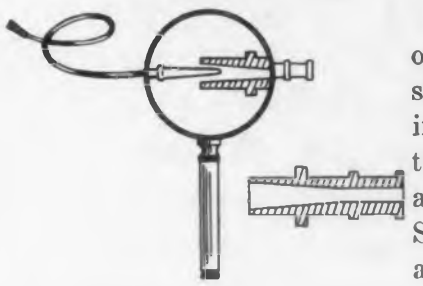
Designed to be as much as 100 times faster than moving coil type galvanometers, the "Magnetik" Null Indicator is a portable unit that performs both d-c null detection and linear deflection measurement. Chief features are a noise level less than 2μv and a zero drift of less than one division per hour. Interference by either 60 or 120cy ripples is virtually eliminated.

Housed in a 7" x 8" x 12" case, the instrument weighs only 16 lb. In contrast to conventional galvanometers and other type null indicators, input terminals are completely isolated from the chassis and the circuit ground. Linearity is ±5%. Only one vacuum tube is used, and there are no moving parts except the meter itself. Doelcam, Div. of Minneapolis-Honeywell Regulator Co., Dept. ED, Soldiers Field Rd., Boston 35, Mass.

CIRCLE 127 ON READER-SERVICE CARD FOR MORE INFORMATION

Tapered Lugs

For Simplified Wiring



Quick connection of wiring without soldreing is offered in the 2700 series of tapered terminal and receptacle lugs. Six standard sizes are offered which range from 0.328" above board with a 0.113" diam, to 0.421" above board with 0.118" diam. Single-end or double-end terminals and feed-thru types are available. They fit standard terminal board thicknesses from 1/32" through 3/16".

Designed for use in conjunction with Amphenol or similar pins, the lugs are made of half-hard brass meeting MIL specs and are offered either non-plated or silver-plated from stock for immediate delivery. Any required finish can be provided. Pull-out forces required at room temperature are approximately 21.3 lb; high temperature force, approximately 21.7 lb; and low temperature force, approximately 41.8 lb. U. S. Engineering Co., Inc., Dept. ED, 521 Commercial St., Glendale 3, Calif.

CIRCLE 128 ON READER-SERVICE CARD FOR MORE INFORMATION

a new lower cost precision camera for economical single-frame oscilloscope recording

THE AREMAC RECORDOSCOPE 1414

utilizes the new small Polaroid self-developing magazine, delivers black-field prints in 60 seconds*

The new Aremac 1414 Recordoscope is a compact oscilloscope camera of special configuration based on an adaptation of the 60-second self-developing Polaroid* magazine. It is a lower cost model designed principally for general application in single frame oscilloscope data recording. The camera, in combination with a packaged accessory group, mounts easily and sturdily on any standard 3" or 5" scope.

A single camera is capable of servicing several scopes of different manufacture when used in conjunction with scope-mounted Aremac swing-away hoods. Overall versatility, plus fine technical performance at a new lower cost, makes the 1414 Recordoscope a standard engineering instrument requirement for electrical, electronic, industrial and basic r & d laboratories.

*POLAROID IS THE REGISTERED TRADE NAME OF THE POLAROID CORPORATION.

1185-C MANUAL RECORDOSCOPE — 1185-B AUTOMATIC RECORDOSCOPE

The 1185-B RECORDOSCOPE features automatic magazine-shifting operation. Camera pre-sets to record from 3-to-16 traces on each 3" x 4" print. Automatic movement is triggered by remote control, cable or manual shutter release. The 1185-C... a manually operated version for use where applications do not justify the automatic-magazine shifting feature.

Write for complete technical literature on Aremac's Oscilloscope Data Recording Cameras.

Aremac ASSOCIATES
Manufacturers of Precision Mechanical and Optical Instruments
50 SOUTH SAN GABRIEL BLVD. • PASADENA 10, CALIF
AREMAC SALES REPRESENTATIVES IN PRINCIPLE U. S. CITIES

CIRCLE 129 ON READER-SERVICE CARD FOR MORE INFORMATION

Thermoplastic Spacers

Increase Relay Performance

Relay manufacturers have reported better performance, longer life, and economies in assembly through the use of these thermoplastic spacers. The spacers are cut from tubing to the proper thickness and in the quantities required for each job, eliminating the necessity of buying pre-cut spacers in large lots. The tubing is available in a wide variety of sizes, special diameters and thicknesses. Pyramid Plastics, Inc., Dept. ED, 554 W. Polk St., Chicago, Ill.

CIRCLE 99 ON READER-SERVICE CARD

Variable Inductance Coils

From 1 to 1000μh Range

The new series 1000 miniature variable inductance coils is designed for such applications as video peaking, r-f and i-f amplifiers, and filter networks. Covering the 1 to 1000μh range, these coils feature ceramic forms, split bushings and locknuts, and single "D" hole type mounting. The coils have solenoid and double-pie windings for higher Q and higher self-resonant frequencies. North Hills Electric Co., Dept. ED, 203-18 35th Ave., Bayside, N. Y.

CIRCLE 100 ON READER-SERVICE CARD

FM Wave Trap

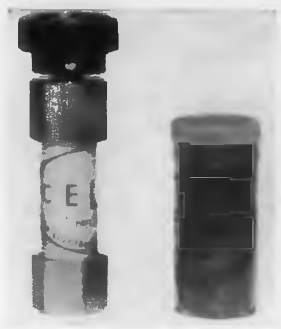
Weather Protected

Model MWT-1 is a precision tunable trap for eliminating FM interference in master TV systems. More than 20db attenuation is achieved on any FM channel from 88 to 108Mc. The interfering frequency is tuned out with two trimmer screws. Rejection is up to 35 db at channel center but less than 3db 1.5Mc on either side. The feedthru circuit provides good 75 ohm impedance match on all v-h-f TV channels. It can be mounted on the antenna mast or at the amplifier inputs. List price is $23. Blonder-Tongue Laboratories, Inc., Dept. ED, 526 North Ave., Westfield, N. J.

CIRCLE 101 ON READER-SERVICE CARD

Pressure Resistors

Can Be Either Insulators or Conductors



"Celab" resistance material is a variable resistance means capable of wide application. A quarter of a thimble-full of this powder will be an excellent insulator at 1 lb pressure, but will be a good conductor at 12-20 lb pressure. In a resistor, the powder's elongation is practically zero; thus contacts do not move or wear. Resistance is increased or decreased with high stability and smoothness for millions of operations.

Many curves can be obtained by varying the quantity and shape of the powder area. For instance, a 1/2" diam area x 1/16" thick, between two metal terminals, after original compression, will vary from several megohms to nearly zero with a 12 lb differential in pressure. Such a variable resistor would be rated at 15w, and the same unit could be used in the low range, to dim a 15w lamp steplessly, from full to out.

The material is uncontaminated by atmosphere, and undamaged by heat up to 600°C (on Type 1 material). It is a true resistance-sensitive to pressure resistor, and not a contact resistance device as a carbon pile rheostat. Shown is a sample pressure-adjustable device, which can be taken apart for design engineers, available in the 15w size. Also shown in a 1/2 oz container of the powder. Clark Electronic Laboratories, Dept. ED, Box 165, Palm Springs, Calif.

CIRCLE 135 ON READER-SERVICE CARD FOR MORE INFORMATION

Magnetic Erasing Pencil

For Film or Tape Recording Use

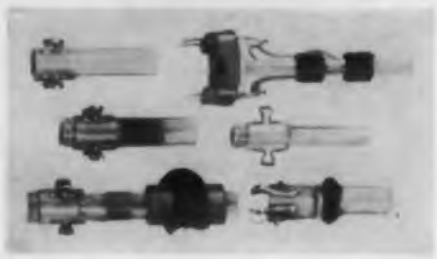
The magnetic erasing pencil, Type 8905, is most practical for erasing limited small areas when it is necessary to erase a syllable or part of a word. It operates on 115v 60cy at 10w, and comes complete with press-to-operate switch and 6′ of cord. Dimensions are similar to a king-size fountain pen.

Also available is the Degausser Type 9205, a tank-type bulk eraser, also for tape and film erasing. It is engineered for complete erasure of program and residual noise. Cinema Engineering Co., Div. Aerovox Corp., Dept. ED, Burbank, Calif.

CIRCLE 136 ON READER-SERVICE CARD FOR MORE INFORMATION

Coil Forms

Eliminate Mounting Clips



"RI-Ion" one-piece coil forms reduce coil production time and costs by eliminating the need for mounting clips, and they minimize the number of assembly operations. They are precision molded forms of high-temperature plastic. The construction is used in both conventional and printed-circuit type applications and is available in a variety of colors for easy identification. The forms resist electrolysis indefinitely, have uniform characteristics, and simplify components for automatic insertion in printed-circuit type applications.

The forms are also being used in the manufacture of this firm's own "Ri-tran" transformers and coils for a wide variety of r-f applications. Radio Industries Inc., Dept. ED, 5225 Ravenswood Ave., Chicago 40, Ill.

CIRCLE 138 ON READER-SERVICE CARD FOR MORE INFORMATION

Volt-Ohm-Milliameter

Can't Burn Out

This instrument is available in two models, Industrial Model 455 and Audio Model 456, and features a new technique to eliminate accidental burn-outs. The instrument disconnects itself and raises a reset button on the case if a dangerous overload is applied.

Model 455 has a sensitivity of 20,000 ohms/v, a-c or d-c; model 456 has a sensitivity of 20,000 ohms/v d-c and 1000 ohms/v a-c. Model 456 also includes decibel ranges and has provisions for output measurements. Both models incorporate a full-wave bridge-type rectifier circuit. Size 8-1/2" long, 5-7/8" wide, height 3" tapered down to 1-3/4". Weight 3-3/4 lbs. Hickok Electrical Instrument Co., Dept. ED, 10525 Dupont Ave., Cleveland, Ohio.

CIRCLE 139 ON READER-SERVICE CARD FOR MORE INFORMATION

COMING JANUARY 1st
DESIGN '56
Yearly Feature Issue of Electronic Design

Video Signal Evaluator

For Monochrome and Color

The "Colorscope" combines the functions of seven test units in one compact instrument measuring only 14" x 16" x 24", plus power supply. It can be set up for dolly carry (as shown) or rack mounted.

By means of a function switch, 10 displays are seen in sequence on the CRT face: picture monitor, pulse cross monitor, two-line horizontal time, two fields at vertical time, NTSC vectorscope presentation, external vertical signal at horizontal or vertical time, external horizontal and vertical amplifier, phase demodulator scope, and quadrature phase demodulator scope. The instrument also features a ready-to-use, self-storing graticule holder and a motor-driven cooling system. Tarc Electronics, Inc., Dept. ED, 48 Urban Ave., Westbury, N. Y.

CIRCLE 140 ON READER-SERVICE CARD FOR MORE INFORMATION

Time-Delay Generator

With 1.5-10,000μsec Range

The Type 326 Time Delay Generator permits accurate measurement of time functions such as duration of waveforms, pulse widths, delay characteristics of oscillograph amplifiers, calibration of synchroscopes and oscillograph sweep generators, radar and sonar ranges, and measurement of numerous other time-basis functions. It is equipped with three overlapping ranges providing delays from 1.5μsec to 10,000μsec. Accuracy is better than 0.1% at delays up to 1000μsec and 1% on the top range to 10,000μsec. Jitter is no greater than one part in 10,000 at any delay setting.

Readily portable, the unit weighs only 27 lb and measures 14-1/2" x 7" x 9-1/2" high. Technical Products Div., Allen B. Du Mont Laboratories, Inc., Dept. ED, 750 Bloomfield Ave., Clifton, N. J.

CIRCLE 141 ON READER-SERVICE CARD FOR MORE INFORMATION

ARE NEW TRENDS IN INSTRUMENTATION AFFECTING COMPONENT DESIGN?
see DESIGN '56

Magnetron Tester

Portable Unit Weighs 35 Lb.

This 35 lb portable magnetron tester, Type 162, will qualify magnetrons in the field, making it of value to users of all types of radar equipment. It will evaluate a large number of magnetron types in present manufacture and use. The main indicator unit is supplied from 115v 60cy and requires approximately 150w.

Characteristics include: continuous monitored filament voltages of 0-10 and 0-25v a-c ±3%; peak modulating volts indicated 0-35kv continuous ±10%; peak power output 0-400kw indicated to ±20%; operating frequency of the magnetron "S" band ±1%; "X" band ±0.3%; dial current 0-50ma at low voltage ±3%. U. S. Electronics Corp. of America, Dept. ED, Alexandria, Va.

CIRCLE 143 ON READER-SERVICE CARD FOR MORE INFORMATION

Microvolt-Ammeter

Can Measure 1 $\mu\mu$amp

The Model 203 D-C Microvolt-meter-Ammeter is capable of making accurate measurements of voltages as small as 10μv and currents as small as 1$\mu\mu$amp. Fifteen voltage ranges cover from 100μv to 1000v (full scale). Ten current ranges from 100$\mu\mu$amp to 100ma (full scale) are provided. The small signal to be measured is amplified by a chopper amplifier, rectified, and applied to a precise microammeter.

The instrument features high input impedance and a zero-center meter with an uncluttered scale. Output terminals are provided so that the unit can be used as an extremely stable low-drift d-c amplifier. Kay Lab, Dept. ED, Box 16, San Diego 12, Calif.

CIRCLE 144 ON READER-SERVICE CARD FOR MORE INFORMATION

NOW
...GERMANIUM
FUSED
JUNCTION

- MEDIUM POWER
- LOW NOISE FIGURE
- HIGH GAINS
- AXIAL LEADS
- MINIMUM ALPHA-CROWDING EFFECT AT HIGH CURRENTS
- CLIP-IN STYLE PACKAGE
- HERMETIC SEAL

NPN TRANSISTORS *by* HUGHES

These devices offer excellent performance characteristics, even up to higher power ratings, together with high gain and low noise figures. The new package is designed to dissipate more heat. This makes it possible to maintain the high performance characteristics.

RATINGS AT 25°C

Type	Alpha		Maximum Collector-to-Base Voltage (V_C)	Collector Cut-Off Current (I_{CO})	Alpha Cut-Off Freq. (α cogb)	Rise Time	Noise Figure
	Min.	Max.					
HA5001	0.975	1.0	30V	5μA	2.5	2.5 μsecs	....
HA5002	0.950	0.965	15V	12μA	1.0	....	15.0 db
HA5003	0.975	0.99	20V	10μA	1.5	....	15.0 db

The low alpha-crowding effect makes the new Hughes transistors particularly adaptable to high current medium power amplifiers, in addition to: Computers ...Switching...Audio Amplifiers...I-F Amplifiers ...Oscillators. For all types, maximum collector current is 100 milliamperes, and collector dissipation is 500 milliwatts. Under certain conditions, or when used with clips or with suitable heat sinks, these ratings can be increased substantially. Detailed specifications for each type are available in pertinent data sheets.

ACTUAL SIZE
(photo, transistors in hand).

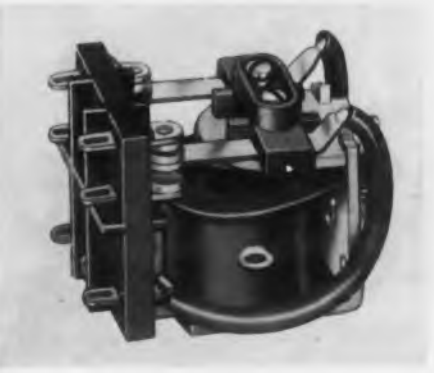
New Hughes Fused Junction NPN Germanium Transistor, available in (A) Three leads, to fit conventional transistor socket mountings; (B) Clip-in style package.

HUGHES
SEMICONDUCTOR DIVISION
Aircraft Company, Culver City, California
New York Chicago Los Angeles

CIRCLE 146 ON READER-SERVICE CARD FOR MORE INFORMATION

Relay

8amp Unit Weighs 1.9 Oz.



The Series 1200 a-c or d-c relay is rated up to 8amp at 115v 60cy non-inductive load. It is a rugged, midget relay that incorporates considerable power capacity and multiple contact combinations in extremely small space. Overall dimensions are 1-11/16" x 1" x 1-1/4" high; weight is only 1.9 oz. Contact combinations are available up to 3pdt. Solder terminals are molded in a phenolic block, with barriers for over-surface insulation to meet UL specifications.

The relay has many applications in automation, computers, communications equipment, and switching devices. It is also available in a variety of interlock arrangements formed with any combination of a-c/a-c, a-c/d-c, and d-c/d-c Series 1200 Relays. Guardian Electric Manufacturing Co., Dept. 1200, 1621 W. Walnut St., Chicago 12, Ill.

CIRCLE 147 ON READER-SERVICE CARD FOR MORE INFORMATION

Servo Amplifier

Accepts Two A-C and One D-C Input

This small, lightweight, reluctance-type servo amplifier, Model 1121, accepts two a-c inputs and one d-c input in any combination. With instantaneous response (time lag is negligible compared to 1 cy of supply frequency) it produces proportional and reversible power output for most 115v 400cy servo motors rated at 18w or less. Operating directly from the power line, total power consumption is low for small input signals, and less than half plate dissipation is required at no load.

Featuring built-in power supply and built-in preamplifier, the amplifier is compact; the factor of output versus weight is over 5w/lb. The unit has no tuned elements. Servo Corp. of America, Dept. ED, 20-20 Jericho Turnpike, New Hyde Park, L. I., N. Y.

CIRCLE 148 ON READER-SERVICE CARD FOR MORE INFORMATION

THE ELECTRONICS INDUSTRY LOOKS AHEAD in DESIGN '56

Differential Voltmeter

Will Measure 0.01% Differences

The Type 1560 Differential Voltmeter checks response and attenuation of filters, transformers, amplifiers, and other applications where a small difference in two voltages is to be measured. It may also be used to observe drift in amplifiers, meters, and filters. The a-c input signals are amplified, then rectified and compared, so that an accurate comparison may be obtained regardless of phase. Voltage differences as low as 0.01% can be observed through the use of a high-gain amplifier and are indicated on a 4″ zero center meter.

Specifications include: difference voltage range of —10% to +5% in 0.01% increments; input voltage levels 0.1 to 100v; frequency range of 30cy to 20kc; input impedance of 500,000 ohms; and operation from a 115v 60cy line. Freed Transformer Co., Inc., Dept. ED, 1715 Weirfield St., Brooklyn 27, N. Y.

CIRCLE 151 ON READER-SERVICE CARD FOR MORE INFORMATION

Socket Cap Screws

In Increased Size Ranges

"Giant Size" Socket Cap Screws in diameters of 1-1/4″ and 1-1/2″ are now carried in stock as standard items by this firm, extending the stock size range from No. 0 Wire size to 1-1/2″. The large size cap screws will be offered with hex sockets, plain heads only, in heat treated alloy steel. They are available in lengths from 2-1/2″ or 3″ up to 12″.

In addition, the full range of sizes in Button Head Socket Screws are offered for applications which require a smooth headed fastener for pleasing appearance, safety considerations, or tight clearances. They are available in a range of sizes from No. 4 wire size to 5/8″ diam, with a variety of lengths in each size. They are made of heat-treated alloy steel, with hex sockets. The Bristol Co., Socket Screw Div., Dept. ED, Waterbury 20, Conn.

CIRCLE 152 ON READER-SERVICE CARD FOR MORE INFORMATION

Encapsulated Transformers

Save Needless Protective Extremes

These three encapsulated transformers are designed for use in a range from Class H temperatures in military applications requiring MIL-T-27A grades 2 and 5 performance, to industrial and commercial applications where protection is required against grease, oil, and corrosive atmospheres. Shown at left is a high temperature unit; at center, a Class A unit, and, at right, a commercial/military unit.

The transformers enable designers to specify the exact degree of encapsulation required without having to pay for unnecessary protective extremes. Encapsulations used include an extremely durable elastomer formulation, a Class A modified epoxy resin, and others. Used in combination with varnishes and permafils, they produce coatings specifically designed to meet specified environmental characteristics. Specialty Transformer Dept. ED, General Electric Co., Schenectady 5, N. Y.

CIRCLE 155 ON READER-SERVICE CARD FOR MORE INFORMATION

Ferrite Microwave Absorbers

For S-Band Use

These "Unilines" are for microwave systems and test equipment operating in the S band. They utilize the transverse field, resonant absorption principle of ferrites at microwave frequencies. Special techniques permit safe operation at substantial peak and average powers.

Four units cover the 2.8-3.2kMc range. Other models cover 2.0-2.4-kMc. Power ratings of most units is 400kw peak, 350w average. Available models provide several values of isolation ranging between 6db and 27db. Isolation to insertion loss ratio for all units is typically 25:1. Typical vswr for all models is 1.2 to 1. Cascade Research Corp., Dept. ED, 53 Victory Lane, Los Gatos, Calif.

CIRCLE 156 ON READER-SERVICE CARD FOR MORE INFORMATION

COMPONENT DESIGN Vs MARKETS AND THEIR INTERRELATIONSHIP DON'T MISS DESIGN '56

Molds For Plastics

Over 5000psi at 400°F

Another variation in molds for plastics, rubber and allied industries is Devcon C, a combination of approximately 80% aluminum and steel and 20% plastic. Of extreme help to design engineers, it is being used experimentally by automotive, plastic, electrical and machine tool companies. It can be poured or formed into any shape for making inexpensive plastic and rubber molds, embossing dies, tools, jigs and fixtures, caulking around steel plates and other applications where high strength at elevated temperatures is essential. Chemical Development Corp., Dept. ED, Endicott St., Danvers, Mass.

CIRCLE 58 ON READER-SERVICE CARD

Heat Sheets

Rated Up to 600°F

"Heat Sheets" can be wrapped around surfaces as small as 1" diam due to their light weight and flexibility. They are glass cloth treated with a newly developed inorganic material. They are also completely unaffected by temperatures as high as 600°F, by solvents, and by most acids. Their unique construction gives uniform temperature and efficient heat transfer. Available in any size up to 36" x 42", and in resistances from 10 to 10,000 ohms per square. Electrical Coatings, Inc., Dept. ED, 10 Broad St., Salem, Mass.

CIRCLE 59 ON READER-SERVICE CARD

Motor Calculator

Quicker Than a Slide Rule

A single setting of Model FR-7 direct reading calculator replaces seven operations with a conventional slide rule. One setting for any relationship of speed vs torque gives equivalent watts output and horsepower in decimal and common fractions. Also gives percent efficiency for any value of watts input. Calculator covers a range from 1/2000 to 1/2hp. It is printed on vinylite in 6-5/8" width with 7" length cycles for torque and speed. Engineering Devices Co., Dept. ED, Box 7741, Chicago, Ill.

CIRCLE 60 ON READER-SERVICE CARD

CIRCLE 61 ON READER-SERVICE CARD ➤

Solder Brazer

Brazes Enamel Wire Directly

The "Hi-Temp Solder Brazer," Model SP-102, brazes formvar or enamel-covered wire without costly pre-stripping or pre-cleaning. Joints are stronger and will stand up longer than the wire itself. The unit is designed for easy use. It has a switch for temperature control on the front panel, providing four convenient ranges: 1200°, 1350°, 1500°, and 1650°F. Tartak Electronics, Dept. ED, 2979 N. Ontario St., Burbank, Calif.

CIRCLE 161 ON READER-SERVICE CARD FOR MORE INFORMATION

Mechanical Integrator

Has Two-Independent Outputs

The Model 256, a 5" ball and disk type integrator, features two integrator sections driven by a common input. Output shaft speeds are independently adjusted by separate control rods. For integration, totalizing, and numerous speed-control applications, the unit has an input speed of 0-150rpm, and output speeds of (unidirectional) 0-0.8 x input rpm, and (reversible) 0 to 0.4 x input rpm. Reflectone Corp., Dept. ED, Stamford,

CIRCLE 162 ON READER-SERVICE CARD FOR MORE INFORMATION

Temperature Controls

Sealed, Disk-Type, Snap-Action

The C-4344 series disk-type snap-acting hermetically sealed temperature controls are particularly suitable for applications where space and weight are limited. The snap-acting disk is located opposite the terminal end at the bottom of the metal enclosure where temperature of air, liquids, or mounting surface can be followed clearly. Spencer Thermostat Div., Metals & Controls Corp., Dept. ED, Attleboro, Mass.

CIRCLE 163 ON READER-SERVICE CARD FOR MORE INFORMATION

Crystal Oven

With Rapid Warm-Up and Precise Control

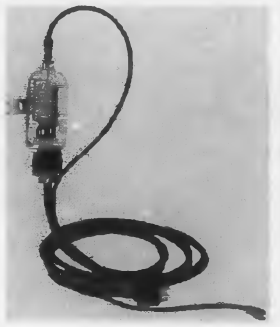
This miniature precision crystal oven, Model AB-200, is designed primarily for use in military communications equipment where rapid warmup and precise control are paramount. Fitted with an octal base, it features a heater construction which eliminates the necessity for two thermostats. It is ruggedly constructed and made for long life.

The operating temperature of the unit is preset to customer requirements. The heater voltage is either 27 or 110v. Quartz Crystal Div., Bulova Watch Co., Dept. ED, Valley Stream, L. I., N. Y.

CIRCLE 166 ON READER-SERVICE CARD FOR MORE INFORMATION

Ionization Gage

Has Non-Burnout Feature



The Type RG-75 is a hot-wire ionization gage that can be operated at atmospheric pressure without burning out and with no permanent effect on subsequent readings; accidental admission of air to a vacuum system does not destroy the gage. It is valuable not only in the high vacuum range (1 micron and less) but in the ultra-high vacuum region below 10^{-8}mm Hg. The non-burnout feature results from the use of a thoria-coated iridium ribbon as the filament.

Range has been extended to below 10^{-10}mm Hg by employing the Bayard-Alpert inverted gage structure. Connection to the gage is made by means of standard connectors. The gage body is of Nonex, and tubulations are available in Nonex, Pyrex, and Kovar. Vacuum Electronic Engineering Co., Dept. ED, 86 Denton Ave., New Hyde Park, N. Y.

CIRCLE 167 ON READER-SERVICE CARD FOR MORE INFORMATION

Selenium Rectifier

Dual Purpose Type

Type 60-9150 is a voltage doubler stack, thus, one of these units can be used as a doubler and two units can be connected as a single-phase full-wave bridge. Two type 60-9150 connected in a single phase full wave bridge circuit will deliver approximately 180v d-c at 0.10amp for an rms voltage input of 230v. As a voltage doubler, this unit will deliver 50ma connected to a maximum a-c input of 175v rms. Used with sufficient capacitance, an output of 350v d-c can be obtained. A good application of this unit is in the design of variable speed controls and field supplies for small d-c motors. Size 21/32" x 1-1/16" x 1-1/4" overall volume. International Rectifier Corp., Dept. ED, 1521 East Grand Ave., El Segundo, Calif.

CIRCLE 130 ON READER-SERVICE CARD

Silicone Resin

For Protecting Printed Circuits

"G-C Print-Kote", a genuine silicone resin used by TV manufacturers for original circuit protection, is now being used as protection for repairs made in printed circuits. It will insulate a printed circuit effectively, preventing arcing and shorting without further attention. A six-ounce can lists for $3.25 (Catalog No. 14-6). General Cement Mfg. Co., Dept. ED, 919 Taylor Ave., Rockford, Ill.

CIRCLE 131 ON READER-SERVICE CARD

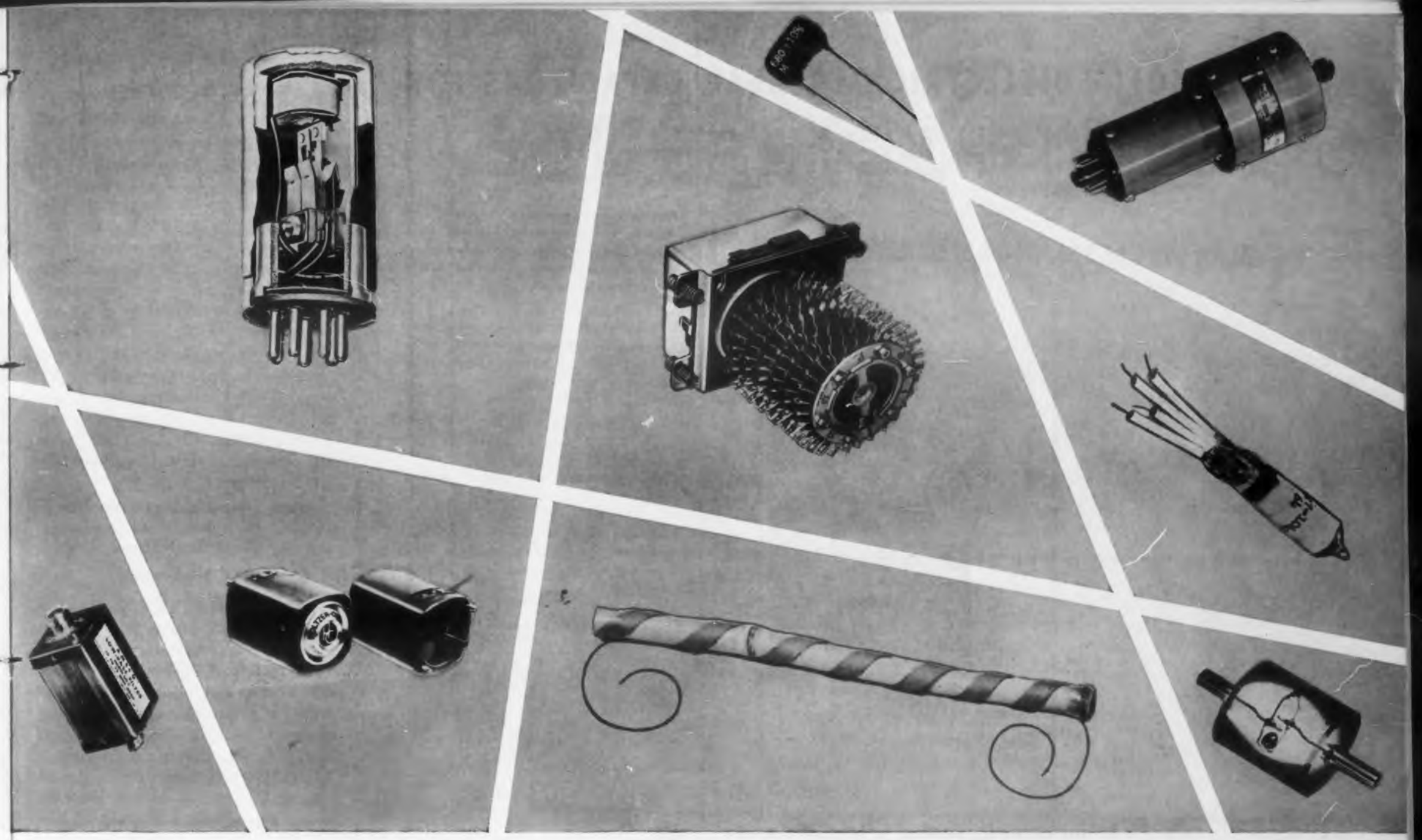
Circle Template

44 Precision Milled Circles

The Circle-Master Template is made of rigid, durable, non-glare acrylic vinyl plastic and contains 44 precision milled circles to speed the work of designers, engineers and many others. The circles are grouped in progressive sizes on the template with increments in 1/64, 1/32, 1/16, 1/8, 1/4, and 1/2". All the circles make allowance for pencil clearance of 1/32". Alvin & Co., Dept. ED, Windsor, Conn.

CIRCLE 132 ON READER-SERVICE CARD

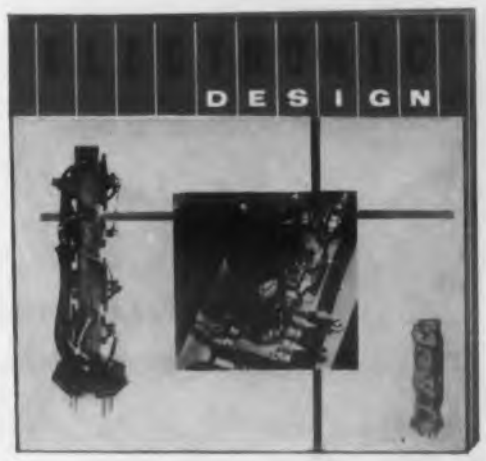
◀ CIRCLE 133 ON READER-SERVICE CARD



These are a few of the products . . .

. . . that you saw *first* in *Electronic Design*.

Electronic Design now reviews *all* of the new products being released. That's why more and more engineers have come to rely on *Electronic Design* for their new product design and development literature . . . at the exclusion of all other publications. *Electronic Design's* complete new product coverage gives all the information, concisely, dependably, and in one magazine. Now coming to you twice a month.



HAYDEN PUBLISHING COMPANY, INC. 19 East 62nd Street, New York 21, N. Y. Telephone: TEmpleton 8-1940

Sharp Cut-Off Pentodes
For V-H-F Tuners

The *3CE5* and *6CE5* are high transconductance, sharp cut-off pentodes for v-h-f tuners and i-f amplifiers. Electrically and mechanically the tubes resemble the types *3CB6* and *6CB6*. The *3CE5* has a 600ma heater with controlled warm-up time for use in series string receivers. Both tubes are manufactured to narrow limits for grid voltage at plate current cut-off. In TV receiver design, this narrow cut-off range characteristic permits closer tolerances in the a-g-c circuit, eliminating the need for tube selection by the manufacturer. CBS - Hytron, Div. of Columbia Broadcasting System, Inc., Dept. ED, Danvers, Mass.

CIRCLE 172 ON READER-SERVICE CARD

Electrical Tape
24" Wide Tape

Kelon-T (Teflon) tape for electrical applications is available in widths up to 24" and in thicknesses varying from 0.005 to 0.125". It fits tightly over sharp bends and corners and has the property of plastic memory, tending to return to its original shape when heated. W. S. Shamban & Co., Dept. ED, 11617 W. Jefferson Blvd., Culver City, Calif.

CIRCLE 173 ON READER-SERVICE CARD

Waterproof Epoxy Sealer
For Strain Gages

Epoxylite No. 222 is a resilient, waterproof strain gage sealing compound which eliminates preheating and much time usually required in preparing strain gages for environmental stress analyses. It requires no heating of either the gage or test hardware, yet has a maximum service temperature of 300°F. Developed specifically for the aircraft industry, tests showed this sealing compound to have a 0% swell volume in contact with SR-10 aviation fuel, and only 5% swell volume with either JP-3 jet fuel or SR-6 aromatic aviation gasoline. The Epoxylite Corp., Dept. ED, 812 Truck Way, Montebello, Calif.

CIRCLE 174 ON READER-SERVICE CARD

CIRCLE 175 ON READER-SERVICE CARD

Medium-Mu Dual Triode

With Dissimilar Units

Type *6CM7* is a medium-mu dual triode of the 9-pin miniature type designed for use as a vertical deflection oscillator and vertical deflection amplifier in TV receivers. It contains two dissimilar units in one envelope and has a 600ma heater which provides controlled warm-up suitable in sets with series-heater string arrangements. Unit No. 1 (for use as vertical blocking oscillator) has a max dc plate voltage of 500v, a max average plate current of 15ma, and a max plate dissipation of 1.25w. Unit No. 2 (for use as vertical deflection amplifier) has a max dc plate voltage of 500v, a max peak positive-pulse plate voltage of 2200v, and a max plate dissipation of 5w. Basing arrangement facilitates use of *6CM7* in printed circuits. Radio Corp. of America, Tube Div., Dept. ED, Harrison, N. J.

CIRCLE 176 ON READER-SERVICE CARD

Polyester Fabric

For Wrapping Components

Called "Scotch" brand polyester web, the new polyester fabric in nonwoven felted form offers increased moisture resistance, superior varnish pickup ability, and greater conformability than materials previously used. Designed for wrapping coils, transformers, motors, and other electrical components, it has approximately 2-1/2 times the varnish pickup ability of cotton, cloth, reducing costs by eliminating extra dipping and baking cycles. Moisture absorption property of the web is only 0.5% as compared to 24 to 27% for cotton cloth. Available in thickness from 6.5 to 9.5 mils in 36 yd lengths and in standard widths up to 44". Minnesota Mining & Manufacturing Co., Dept. ED, 900 Fauquier St., St. Paul, Minn.

CIRCLE 177 ON READER-SERVICE CARD

COMPONENT DESIGN Vs MARKETS AND THEIR INTERRELATIONSHIP DON'T MISS DESIGN '56

Coil Turn Counter

Accurate to 0.1%

This coil turn counter quickly measures the number of turns on coils wound on non-magnetic forms with an accuracy of 0.1%. It is available in three models, with the following ranges: 0-11,110; 0-31,110; and 0-61,110 turns. Sunshine Scientific Instrument, Dept. ED, 1810 Grant Ave., Philadelphia 15, Pa.

CIRCLE 180 ON READER-SERVICE CARD FOR MORE INFORMATION

Coaxial Cables

In Three Miniature Types

These Teflon-insulated cables are available in three standard types: 50, 70, and 93 ohms. Each type can be obtained with an outer covering of vinyl, nylon, kel-F, teflon, or a glass fibre braid. Special low-noise cables are also available in any of these types.

The small diameter and light weight of the cables makes them valuable for aircraft and telemetering applications. Hitemp Wires, Inc., Dept. ED, 26 Windsor Ave., Mineola, L. I., N. Y.

CIRCLE 181 ON READER-SERVICE CARD FOR MORE INFORMATION

Standard Signal Generator

With 900-2000Mc Oscillator

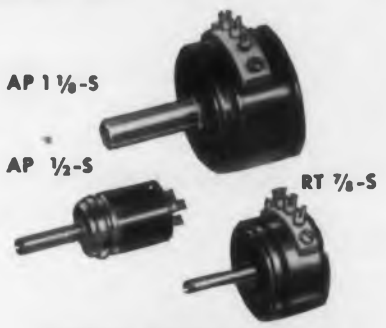
A new grid-separation oscillator, the Type 1218-A Unit Oscillator, for the 900-2000Mc range, is available by itself or incorporated in a new standard-signal generator. Adjustable lines are used to tune the cathode and plate of a pencil-type triode. General Radio Co., Dept. ED, 275 Massachusetts Ave., Cambridge 39, Mass.

CIRCLE 182 ON READER-SERVICE CARD FOR MORE INFORMATION

Aerohm Precision wire-wound Potentiometers

"Lo-TORK" POT LT ⅞

For minimum-torque uses in computer, servo, and selsyn service. Stainless-steel precision ball bearings. Maximum torque is 0.01 inch-ounce. Dissipates one watt at 80°C. Resistances—100 to 100,000 ohms. Weight is only ½ ounce. Ganging to six decks; internal clamps hold ⅞" diameter. Standard linearity 0.5%; on special order 0.25%; toroidal winding allows winding angles to 360°; standard 354°.



MICRO-MINIATURE and MINIATURE

Series AP ½-S—2 watts continuous at 80°C; resistances 10 to 20,000 ohms, 5% tolerance standard; diameter ½", depth ½", weight ¼ ounce; sealed well enough for potting.

Series RT ⅞-S—3 watts continuous at 80°C; resistances 10 to 100,000 ohms; diameter ⅞", depth ⅜", weight ½ oz.; standard linearity 2%.

Series AP 1⅛-S—4 watts continuous at 80°C; resistances 10 to 150,000 ohms; diameter 1⅛", depth ⅜", wt. less than ¾ oz.; standard linearity 1%.

All precision-machined, with anodized aluminum bodies, line-reamed phosphor bronze bearings, centerless ground stainless steel shafts, and gold-plated fork terminals. Fully sealed and fungus-proofed. Can be processed, on special order for use at 125°C. Aerohm potentiometers are individually checked for quality and performance.

MFG. INC.

Write today for detailed information and prices

WATERS MANUFACTURING, inc.
Waltham 54, Massachusetts
APPLICATION ENGINEERING OFFICES IN PRINCIPAL CITIES

CIRCLE 184 ON READER-SERVICE CARD

Weight Cell

Activated at Predetermined Load Point

This weight-sensitive contact cell activates at any one predetermined load point. Features include small size, resistance to extreme overload, low cost, and resistance to corrosion or weather effects. The interior and the completed cell are illustrated. The unit incorporates a Micro-Switch (built to withstand over 1,000,000 cycles of operation) fitted to a patented deflecting member. The entire assembly is hermetically sealed in a stainless-steel case. No special instrumentation or readout equipment are required.

The cell operates at 1amp 125v a-c and is currently available in ranges of 500 through 10,000 lb. Total travel at the load point is approximately 0.005". Typical applications include use as an actuator for treadles where low loads must be ineffectual; as a safety indicator; and as a tripping device for automation at given load points. Control Cells Corp., Dept. ED, Box 337, Boulder, Colo.

CIRCLE 185 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Shock Mounts

All-Metal Units for Tubes

These mounts for miniature tubes are designed for any shape to fit all varieties of circuit configurations. Integral in construction is a metal sleeve, serving as a brace and support for the electronic tube, which can be adjusted with a screw clamp. "Met-L-Flex" spring-enclosed cushions fabricated of stainless steel (in projecting cups) attenuate shock and vibration between the sleeve and the outer support.

Performance is unimpaired from heat because of resistance extending to 375°F throughout the all-metal system. Cold to −130°F does not hamper resiliency. Flexible electrical leads are securely connected at the base of the tube and do not interfere with the free action of the mounts. Robinson Aviation, Inc., Dept. ED, Teterboro, N. J.

CIRCLE 186 ON READER-SERVICE CARD FOR MORE INFORMATION

LAPP GAS-FILLED CONDENSERS

for duty at

High Voltage

High Current

High Frequency

Lapp's experience of 18 years of design and manufacture of gas-filled condensers is back of this precision-made unit and its promise of years of trouble-free duty. It is small in size and low in loss, offers high voltage and current ratings, high frequency limits, safety, puncture-proof operation and constant capacitance under temperature variation.

The entire electrical and mechanical assembly of the Lapp gas-filled condenser is supported by a top aluminum ring, the steel tank serving only as a support for this ring and as a leak-proof gas container. High-potential plates are carried on a rigid center stud which is supported by a top ceramic bowl. Grounded rotor plates are carried on ball bearings nearly the full tank diameter. This construction provides a grounded tuning shaft on variable models and makes possible efficient and complete water cooling for high current operation.

Models in four tank diameters, 7" to 18", are available, in variable or fixed capacitances, for duty up to 30,000mmf; in current ratings to 400 amps at 1mc; operating voltages to 80Kv peak. Write for Bulletin 302, with complete description and characteristics data. Lapp Insulator Co., Inc., Radio Specialties Division, 279 Sumner Street, Le Roy, N. Y.

Lapp

CIRCLE 187 ON READER-SERVICE CARD FOR MORE INFORMATION

Microwave Load Isolator

For Laboratory Use

The Model X20-L Microwave Load Isolator, designed especially for laboratory use, provides high isolation over a wide band of frequencies. A minimum isolation of 18db and an average isolation of 25db are obtained over an 8600-9600Mc band. Litton Industries, Components Div., Dept. ED, 336 N. Foothill Rd., Beverly Hills, Calif.

CIRCLE 189 ON READER-SERVICE CARD FOR MORE INFORMATION

Magnetic Clutch

Uses Two Coils, Couplings

This magnetic clutch is designed for servo system applications requiring the possibility of engagement or disengagement of either one or both output shafts from a single input shaft. This is accomplished by enclosing two magnetic coils and two sets of couplings in one housing. Sterling Precision Instrument Corp., Instrument Div., Dept. ED, 34-17 Lawrence St., Flushing, N. Y.

CIRCLE 190 ON READER-SERVICE CARD FOR MORE INFORMATION

Transistors

For High-Speed Switching

Four new types of germanium n-p-n transistors available from this firm are especially designed for general-purpose switching and computer applications. With parameter tolerances closely held, they feature a beta spread of 2:1 (beta values for the individual types are 12:24, 24:48, 48:-100, and 100:200). Rise time in a typical circuit is 0.15μsec, and typical cutoff time is 3.5μsec. The transistors are mass-produced to standard design characteristics. Texas Instruments, Inc., Dept. ED, 6000 Lemmon Ave., Dallas 9, Tex.

CIRCLE 191 ON READER-SERVICE CARD FOR MORE INFORMATION

Delay Lines

Variable from 0-10μsec

Type 611 Variable Delay Lines are continuously variable from 0 to beyond 10μsec. Type 611A consists of a continuously variable delay line and a step variable delay line. The continuously variable delay line serves as a fine control; the smallest incremental time delay that can be adjusted (resolution time) is 5 x 10^{-10}sec. The step variable delay line serves as the coarse control for time variation.

Type 611B consists of a tapped delay line, a 12-position rotary switch, and a step variable delay line. The tapped line and the switch serve as the fine control for time variation, while the step variable line serves as the coarse control. Advance Electronics Co., Inc., Dept. ED, 451 Highland Ave., Passaic, N. J.

CIRCLE 192 ON READER-SERVICE CARD FOR MORE INFORMATION

Digital Interval Timer-Counter

Contains 10 Plug-in Decade Counters

The "Digitac" Model 1500 Digital Interval Timer and Counter contains 10 plug-in decade counters arranged in two banks of five each. By means of switches on the front panel, the circuitry may be connected so that the instrument will serve many functions, such as a 5, 10, or dual 5 decade counter or timer; a preset timer or counter; combination timer and counter; or as an electronic delay circuit.

This unit can be used as a portable lab or test instrument, or incorporated into computers or automation equipment. It will count up to 10 billion at a rate not exceeding 100,000/sec. The timing capacity is 10μsec to 100,000 sec (27.8 hours), and timing increments may be preset at any value in 10μsec steps within that range. Count may be preset at any value from 1 to 10 billion with both banks of decade counters in series or up to 100,000 in each 5-decade bank when used separately.

The instrument weighs only 25 lb and may be mounted in a standard telephone relay rack, or is available in a carrying case. Ransom Research, Dept. ED, P. O. Box 382, San Pedro, Calif.

CIRCLE 193 ON READER-SERVICE CARD FOR MORE INFORMATION

DECADE RESISTANCES & VOLTAGE DIVIDERS

delivered from stock

Accuracy: 10 ohms and above: ±0.1%
1 ohm: ±0.25%
0.1 ohm: ±1%
0.01 ohm: ±5%

Temp. Coeff.: ±0.002% per degree C.
Maximum Load: ½-watt per step
Frequency Limit: Non-inductive to 20KC

DECADE RESISTANCE BOXES

Type	Dials	Ohm Steps	Total Resistance—Ohms	Price
817	3	0.01	11.1	$60.00
818	3	0.1	111	51.00
820	3	1	1,110	56.00
821	3	10	11,100	60.00
822	3	100	111,000	63.00
823	3	1,000	1,110,000	77.00
824	3	10,000	11,100,000	120.00
817-A	4	0.01	111.1	75.00
819	4	0.1	1,111	71.00
825	4	1	11,110	77.00
826	4	10	111,100	79.00
827	4	100	1,111,000	92.00
828	4	1,000	11,110,000	139.00
8285	5	0.1	11,111	94.00
829	5	1	111,110	101.00
830	5	10	1,111,100	113.00
831	5	100	11,111,000	155.00
817-C	6	0.01	11,111.1	105.00
8315	6	0.1	111,111	109.00
832	6	1	1,111,110	121.00
833	6	10	11,111,100	169.00

UNMOUNTED DECADE RESISTANCES

Type	Dials	Ohm Steps	Total Resistance—Ohms	Price
435	1	0.1	1	$12.00
436	1	1	10	13.25
437	1	10	100	13.25
438	1	100	1,000	15.00
439	1	1,000	10,000	16.00
440	1	10,000	100,000	18.50
441	1	100,000	1,000,000	32.50
442	1	1,000,000	10,000,000	60.00

DECADE VOLTAGE DIVIDERS (Potentiometers)

Type	Dials	Ohm Steps	Total Resistance—Ohms	Price
845	3	1	1,000	98.00
837	4	0.1	1,000	126.00
835	4	1	10,000	132.00
836	4	10	100,000	146.00

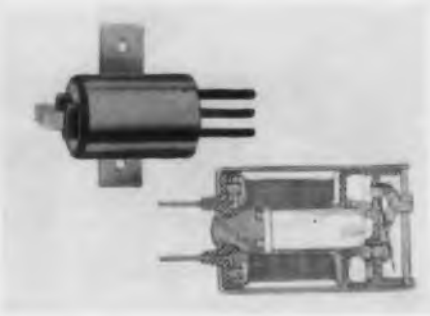
SHALLCROSS MANUFACTURING COMPANY
526 Pusey Ave., Collingdale, Pa.

Shallcross

CIRCLE 195 ON READER-SERVICE CARD FOR MORE INFORMATION

Power Relay

For Equipment Protection



This relay is completely enclosed in a metal case, plugged with molded Bakelite on the contact end. Three contact leads are equipped with female AMP terminals; the coil has two male AMP terminals. In either a-c or d-c, the unit is available for any voltage from 6v to 115v. Contacts are rated up to 8amp at 115v non-inductive. Contact combination is spdt. Size is only 2-11/32" x 1-7/32" x 1-7/32". Guardian Electric Manufacturing Co., Dept. ED, 1621 W. Walnut St., Chicago 12, Ill.

CIRCLE 196 ON READER-SERVICE CARD FOR MORE INFORMATION

Twin Triode

For Series String

This 9-pin, miniature general-purpose medium-mu twin-triode tube, the *6CG7*, is intended primarily for use as a vertical deflection oscillator and horizontal deflection oscillator in TV receivers. It may also be used as a phase inverter, multivibrator, sync separator and amplifier, and resistance-coupled amplifier in electronic equipment. It is similar to the *6SN7GT* in characteristic, and is in a T6-1/2 envelope. Sylvania Electric Products, Inc., Dept. ED, 1740 Broadway, New York 19, N. Y.

CIRCLE 197 ON READER-SERVICE CARD FOR MORE INFORMATION

Rotary Limit Switch

Features Ratio of 250, 500 and 1000:1

The Model B Rotary Limit Switch features ratios of 250:1, 500:1, or 1000:1. Primary use is for machine tools, handling devices, and rotary operators where motion is expressed in shaft rotation. Two micro-switches, operated by independently adjustable cams, provide the upper and lower limits. Standard units are supplied in a molded fibreglass alloy case, and special rotary limit switches are also available in explosion-proof enclosures. Gemco Electric Co., Dept. ED, 25681 W. 8 Mile Rd., Detroit 19, Mich.

CIRCLE 198 ON READER-SERVICE CARD FOR MORE INFORMATION

where stability is a must . . .

TIC®

PRECISION TRIMMER POTENTIOMETERS
small..compact..precise

Engineered to the high standards of TIC Quality . . . a familiar standard of comparison. Environmental tested for MIL-E-5272A. TIC's Trimmer Potentiometers may be used as adjustable resistors or voltage dividers.

for

- Adjusting scale factors of functions basically derived by other potentiometers
- Pinpointing circuit values of voltage, current, or resistance
- Balancing adjustments
- Critical magnetic or electric bias
- Padding or fixed reference circuits
- Establishing critical threshold voltages
- Fixed gain adjustments
- Compensation for variable parameters

RV⅞ MINIATURE TRIMMER

- ⅞" diameter, threaded bushing mounting, aluminum cup construction
- Dissipation: 2.0 watts at 25°C
- Resistance values: 50 ohms to 15K
- Temperature range: −55°C to +80°C

RV½ SUBMINIATURE TRIMMER

- ½" diameter, threaded bushing mounting, stainless steel case
- Dissipation: 1.5 watts at 25°C
- Resistance values: 50 ohms to 15K
- Temperature Range: −55°C to +80°C

RFT SUBMINIATURE METLFILM TRIMMER

- 13/32" x .400 x 1 21/64", rectangular case, 2 screw eyelet mount, 25 turn lead screw adjustment
- Size permits stacking 7 per square inch
- Infinite resolution
- Dissipation: 0.5 watts at 40°C
- Resistance values: 50 ohms to 25K
- Temperature range: −55°C to +125°C

RVH1 HIGH TEMPERATURE TRIMMER

- 1" diameter, threaded bushing mounting, aluminum cup construction
- Dissipation: 2 Watts at 25°C, 0.5w at +130°C
- Resistance values: 100 ohms to 5K
- Temperature range: −55°C to +145°C

For further information regarding your trimmer requirements, TIC invites your inquiries.

TECHNOLOGY INSTRUMENT CORP.
555 Main Street, Acton, Mass.
P.O. Box 3941, North Hollywood, Calif.

CIRCLE 199 ON READER-SERVICE CARD

ALLEN
MINICAP†
AND
MINISET†
SOCKET SCREWS!
#0 THRU #3

Dependable fastening, easier assembly, for your "miniaturized" products

Count on these Allen Miniature Cap and Set Screws for Allen accuracy and uniformity — in sockets, threads, heads and sizes. Extremely close tolerances are maintained in these very small screws. Strength is so great that you can use fewer, or smaller, screws to hold securely.

Sockets are highly accurate, for maximum tightening — so accurate that these miniature screws will hold to the key for placing and starting. Allen Minicaps are knurled, and *trimmed* on top and under the heads, for better fit and appearance.

Allen's long experience in dependable fastening is at your service when you're developing your "miniaturized" designs. Just call on the Allen engineers for prompt and practical help.

Your Industrial Distributor has Allen Minicaps and Minisets now.

Sold Only Through Leading Industrial Distributors.

ALLEN
MANUFACTURING COMPANY
Hartford 2, Connecticut, U.S.A.

CIRCLE 200 ON READER-SERVICE CARD

Impulse Counter

Can Be Preset to 100,000

This panel - mounting electrical impulse counter is presettable in seconds for any number to 100,000. On reaching predetermination a dpdt process control switch is thrown and the counter resets automatically by motor and is ready for the next cycle. It is also resettable by signal (pushbutton, etc.), or manually by lever. It may be reset during the cycle without changing setting, and gives visible progress count. An 8-digit totalizer is optional.

The unit is also available for base mounting and for stroke, revolution, or measuring counting. Size of digits is 5-9/32" high. Counting rate is 5/sec. Resetting time is 3/10sec. Presin Co., Dept. ED, 802 N. Fairfax Ave., Los Angeles 46, Calif.

CIRCLE 201 ON READER-SERVICE CARD FOR MORE INFORMATION

Laboratory Bath

With ±1°C Control From 35 to Over 225°C

The "Hy-Temp Aging Bath" is a constant-temperature 19 gal capacity bath capable of continuous high temperature operation in tempering, conditioning, preheating, and stability tests, and in routine laboratory work. Especially suited for rubber and plastics, it conforms with ASTM Methods D471 and D735. A thermostat maintains control to ±1°C from 35° to over 225°C. This thermostat consists of two complete systems, one acting as a safety thermostat in the event of failure of the other.

The bath will reach 200°C in only 2 hr. Stainless steel inside and out, it can be used with water, oil, or other liquid media. Precision Scientific Co., Dept. ED, 3737 W. Cortland St., Chicago 47, Ill.

CIRCLE 202 ON READER-SERVICE CARD FOR MORE INFORMATION

AIRCRAFT ELECTRONICS—FROM THE COMPONENT VIEWPOINT
Read it in DESIGN '56

Eccosorb CH
Microwave Absorber for Darkrooms

Microwave Darkroom with
Emerson & Cuming Luneberg Lens under test

Eccosorb CH is a series of broadband absorbers reflecting less than 2% of the energy incident upon its surface. It is composed of enmeshed, rubberized fibers and made in sheets 2 feet by 2 feet in various thicknesses. Eccosorb CH is light weight and flexible. It is easily mounted and its natural, white surface color gives good light reflection.

Free Space Rooms are easily and economically built for indoor antenna measurements. Reflections are eliminated for all practical purposes. You can build your own microwave dark room or **we offer you a complete Free Space Room ready to use.** Emerson & Cuming engineers design and build special types for unusual conditions. Send us your specifications.

Another absorber, ECCOSORB HF comes in rods, sheets or molded shapes in several volume resistivities for waveguide terminations and similar uses. If you have a problem write for information on . . .

Plastics for Electronics

Emerson & Cuming, Inc.
869 WASHINGTON STREET, CANTON, MASS

PLASTIC FOAMS
LAMINATING AND IMPREGNATING RESINS
PLASTIC-FIBER GLASS LAMINATES
HIGH DIELECTRIC CONSTANT PLASTICS
METALIZED PLASTICS
ELECTRONIC EMBEDMENTS
CASTING RESINS
LOW LOSS ROD AND SHEET STOCK
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McCarthy Associates
P. O. Box 36, Altadena, Calif
Sycamore 8-5790

CIRCLE 203 ON READER-SERVICE CARD FOR MORE INFORMATION

Oscillographs

Record Output of Almost Any Test Meter

"Record-a-meters" are compact, rugged, lightweight, direct-writing oscillographs used in place of, or in conjunction with, meter-type test equipment to secure a continuous recording of any measurable phenomenon within the frequency and sensitivity limits of the instrument. Models RA-1000 and RB-1000 (which differ mainly in sensitivity: 200mv/cm and 10mv/cm, respectively) will record the output of practically any test meter and of many pick-ups and sensing elements directly.

The high input resistance (varying with sensitivity from 500,000 ohms to 5.5 megohms) eliminates any serious loading of most circuits or equipment under test. They can be operated from a 115v line, or from storage batteries of 6, 12 and 24v, or from heavy-duty dry batteries. Power consumption is about 20w. A chart speed of 15cm/minute is standard, but other speeds are available.

Both instruments use either conventional ink-type paper or electrosensitive (teladeltos) inkless paper. Dimensions are 10" x 7-1/2" x 5-1/2", and weight is about 12 lb. Douglas and Gierens, Inc., 5516 Cahuenga Blvd., No. Hollywood, Calif.

CIRCLE 205 ON READER-SERVICE CARD FOR MORE INFORMATION

Timing Motor

Rated 30 oz-in at 1 rpm

The Type 113 is an inexpensive synchronous timing motor. Torque rating is 30 in-oz at 1rpm. Right, left, or oscillating shaft rotation is available. The motor runs equally well in any position. Other features include instant start-stop (within 2cy); truly synchronous operation; and a temperature rise of only 43°C. Compactly constructed, the motor is 1-3/16" deep x 1-7/8" diam and weighs under 6 oz.

The gear train is cylindrical: 1, 2, 4, and 8rpm output speeds are offered. An 8-tooth shaft pinion is standard. The Type 113 can be supplied in 115v or 220v, 50cy and 60cy. R. W. Cramer Co., Inc., Dept. ED, Centerbrook, Conn.

CIRCLE 206 ON READER-SERVICE CARD FOR MORE INFORMATION

Stroboscopic Synchronizer

For Vibration Analyses

The "Strobo-Sync" automatically synchronizes stroboscopic light sources with electrically driven high-frequency shake machines so that objects may be observed in apparent slow motion. The slow motion or visual frequency is adjustable from zero to over 2cy and, once adjusted, remains constant over the entire range of shake frequencies from 20cy to 2000cy. No adjustment of amplitude is required over a 40db range. No other adjustments exist or are required. The unit eliminates the need of an operator normally required to constantly adjust the stroboscopic light frequency. Winkler Laboratories, Dept. ED, 5225 N. 20th St., Phoenix, Ariz.

CIRCLE 209 ON READER-SERVICE CARD FOR MORE INFORMATION

Vacuum Gage

For 100mm to 1Micron Hg

The "Autovac" is a one- to four-station vacuum gage which gives continuous pressure readings from 100mm to 1 micron Hg. Made by LKB-Produkter of Stockholm, Sweden,, it will be distributed by Consolidated Vacuum Corp. of Rochester, N. Y., a subsidiary of Consolidated Engineering Corp. The unit is a self-balancing, direct-reading, hot-wire type vacuum gage. It covers substantially all laboratory and industrial applications now using Pirani and similar gages.

Outstanding feature is automatic switching from the millimeter to the micron range. The unit has the ability to actuate an external relay circuit for various purposes, such as operation of valves. The "Autovac" operates from 110-240v, 50/60cy. Overall dimensions are 12-1/4" x 6-3/4" x 8-1/2". Consolidated Engineering Corp., Dept. ED, 300 N. Sierra Madre Villa, Pasadena 15, Calif.

CIRCLE 210 ON READER-SERVICE CARD FOR MORE INFORMATION

ARE NEW TRENDS IN INSTRUMENTATION AFFECTING COMPONENT DESIGN?
see DESIGN '56

Transistor Power Pack

Can Be Remote Controlled

This Power Pack is 3-1/2″ high and weighs 14 lb. It provides 0 to 100v d-c at 100ma. Two calibrated controls cover 0 to 100v and 0 to 10v to permit precise adjustment. A modulation input is provided to permit measurement of transistor parameters by the small signal method. Entirely new circuitry is used.

A remote control connection permits the unit to be controlled from a distance by inserting resistance across a two-terminal line. Voltage is controlled according to $E_o = KR$, where K is a constant and R is the inserted resistance. A typical application would be tube testing with automation. Other features include 0.1% regulation, 0.15% stability, 1/2mv ripple, and polarity reversal. Electronic Measurements Co., Dept. ED, Lewis St., Eatontown, N. J.

CIRCLE 213 ON READER-SERVICE CARD FOR MORE INFORMATION

Power Supply

With 100-5000v D-C Range

The r-f high voltage power supply Model No. R-500A is a precision instrument designed for extra stable, well filtered, uniform operation. Its range is 100-5000v d-c, with a current output of 8ma at 5000v. Output polarity is switch controlled on the front panel.

Regulation is 1/2% or better, no load to full load and with line voltage variation of 105-130v. Stability is 0.25%, and ripple is 0.05%. Response time is better than 5millisec from 1kv to 5kv. Metering accuracy is 1%.

A "Helipot" type potentiometer permits extra fine control of output voltage. Neutronic Associates, Dept. ED, 87-16 116th St., Richmond Hill 18, N. Y.

CIRCLE 214 ON READER-SERVICE CARD FOR MORE INFORMATION

AIRCRAFT ELECTRONICS—FROM THE COMPONENT VIEWPOINT
Read it in DESIGN '56

Low-Pass Filter

Attenuates Spurious R-F

The Low Pass Filter Unit No. 8314 has wide application for use between the transmitter and antenna to attenuate spurious r-f output. It is particularly useful in installations of several transmitters and receivers to reduce interference and to improve transmitter performance to meet FCC technical requirements. Kaar Engineering Corp., Dept. ED, Middlefield Rd., Palo Alto, Calif.

CIRCLE 217 ON READER-SERVICE CARD FOR MORE INFORMATION

Punched Card Converter

Transforms Decimals to Analogs

The Punched Card Converter, Model 250, translates the decimal code punched into cards into an analog signal for automatic point plotting by the Librascope X-Y Plotter and Recorder Model 200-A. It will accept digital information from various types of IBM equipment such as the 519 Reproducer and 523 Punch, and transforms digital information to a resistance divider suitable for input to the X-Y plotter. Librascope, Inc., Dept. ED, 808 Western Ave., Glendale, Calif.

CIRCLE 218 ON READER-CIRCLE CARD FOR MORE INFORMATION

Overheat Protector

Mounted in Motor Windings

Type B9500, a small tubular shaped inherent overheat protector can be mounted directly in motor windings or small transformer enclosures. Unit is intended for use particularly in shaded pole and permanent split-capacitor fan motors. Voltage rating 300v maximum; current rating 10amp maximum, at 115v, a-c. A disc type thermal element gives positive snap-acting make and break. The unit is sealed to withstand varnish dipping and baking. Metals & Controls Corp., Spencer Thermostat Div., Dept. ED, Attleboro, Mass.

CIRCLE 219 ON READER-SERVICE CARD FOR MORE INFORMATION

Card Translator

Produces Analog Voltages

Rapid plotting of computed points on an automatic basis is made possible by the Model 30A Card Translator unit. It is designed specifically for use with the Model 2 flat-bed Mosely "Autograf" recorder. F. L. Mosely, Co., Dept. ED, 409 N. Fair Oaks Ave., Pasadena 3, Calif.

CIRCLE 222 ON READER-SERVICE CARD FOR MORE INFORMATION

D-C Amplifier

Frequency Response to 100Kc

The Model D-4, a d-c wide-band stabilized amplifier, has a gain of 50,000 with drift, referred to input, of less than 25-μv/hour. Frequency response is d-c to 100kc for gain up to 1000. Gain is continuously adjustable from 0.001 to 50,000 by means of a 10-turn precision potentiometer and a 6-step decade attenuator. Accuracy of gain settings is ±1.5%. Input impedance is 1 megohm. Either a pen or string galvanometer can be driven directly from the output. Adjustable frequency-compensation for Photron pen galvanometers is provided. Photron Instrument Co., Dept. ED, 6516 Detroit Ave., Cleveland 2, Ohio.

CIRCLE 223 ON READER-SERVICE CARD FOR MORE INFORMATION

L&C Meter

Measures Capacity and Inductance

Precision capacitance and inductance measurements can be obtained extremely easily with this meter. These values can be determined with laboratory accuracy under conditions of actual use. The unit comes equipped with a probe, with which installed components can be tested quickly and easily. Erdco Engineering Corp., Dept. ED, Westgate Dr. and Official Rd., Addison, Ill.

CIRCLE 224 ON READER-SERVICE CARD FOR MORE INFORMATION

400cy Alternator

For Guided Missiles, Aircraft

This 400cy, 12,000rpm alternator, for application to guided missiles and aircraft, meets extreme environmental requirements for periods of short duration. It can be driven by a wide variety of prime movers, including d-c motors, jet air drives, and turbines, using either solid or liquid propellants. It weighs less than 15 lb.

The alternator can be rated as high as 2000va at unity power factor. It is a three-phase, 115v, Y-connected unit. For extremely close voltage regulation, it can be supplied with a regulator mounted on the frame or as a separate unit. General Electric Co., Specialty Component Motor Dept. ED, Schenectady 5, N. Y.

CIRCLE 227 ON READER-SERVICE CARD FOR MORE INFORMATION

Rectifier Relays

For 25-400cy Operation

Increased operating reliability throughout the 25cy to 400cy range is provided in these rectifier relays. Full wave rectifiers convert a-c to rectified d-c, providing d-c operation from an a-c power supply.

Advantages obtained in comparison with conventional a-c operation include: increased operating sensitivity, higher contact pressures, greater resistance to vibration, reliable operation through much wider variations in voltage or current, freedom from a-c hum, and in many cases, reduced size. The relays are available with a wide range of contact combinations in hermetically sealed or dust-proof enclosures, as well as open. Magnecraft Electric Co., Dept. ED, 3350D W. Grand Ave., Chicago 51, Ill.

CIRCLE 228 ON READER-SERVICE CARD FOR MORE INFORMATION

RADIO & TV
COMMUNICATIONS
COMPUTERS
AUDIO
INSTRUMENTS & CONTROLS
AIRCRAFT ELECTRONICS

YOUR CUSTOMERS LIST THEIR REQUIREMENTS

DESIGN '56

Strain Gage Amplifier

Uses New Chopper Circuitry

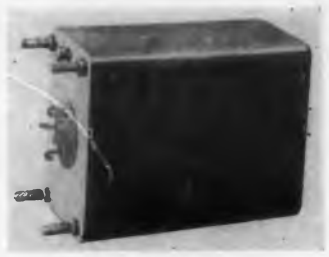
The Model 110 is a chopper - stabilized broadband d-c amplifier with longtime drift (40 hours) of $\pm 2\mu v$. Equivalent input noise is less than $5\mu v$ peak-to-peak for 3cy bandwidth, less than $5\mu v$ rms for 750cy band, and less than $12\mu v$ rms for 50kc bandwidth. Variable gains of 0, 20, 30, 50, 70, 200, 300, 700, and 1000, accurate to 1%, are provided. Bandwidth is flat within 3db from d-c to 30kc.

High input impedance and low output impedance make the device valuable as an amplifier for many electro-chemical, electro-mechanical, electro-thermal transducers and recorders. Its broad bandwidth and dynamic characteristics make it a versatile general-purpose laboratory amplifier. Output is 25v with a 1000 ohm load. Linearity is better than 0.1%. Kay Lab, Dept. ED, Box 16, San Diego 12, Calif.

CIRCLE 231 ON READER-SERVICE CARD FOR MORE INFORMATION

Time Delay Relays

With Proportional Delayed Reset



Time delay relays which provide a proportional delayed reset after current interruption are offered by this firm. These timers can be supplied hermetically sealed in an extruded aluminum housing, as shown, or provided in a standard dust cover. The hermetic model can be supplied with a glass metal header or AN connector, and with four-stud or bracket mounting.

Primary function of the units is for delaying application of plate voltage in gas and vacuum power tubes until filaments or heaters have reached the proper temperature. Time delays from 5sec to 1 hr and reset times from 30sec to 7-1/2min can be provided. Standard or governed d-c, or 60cy or 400cy motors can be provided on these units. All units meet military requirements. The A. W. Haydon Co., Dept. ED, Waterbury, Conn.

CIRCLE 232 ON READER-SERVICE CARD FOR MORE INFORMATION

WHAT'S NEXT IN SIGHT FOR COMPONENTS IN RADIO AND TV? SEE "DESIGN '56"

D-C Transformer

A Transistorized Unit

This small, lightweight, transistorized, d-c transformer is completely static and has no bearings or brushes. It handles an input of 24 to 30v d-c, and will produce any d-c output. Occupying only 10 cu in, the unit is well suited for miniaturization applications. The shape of the unit is squared and is suitable for stacking. Weight is only 11 oz. Efficiency is 85%.

The operating principle involves conversion of d-c to square-wave a-c. This is stepped up or down in a transformer, and then rectified to give d-c output. Normal output variation is 8% no-load to full load. Regulation can be supplied within ±0.5%. Output is available in 10μsec. Multiple outputs can be furnished. Temperature range is +85° to −80°C and lower. Shock and vibration characteristics are excellent, and the unit is unaffected by altitude.

The transformer is designed as a plate supply for receivers and transmitters, or wherever d-c voltage change is needed. It is available in production quantities, and priced in line with rotary equipment up to 35w. Nader Mfg. Co., Dept. ED, 2661 S. Myrtle Ave., Monrovia, Calif.

CIRCLE 235 ON READER-SERVICE CARD FOR MORE INFORMATION

Potentiometer

Permits Up to 33 Taps

The Type 748-E Potentiometer has a resistance range of 80 ohms to 150,000 ohms and a standard linearity tolerance of ±0.10%. On special order, linearity up to ±0.05% can be obtained on high resolution windings. Starting torque is only 1.0 oz-in per cup.

A special clamp band provides an unrestricted tapping area, allowing up to 33 taps, and presents a simplified means of phasing units in a ganged assembly without disassembling the units. The potentiometer is gangable in assemblies of up to 6 cup units on a single shaft. It has a diameter of 3-1/8″ max and a cup width of 0.984″. Potentiometer Div., Fairchild Controls Corp., Dept. ED, Robbins Lane, Syosset, L. I., N. Y.

CIRCLE 236 ON READER-SERVICE CARD FOR MORE INFORMATION

Simulation Table

Threshold Less Than 5μradians

This "Simulation Table" is a single degree of freedom roll table for angularly displacing gyros and accelerometers, either statically or dynamically. It features a threshold of less than 5μradians and a natural frequency greater than 15cy. Extremely smooth operation is obtained by using a specially designed, driven pendulum mechanism.

Operation of the table in conjunction with analog computers makes flight testing of a complete aircraft or missile stabilization system possible on the ground. In addition, the unit may be used as an oscillating table to determine the frequency response and threshold characteristics of high performance gyros and accelerometers. It will follow signals such as those from an analog computer, a low frequency function generator, a tape recorder, or a digital-to-analog converter, when these signals are applied to the input terminals of the power amplifier that drives the table. Micro Gee Products, Inc., Dept. ED, Box 1005, 6100 W. Slauson Ave., Culver City, Calif.

CIRCLE 239 ON READER-SERVICE CARD FOR MORE INFORMATION

Portable Tube Tester

Also Uses Germanium Diodes

The Model 750 permits quick and accurate evaluation of any tube normally encountered in all phases of electronic work, including the latest military ruggedized types, TV, or hearing aid receivers. It also tests germanium diodes and selenium rectifiers, and, in addition, contains a short test which will show up even the slightest heater cathode leakage condition of a vacuum tube. Case size is 18-3/8" x 16-3/4" x 7-1/2", and weight is only 24 lb. It takes 105-125v a-c, 40w. The Hickok Electrical Instrument Co., Dept. ED, 10525 Dupont Ave., Cleveland 8, Ohio.

CIRCLE 240 ON READER-SERVICE CARD FOR MORE INFORMATION

Spring Motor

Constant-Torque Model for Designers

To aid design engineers in the development of mechanisms based on the "Neg'ator" constant-torque spring motor, a tiny working model of the B-motor form of the spring is offered by this firm. It is mounted on a 1" x 1-3/4" plastic base and exerts a nominal 6 oz tension on the output cable as it is extended through 36".

The spring is a long flat strip of stainless steel, 0.0025" thick x 1/4" wide, given a curvature by continuous heavy forming so that in its relaxed condition it is a tightly wound spiral. It is mounted on two low-friction aluminum bushings so that a constant force is exerted as extension of the output cable winds the "Neg'ator" from its relaxed condition on the smaller bushing onto the output bushing. Constant torque of 0.11 lb-in is developed through 20 revolutions of the output bushing at all positions of cable extension. Neg'ator Div., Hunter Spring Co., Dept. ED, Lansdale, Pa.

CIRCLE 245 ON READER-SERVICE CARD FOR MORE INFORMATION

Voice Recorder

For Airborne Applications

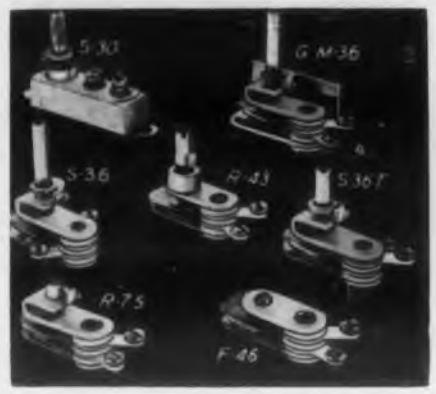
The RD-106/ANH-2 is a recorder primarily intended for making voice recordings in aircraft from microphones, radio sets, and intercommunication systems. Both remote-controlled and local-controlled equipment for recording complete and detailed pilot observations on all flight operations is available. The recording is made on a 60-minute magazine, removable for transcription on the ground.

The recorder weighs 6 lb, 4 oz and occupies 0.22 cu ft. With recording magazine and mounting, it weighs about 9 lb. Recorder control units are available in four variations, depending upon application. The entire recording and control unit operates on 27v d-c at 2.5amp. Peirce Wire Recorder Corp., Dept. ED, 5900 Northwest Highway, Chicogo 31, Ill.

CIRCLE 246 ON READER-SERVICE CARD FOR MORE INFORMATION

Custom Thermostats

Offered at Cost of Stock Units



Custom-made bimetal thermostats with single-stud mounting for fast transfer of heat are offered by this firm at costs equal to those of stock units. To eliminate false cycling and chatter of contact points, these units are designed to pass current through the independent contact springs instead of the bimetal thermal member. Operating temperatures are available up to 650°F.

A trim screw inside the adjusting shaft permits readjustment and recalibration. Contact ratings vary to a maximum of 1500w at 110v a-c. A wide variety of terminal arrangements and adjusting shafts is available. The thermostats are UL approved and include two basic types: open and fully closed. Bimet Electrical Research Corp., Dept. ED, 1373 Division St., Morris, Ill.

CIRCLE 249 ON READER-SERVICE CARD FOR MORE INFORMATION

Frequency Converter

Does Not Use Brushes

This "Nobrush" frequency converter furnishes constant 420cy with output frequency as steady as the 60cy input. The motor is a synchronous type, direct-coupled in a compact unitary combination with a "Nobrush" 420cy generator. The resulting unit is free of brushes, exciter, slip rings, etc. Without any regulator the unit will maintain output voltage to better than 2% for a given load. The generator creates no radio interference.

Converters are available from 150va to 5kva with any desired combination of single or three-phase input and output. All standard output voltages are available, with special or multiple voltages on special order. Electric Products Div., Georator Corp., Dept. ED, Manassas, Va.

CIRCLE 250 ON READER-SERVICE CARD FOR MORE INFORMATION

AIRCRAFT ELECTRONICS—FROM THE COMPONENT VIEWPOINT
Read it in DESIGN '56

Transistor Housing Base

Employs Glass in Exposed Areas

The No. 1619 Transistor Base features all-glass construction in the internally exposed area of the unit. This construction prevents contamination of a transistor wafer when closure is made after mounting. The advantage over all-metal internally exposed areas is that the "buttoning-up" operation does not float solder and the solder fluxes in under the wafer, with subsequent contamination and degradation. Hermetic Seal Products Co., Dept. ED, 33 S. 6th St., Newark 7, N. J.

CIRCLE 255 ON READER-SERVICE CARD FOR MORE INFORMATION

Ceramic Coil Forms

For Printed Circuitry

These grade L-5 ceramic coil forms, SPC-11 and SPC-12, are for printed circuitry. One has a mounted height of 5/8" and the other 13/16". Both forms have an OD of 1/4", and a 10/32" threaded powdered iron core and silicone fiberglas collar.

These forms are available with two to four solder lugs. They can be dip soldered after mounting. They are available as a form alone or wound to the required specification of the user. Cambridge Thermionic Corp., Dept. ED, 445 Concord Ave., Cambridge, Mass.

CIRCLE 256 ON READER-SERVICE CARD FOR MORE INFORMATION

VTVM

Measures Pulse Heights

The British Physical Laboratories PV-812 Pulse Height Vacuum-Tube Voltmeter measures repetitive pulse heights with an accuracy of better than 2% of full scale deflection. Readings are entirely independent of pulse width from 0.01μsec upward. Ranges of 0-10v, 0-30v, and 0-100v are provided, and the 5" meter is equipped with a knife-edge pointer and mirror scale. Television Accessories Co., Dept. ED, 1412 Great Northern Bldg., Chicago 4, Ill.

CIRCLE 257 ON READER-SERVICE CARD FOR MORE INFORMATION

Tester

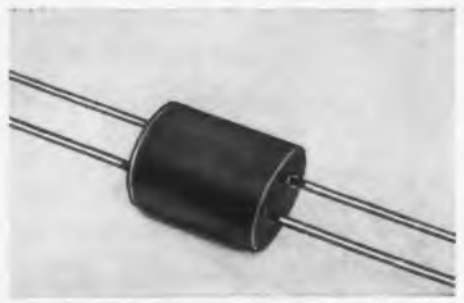
Checks Thermocouples, Temperatures

This self-contained, combination tester, Model 32-JP-4-MV, is designed for checking the millivolt output of thermocouples in both open and closed circuits, from 0-50mv and 0-1000mv. It will test either single or multiple thermocouples. It will also accurately check temperatures, up to 650°F. Robertshaw Thermostat Div., Robertshaw-Fulton Controls Co., Dept. ED, Youngwood, Pa.

CIRCLE 260 ON READER-SERVICE CARD FOR MORE INFORMATION

Two-Resistor Assembly

Is Thermally Balanced



This firm has developed a method of encapsulating two precision deposited carbon resistors, with nearly identical temperature coefficients, in a single enclosure in order to provide highly similar thermal conditions within the capsule as the ambient temperatures vary. This assembly also increases the reliability of the individual units when used under extreme humidity, vibration, and altitude conditions. Clarostat Mfg. Co., Inc., Dept. ED, Dover, N. H.

CIRCLE 261 ON READER-SERVICE CARD FOR MORE INFORMATION

Vibration Table

In 5-60cy Range

The Model AF variable frequency vibration table is for use in vibration testing, vacuum tube aging, instrument shakedown, noise studies, and the location of intermittent or incipient faults in electronic and instrument equipment. It consists of an elastically mounted platform, pickoff, forcing transducer, and power amplifier. Lance Products, Dept. ED, P. O. Box 251, Forest Hills 75, N. Y.

CIRCLE 262 ON READER-SERVICE CARD FOR MORE INFORMATION

Dual-Beam Oscilloscope
For Long-time Phenomena

This dual-beam oscilloscope is particularly useful in the investigation of long-time phenomena using sweeps up to 10sec (200sec on special order). Signals on the two beams may be related using the variable delay trigger, so that a slowly moving signal displayed on Sweep 1 can have small detail occurring at mid-sweep displayed on Sweep 2 on a much faster time scale. American Electronic Laboratories, Inc., Dept. ED, 641 Arch St., Philadelphia 6, Pa.

CIRCLE 267 ON READER-SERVICE CARD FOR MORE INFORMATION

Klystron Power Supply
For 400cy Operation

The Klystron Power Supply Model TVN-11 is now available for 75ma reflector current and 400cy operation on special order. The standard unit has a continuously variable beam voltage from 225v to 450v with better than 1% regulation, regulated reflector supply of 25v to 875v, and internal square wave modulation of 500 to 5000cy. Browning Laboratories, Inc., Dept. ED, 750 Main St., Winchester, Mass.

CIRCLE 268 ON READER-SERVICE CARD FOR MORE INFORMATION

Self-Locking Nuts
In Sizes Down to 0-80

A line of tiny "Flexloc" micro nuts, miniature self-locking fasteners for precision instrument and electronic fastening applications, ranges in size from 0-80 up to 4-48. The 0-80 micro nut measures less than 1/8" across its largest dimension. Standard Pressed Steel Co., Dept. ED, Jenkintown, Pa.

CIRCLE 269 ON READER-SERVICE CARD FOR MORE INFORMATION

DASAC Push Button Control Center which uses Clare relays and stepping switches in automatic control of warehouse assorting system

Rear view of panel shows Clare relays, provided with dust tight covers, accessible for quick inspection and maintenance

Stability and reliability make CLARE Relays and Stepping Switches ideal components for DASAC

• Pushbutton control center of the DASAC warehousing and assorting system makes use of over a hundred CLARE Type A and D relays and CLARE ten-level, twenty-six-point stepping switches.

This device was developed by New York's Dasol Corporation, consulting engineers, to facilitate the warehouse operations of their client, Judy Bond, Inc., large blouse manufacturer.

The DASAC Control Center performs three basic functions. These include selection of container destination, "memorizing" the selections in consecutive order and coordinating the information to stop the container at its proper discharge point. "Relay requirements," said Sol Tanne, Dasol Chief Engineer, "above all, demanded stability and reliability. They had to be fast-acting, quiet, stable telephone-type relays which could easily be replaced if necessary."

If your design calls for long-life, high-quality relays or stepping switches, it will pay you to bring your problem to CLARE. C. P. Clare & Co., 3101 Pratt Blvd., Chicago 45, Illinois. In Canada: Canadian Line Materials, Ltd., Toronto 13. Cable Address: CLARELAY.

CLARE RELAYS

FIRST *IN THE INDUSTRIAL FIELD*

CIRCLE 271 ON READER-SERVICE CARD FOR MORE INFORMATION

Phone Plugs and Jacks

Interlocked Plug Body and Tip Rod

A line of "Han-D" phone plugs and jacks has been introduced by this firm. The plugs are reduced in size, sturdy in construction, and contain a one-piece solid brass nickel-plated rod pressed into the tip terminal and staked to insure positive electrical contact. Terminals, insulation, plug body, and tip rod are mechanically interlocked to prevent turning. A variety of terminal and handle styles is available. The plugs are designed to fit all standard two-conductor phone jacks.

The jacks require a minimum of panel space and depth behind panel, yet make positive electrical contact with the mating plug which is held firmly attached by positive spring pressure. Electrocraft, Dept. ED, 3741 N. Kedzie Ave., Chicago 18, Ill.

CIRCLE 272 ON READER-SERVICE CARD FOR MORE INFORMATION

Power Resistors

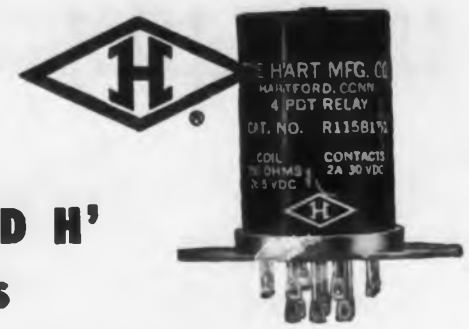
Fixed, Tapped, or Adjustable

Three types of power wire-wound resistors, especially engineered for continuous operation under extremes of humidity, salt water, and severe atmospheric conditions, are offered by this firm. They are fixed, tapped, and adjustable types which feature a built-in safety reserve and can be maintained at three times rated load without deterioration or damage.

Three types of resistor coatings are available: a vitreous coat which is tough, crazeless, and has excellent thermal conductivity; a silicone coat of high dielectric strength and high resistance to abrasion; and "Ceramikote", a high-temperature coating useful in economy applications. Reon Resistor Corp., Dept. ED, 117 Stanley Ave., Yonkers, N. Y.

CIRCLE 273 ON READER-SERVICE CARD FOR MORE INFORMATION

COMING JANUARY 1st
DESIGN '56
Yearly Feature Issue of Electronic Design



Versatile 'DIAMOND H' Relays

Handle Many Different Jobs

"Diamond H" Series R hermetically sealed aircraft type relays perform outstandingly over such a broad area that they are frequently used to do many different types of jobs in a given application. For example, they give excellent reliability in dry circuits yet will carry up to 10 amperes in power circuits . . . or even 20 amperes for reduced life requirements.

Savings inherent in uniform size and mounting arrangements for one relay family can be multiplied by the lower inventory of spare parts needed when a single model is used for two or more functions. Matching or surpassing requirements of USAF Spec. MIL-R-5757B as well as important provisions of MIL-R-25018, tens of thousands of Series R 4 PDT and DPDT relays are in use, engineered for:

Various brackets of vibration resistance from 10 to 2,000 cps, temperature ranges from —65° to +200° C, coil resistances from 1 to 50,000 ohms, operational shock resistance of 30, 40 or over 50 "G" and mechanical shock resistance to 1,000 "G", contact capacities from 350 V., D. C., 400 MA, to 10 A., at 30 V., D. C., as well as signal circuits.

For complete information, send for a copy of Bulletin R-250.

THE HART MANUFACTURING COMPANY

210 Bartholomew Avenue, Hartford, Conn.

CIRCLE 274 ON READER-SERVICE CARD FOR MORE INFORMATION

OFTEN

TWO HEADS ARE BETTER THAN ONE

Sometimes two heads are the only solution to a part or fastener problem. Take a quick look at the belt buckle roller illustrated. The big problem here was to produce this roller in *quantity, inexpensively* and *quickly* . . . and HASSALL double-heading did the trick.

Double-heading is only one example of the almost limitless possibilities Hassall cold-heading offers you. If you have a fastener problem just send us samples or specifications for a quotation.

WRITE FOR CATALOG . . . with it we will send you our popular decimal equivalent wall chart.
John Hassall, Inc., Box 2202, Westbury, L. I., N. Y.

HASSALL

SINCE 1850

NAILS, RIVETS, SCREWS AND OTHER COLD-HEADED FASTENERS AND SPECIALTIES

CIRCLE 275 ON READER-SERVICE CARD FOR MORE INFORMATION

Up to 40% higher tightening torques

a feature of new High-Torque Unbrako socket set screws

Compare UNBRAKO-recommended tightening torques with those of ordinary socket set screws and you readily see why you can set an UNBRAKO and then forget it. The reasons are simple. UNBRAKOS have deeper sockets, which give you better purchase with the wrench; rounded socket corners, which eliminate the sharp corners where cracks start; fully formed threads, which make them stronger; and knurled cup points, which keep them tight.

Bulletin 2067 tells the complete story—briefly and pictorially. Ask your UNBRAKO industrial distributor for a copy. Or write us today. STANDARD PRESSED STEEL CO., Jenkintown 12, Pa.

STANDARD PRESSED STEEL CO.

UNBRAKO SOCKET SCREW DIVISION SPS

JENKINTOWN PENNSYLVANIA

CIRCLE 276 ON READER-SERVICE CARD FOR MORE INFORMATION

NEW! Electric Impulse Counters

- Tamperproof Preselection
- Manual or Electric Reset
- Low Power Demand

The latest in the now famous line of SODECO Electric Impulse Counters, the Ti series offers these outstanding features.

Tamperproof Preselection—
Select any number up to 99999 on the upper register. You can then lock your selection to prevent tampering. When the counter reaches that number, it can automatically reset itself to the original preselected number and begin the cycle again. A built in secondary contact can record each cycle on another counter if desired.

Manual or Electric Reset

Low Power Demand—0.8 to 3 Watts.

Ti series counters are fast—up to 12 impulses per second—and are furnished with either a front plate for flush mounting or for surface mounting. Write for full details.

LANDIS & GYR, Inc.

45 WEST 45TH STREET • NEW YORK 36, N. Y.

CIRCLE 277 ON READER-SERVICE CARD FOR MORE INFORMATION

Digital Ohmmeter

Has 0.1 ohm to 1 Megohm Range

This completely automatic digital ohmmeter, the Model D040 "In-Line Read Out", provides quick accurate measurements, visually indicated. It displays four digits accurate to 0.05% ±1 digit from 0.1 ohm to 1 megohm in four ranges. Range is indicated by a lighted, automatically located decimal point and by ohm and kilohm symbols in the extreme right window. Average reading time is approximately 1sec. Size (standard) is 7" x 19", rack mounted. Electro Instruments, Inc., Dept. ED, 3794 Rosecrans, San Diego 10, Calif.

CIRCLE 278 ON READER-SERVICE CARD FOR MORE INFORMATION

D-C Power Supply

For 20-40kv Range

The Model RC-40, a regulated continuously variable 20-40kv d-c power supply is designed for use with 5AZP4 and 5TP4 projection tubes and flying spot types. It has a positive polarity output with a negative ground. Spellman Television Co., Dept. ED, 3029 Webster Ave., New York 67, N. Y.

CIRCLE 279 ON READER-SERVICE CARD FOR MORE INFORMATION

Amplitude Modulator

Operates Over 0.1-50Mc

Operating over a frequency range of 0.1Mc to 50Mc, with external modulation frequencies of 30cy to 15kc, the Model 115 Amplitude Modulator provides 100% amplitude modulation with low envelope distortion and negligible incidental frequency modulation. Measurements Corp., Dept. ED, Boonton, N. J.

CIRCLE 280 ON READER-SERVICE CARD FOR MORE INFORMATION

KANTHAL DR

resistance wire

TEMPERATURE STABILITY

The low temperature coefficient of KANTHAL DR (20 ppm −55 to +150°C) is inherent in the melt. No superficial heat-treating required. More stable at higher temperatures — improves vitreous enameled resistors . . . Curves showing % change of resistance vs temperature identical for a melt regardless of wire size. Using different gages from the same melt aids in matching resistors. . . . High resistivity (812 ohms/cir. mil ft.) . . . Low thermal EMF to copper (0.0035 mv/°C) . . . KANTHAL DR costs less.

Our NIKROTHAL 6 (60/16) Nickel-Chromium (675 ohms/cir. mil ft.) also shows substantial savings.

Both KANTHAL DR and NIKROTHAL 6 available in fine gages . . . all insulations.

Write for literature

KANTHAL THE KANTHAL CORPORATION

8 Amelia Place, Stamford, Conn.

CIRCLE 281 ON READER-SERVICE CARD FOR MORE INFORMATION

Signal Generators for Servos

Available with C-R Indicator

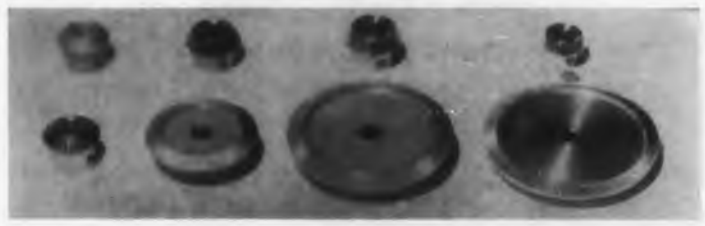
The entire series of "Servoscope" models may now be obtained with a matched cathode ray indicator. The combined instruments are available in one cabinet or ready for rack mounting.

The "Servoscope" is a multiple signal generator which provides sinusoidal, sinusoidal modulation in a suppressed carrier envelope or square wave patterns. Servo Corp. of America, Dept. ED, 20-20 Jericho Turnpike, New Hyde Park, L. I., N. Y.

CIRCLE 283 ON READER-SERVICE CARD FOR MORE INFORMATION

Miter and Bevel Gears

In Many Stock Units



Type N precision pin hub type miter and bevel gears are available from stock in No. 303 stainless steel, clear passivated, or 24ST aluminum, chronic acid anodized (before cutting). Cut to AGMA Precision 1 tolerances, these gears are stocked in 48, 64, and 72 pitch with 20° pressure angle. They are available in three basic shaft sizes: 1/8", 3/16", and 1/4", with stainless-steel set screws for holding, and a subdrill hole for fixed pinning, as desired. PIC Design Corp., Dept. ED, 160 Atlantic Ave., Lynbrook, L. I., N. Y.

CIRCLE 284 ON READER-SERVICE CARD FOR MORE INFORMATION

Centrifugal Governor

For Fractional-HP Motors

A miniature centrifugal governor for fractional-hp motors, is made entirely of metal and non-hygroscopic materials, and is unaffected by fungus or humidity. It is designed for use with motors operating on 30v d-c or 110v a-c. Contacts open when a preset speed is exceeded, shutting off the power. When speed drops below the set value, the contacts close. Nader Mfg. Co., Dept. ED, 2661 Myrtle Ave., Monrovia, Calif.

CIRCLE 285 ON READER-SERVICE CARD FOR MORE INFORMATION

Pressure Transmitter

Takes 25g at 2000cy

A high vibration version of the 45154 series Pressure Transmitter, the Model 45145S is a ruggedized unit to meet all performance requirements while subject to a sinusoidal vibration of 25g at frequencies up to 2000cy. It presently is available in pressure ranges up to 0-20psi, absolute, differential, or gage. Airborne Instrument Div., G. M. Giannini & Co, Inc., Dept. ED, 918 E. Green St., Pasadena 1, Calif.

CIRCLE 290 ON READER-SERVICE CARD FOR MORE INFORMATION

Digital Readouts

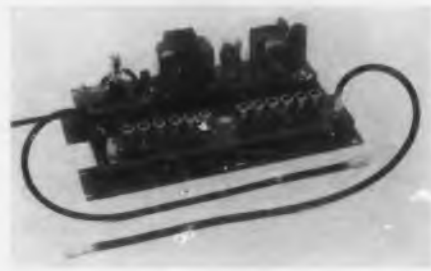
With 1 to 6 Windows

The NLS 3W series of in-line, luminous digital readouts is available with from one to six windows arranged horizontally. The edge-lighted lucite plates are engraved with numbers from 0 through 9, decimal points, and polarity signs. The numbers are 1/2" wide and 1" high, spaced 1-1/8" on centers to provide maximum legibility. Non-Linear Systems, Inc., Dept. ED, Del Mar Airport, Del Mar, Calif.

CIRCLE 291 ON READER-SERVICE CARD FOR MORE INFORMATION

Amplifier System

For the Laboratory



An r-f amplifier and power supply are offered by this firm as an amplifier system for use with signal generators, sweep generators, and in laboratory bench distribution and similar uses.

The Model 100 Line Amplifier is a broadband r-f unit which consists of two distributed amplifier stages in cascade. Ampli-Vision Div., International Telemeter Corp., 200 Stoner Ave., Los Angeles 25, Calif.

CIRCLE 292 ON READER-SERVICE CARD FOR MORE INFORMATION

Moving Coil Instruments

With ±0.5% Accuracy

The new G. P. Goerz (Vienna) precision (±0.5%) moving coil ammeters, milliammeters, microammeters, galvanometers, voltmeters, high sensitivity millivoltmeters, and electro-dynamometer single and three phase (both three and four-wire) wattmeters are now available from this firm. Most models are available in a-c or d-c. With the aid of accessories, currents as high as 300amp may be measured. Physics Research Laboratories, Inc., Dept. ED, 507 Hempstead Turnpike, West Hempstead, N. Y.

CIRCLE 295 ON READER-SERVICE CARD FOR MORE INFORMATION

Power Resistor

Has Built-In Mountings

This 20w miniature power resistor is designed primarily for use in compactly-built equipment where space saving considerations are essential. The unit is 2-5/16" long. It has a strong, oval shaped, ceramic core on which an alloy resistance wire is wound and silver brazed to tightly banded tab terminals. Ward Leonard Electric Co., Dept. ED, Mount Vernon, N. Y.

CIRCLE 296 ON READER-SERVICE CARD FOR MORE INFORMATION

Square Wave Generator

Produces 400cy and 1000cy

This square wave generator is designed for use as a modulator for radio frequency low-power klystrons, and is also useful for general laboratory work wherever a 400cy or 1000cy square wave is required. It produces a square wave at either frequency tunable over a ±10% range by means of a front panel control. Output is adjustable in amplitude from 0 to 50v peak-to-peak, no-load; or 12v peak-to-peak into a 600 ohm load. American Electronic Laboratories, Inc., Dept. ED, 641 Arch St., Philadelphia 6, Pa.

CIRCLE 297 ON READER-SERVICE CARD FOR MORE INFORMATION

PUSH-BUTTON OSCILLATOR

from 0.001 cps to 100 kc

Model 440-A

The Model 440-A PUSH-BUTTON OSCILLATOR is designed for applications requiring very low distortion or extremely good frequency stability and resetability. It provides both sine waves and square waves at any frequency between 0.001 cps and 100 kc. Distortion and Hum is less than 0.1% at any output level. Frequency calibration is ±1%. For fine control of frequency, three banks of ten push-button switches are provided. An additional vernier control varies the frequency continuously by an amount equal to the increment between adjacent buttons of the third switch bank. Ideally suited for bridge measurements, tuned filter alignment, rapid spot frequency checks, and distortion measurement. Price, $450.00 f.o.b. factory.

For Further Details Write

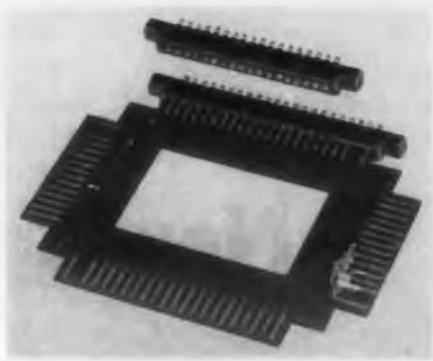
KROHN-HITE INSTRUMENT CO.

Dept. ED, 580 Massachusetts Avenue, Cambridge 39, Mass.

CIRCLE 300 ON READER-SERVICE CARD FOR MORE INFORMATION

Printed Circuit Connectors

With Bellows-Type Contacts



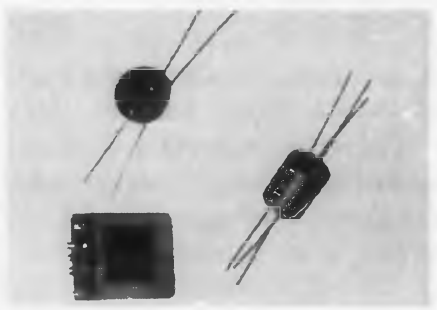
"Bellows-type" contacts, now supplied with this firm's printed circuit receptacles, are available in single and double row construction of 6, 10, 15, 18, or 22 contacts. The "Bellows-type" design provides long contact life and smooth engagement. It accepts 0.054" to 0.071" variations of a standard 1/16" copper-clad printed-circuit laminated card. (A receptacle to accommodate 1/8" board is also available on special order.)

Wiring styles include solderless wire wrap, solder lugs, or taper pins for "AMP 53". A choice of molding compounds is available; mineral-filled melamine, Alaskon-reinforced (glass) Alkyd 440A, and Orlon-filled Diallyl Phthalate. DeJur-Amsco Corp., Dept. ED, 45-01 Northern Blvd., Long Island City 1, N. Y.

CIRCLE 302 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Transformers

Missile and Computer Types



A complete range of designs in miniature wide-band transformers (Types ES6 and ES7) are available from this firm for application in pulse and computer circuitry. Performance ratings extend from 0.2 to 20μsec pulse width in blocking oscillator and pulse coupling circuits. The units are also provided as wide-band step-up step-down transformers for tape and computer circuits up to 10:1 turns ratio. High potential ratings of 2kv d-c may be called out on ES6 designs.

All units are epoxy impregnated and will withstand environmental requirements of MIL-T-27A, including shock, temperature cycling, humidity, salt spray, and vibration. Pulse Engineering, Dept. ED. 2431 Spring St., Redwood City, Calif.

CIRCLE 303 ON READER-SERVICE CARD FOR MORE INFORMATION

WHAT'S NEEDED IN '56?
The Industry Lists COMPONENT REQUIREMENTS in DESIGN '56

New Literature

Coilless Type Relays 325

New coilless type relays designed to function like current transformers are described in publication No. 584. The literature includes a discussion of features, applications, construction, ratings, dimensions, and prices. Automatic Switch Co., 391 Lakeside Ave., Orange, N. J.

Compression Molding Facilities 326

A 4-page bulletin describes this firm's facilities for compression molding, inspection, and finishing. The bulletin also illustrates the variety of sizes and shapes which can be molded of thermosetting materials. Specialty Insulation Manufacturing Co., Inc., Hoosick Falls, N. Y.

Tube Tester 327

The Model 500 Dynamic Mutual Conductance Portable Tube Tester is described in this bulletin. The tester can check tubes for dynamic mutual conductance, shorts, grid emission, gas content, leakage, and life expectancy under actual operating conditions. B & K Manufacturing Co., 3726 N. Southport Ave., Chicago 13, Ill.

Thermocouples 328

Engineering Bulletins Nos. 1601, 2, 3, 4. totaling 14 pages, cover design and selection of thermocouples for liquid, gas, and surface temperature measurements. Bulletins contain outline drawings of standard units, information on conductors, junctions, tubes and other engineering data. Revere Corp. of America. Wallingford, Conn.

Welding Head 329

This data sheet describes the Model J Welding Head, a precision welding unit for small parts and subassemblies. Design features, operating characteristics, specifications, and accessories are given, and cutaway and mounting drawings are shown. Equipment Marketing Div., Raytheon Manufacturing Co., 100 River St., Waltham 54, Mass.

Panel Instruments 330

This 2-page illustrated bulletin describes self-contained precision panel instruments. It includes special features, general specifications, mounting dimensions, diagrams, and photographs. Electronic Sales Div., De-Jur Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.

Servo Amplifiers 331

A 4-page brochure describes four new servo amplifiers. Each model features instantaneous response, built-in preamplifier, built-in power supply, compact assembly, standard tubes and stability. Applications, features, and specifications are listed. Servo Corp. of America, 20-20 Jericho Turnpike, New Hyde Park, L. I., N. Y.

Precision Selector Switch 332

A miniature ultra-low torque precision selector switch is described in a new brochure. The switch, designed for high speed operation, withstands shock and vibration and offers high accuracy measurement. Typical chopper application and typical wiring diagrams are shown, as well as dimensional and cutaway drawings. Electro Tec Corp., S. Hackensack, N. J.

Thermostats 333

A new bulletin covers this company's line of snap-action thermostats. The bulletin describes operating principles, which are illustrated with schematic diagrams, and includes information on performance data, ratings, dimensions, construction details, and various mounting arrangements. Stevens Manufacturing Co., 69 S. Walnut, Mansfield, Ohio.

Hermetic Seal Plugs 334

A new 2-color, 4-page brochure introduces this company's Type "S" line of glass insulated connectors. The brochure presents design drawings and specifications and includes discussions of general use, available finishes and standard characteristics, copper brazing service, and special customer design services. Seals, Inc., 1010 Mission St., S. Pasadena, Calif.

Rectangular Connector 337

A 2-page illutrated bulletin describes a 15 contact rectangular connector now available with aluminum hoods. The bulletin includes special features of the connector, electrical and mechanical ratings, mounting and clearance dimensions, and diagrams. Electronic Sales Div., DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.

Molded Caps and Connectors 338

A new catalog illustrates and describes stock mold for caps, connectors, strain-reliefs, and other special cord attachments. There are dimensional drawings of each attachment and recommended cord types and sizes to which they can be molded. Royal Electric Co., Inc., Pawtucket, R. I.

Magnetic Output Amplifiers 339

This bulletin on magnetic output amplifiers describes the construction and characteristic details of a series of these amplifiers for control and regulating purposes. Basic circuits of these devices are shown and characteristic curves are included. Allgemeine Elektricitats-Gesellschaft. Available from D. C. Seibert, Box 281, Wilmington, Del.

Electrical Connections 340

A 4-page brochure describes reliable electrical connections, discussing wire stripping practice as reported by various companies. Several electrical and electronics manufacturers have contributed ideas and applications. Rush Wire Stripper Div., The Eraser Co., Inc., 1068 S. Clinton St., Syracue 4, N. Y.

Test Equipment 341

Electronic, radio, and TV test equipment is illustrated and described in an 8-page catalog. Specifications, features, and applications are given. Dimensions and prices are included. Radio City Products Co., Inc., Centre and Glendale Sts., Easton, Pa.

Voltage Stabilizers 342

This product data sheet, No. PD4-261, describes the standard styles of this firm's harmonic-filtered voltage stabilizers. The literature gives data on applications and characteristics of this type voltage stabilizer. Equipment Marketing Div., Raytheon Manufacturing Co., 100 River St., Waltham, Mass.

Relays 345

A new catalog illustrates and describes high speed and sensitive relays. The 12-page catalog describes relays especially designed for precision aircraft electronic equipment conforming to highest standards of inspection. Operational charts and instructions for their use are included and dimensional and wiring diagrams are also shown. Electronics Div., Iron Fireman Mfg. Co., 2838 S. E. 9th Ave., Portland 2, Ore.

Electronic Photographic Printer 346

A folder describes a new principle which combines electronics with photography to create high quality standards for photographic prints. Contrasts between identical negatives printed in the conventional manner and by this electronic contact printer are shown. Log Etronics Inc., 1177 New Hampshire Ave., N. W., Washington 7, D. C.

Power Supplies 347

New data sheet describes a line of four power supplies, electronically regulated and designed to meet the extremely close tolerances encountered in color and monochrome television. Specifications for units with output currents ranging from 50 to 600ma are given. Tare Electronics Inc., 48 Urban Ave., Westbury, N. Y.

Engineered Ceramics 348

An 8-page, 2-color bulletin, No. 955, describes the facilities and precision porcelain products made by this firm. Quality control and interior production methods are pictured and the prototype service of the company is described. A properties chart is included. Frenchtown Porcelain Co., 101 Muirhead Ave., Frenchtown, N. J.

Infrared Detectors 349

The latest type of infrared detectors used as sensing elements in radiometers, pyrometers, infrared spectrometers and other infrared instrumnts are described in a new bulletin. The bulletin gives the characteristics, construction, circuitry, and uses of these high-speed thermistor-type sensing elements. Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn.

Electrical Tachometers 356

Catalog No. D9A gives complete details on the new Weston bearingless tachometer generators, as well as complete information on all a-c and d-c voltage responsive and frequency responsive tachometer systems. The catalog also illustrates and describes the types and sizes of indicators, recorders, and tachometer generators available, together with dimensional drawings and mounting information. Weston Electrical Instrument Corp., 614 Freylinghuysen Ave., Newark 5, N. J.

Recording Equipment 357

All this firm's "150" Series oscillographic recording systems, components, and associated equipment are described in a 16-page illustrated catalog. Basic "150" systems, in 1, 2, 4, 6, and 8-channel models, as well as the 11 currently available plug-in preamplifiers, are covered. Performance data for these interchangeable front-ends and frequency response characteristics of galvanometer with driver amplifier are provided. Sanborn Co., Industrial Div., 195 Massachusetts Ave., Cambridge 39, Mass.

Magnetic Servo Amplifier 358

Magnetic servo amplifiers featuring half-wave circuitry, non-frequency-sensitive compensation, full wave outputs, and maintenance-free operation are described in this literature. Dimensional drawings, frequency response curves, circuit diagrams and complete specifications are given. Feedback Controls, Inc., 1332 N. Henry St., Alexandria, Va.

Dielectric Capacitors 359

A 2-page, 2-color catalog sheet describes and lists a complete line of ultra high stability Polystyrene dielectric capacitors. The capacitors are designed for use where low leakage and low dielectric absorption are important. The sheet shows both standard and special units. Corson Electric Mfg. Corp., 540 39th St., Union City, N. J.

Industrial Cork 360

Industrial Cork Bulletin discusses the various properties of both natural and composition cork. It illustrates available forms, gives physical properties of natural cork and physical properties, specifications, sheet sizes, and thicknesses of this firm's cork compositions. Typical products and parts made from natural and composition cork are shown. Dodge Cork Co., Inc., Lancaster 26, Pa.

Buying Directory 366

The 1955-56 Buying Directory lists the location and facilities of all National Screw Machine Products Association members. More than 270 firms are listed both alphabetically and geographically in the 74-page directory. Other information contained in the directory is a key list of second operation services, end products manufactured and marketed, general facilities of each screw machine products producer, and conditions of sale and manufacturing practices for screw machine products. National Screw Machine Products Association, 2860 E. 130th St., Cleveland 20, Ohio.

Potentiometer Reliability 367

A technical paper, "Precision Potentiometer Life and Reliability", describes what happens to the operating characteristics of a precision potentiometer during its working life. The paper, which was presented at the 6th Annual Electronic Components Conference, discusses the effects of wear on operating characteristics (linearity, total resistance, noise, torque, and shaft play) and the operating characteristics of potentiometers which are affected during use. Photographs show the results of too soft and too hard contacts and the best combination of coil and contact. Suggestions for increasing useful life of potentiometers are given. Technical Information Service, Helipot Corp., 916 Meridian Ave., S. Pasadena, Calif.

Product Directory 368

This 20-page directory lists and describes the characteristics of this company's line of beryllium copper, beryllium aluminum and beryllium nickel alloys; of beryllium metal and beryllium oxide; of wrought, forged, and cast beryllium copper alloys and of beryllium copper safety tools. New extrusion items include bar and rod stock, seamless beryllium copper tubing in redraw sizes, and extruded shapes now available in commercial quantities. The Beryllium Corp., Reading, Pa.

Printed Wiring Boards 369

A 6-page brochure gives technical data and circuit design pointers for "Thru-Con" printed wiring boards. These boards are made by an additive process which plates the copper through the component lead holes. A typical circuit is used to illustrate design and layout information necessary for this type of circuit design. Suggestions are included on the kind or art work needed. General specifications for base and conductor materials are discussed and tabulated, and use characteristics of grades of paper base phenolics are given. Electronic Components Dept., General Electric Co., W. Genesee St., Auburn, N. Y.

Reinforced Plastic 374

A 20-page reference manual describes the advantages, applications, and procedures for using reinforced plastic. Design and performance data given includes tables of mechanical, electrical, chemical resistance, and thermal properties and typical strength and directional properties. Machining and handling, molding, finished items, tape applications, sanding and grinding, sawing, milling, shaping, turning, drilling, and tapping are illustrated. A chart gives a comparison of strength and stiffness properties and strength-weight and stiffness-weight ratios of various structural materials. Articles discuss the advantages of reinforced plastic, instructions for molding and handling, machining and finishing information, material selection, and mechanical strength properties of structural materials and what they mean in design and service performance. Minnesota Mining and Manufacturing Co., 900 Fauquier Ave., St. Paul 6, Minn.

Plastic Dielectric Capacitors 375

A 6-page engineering bulletin (No. XC-201-4) illustrates and gives complete technical information on high temperature plastic film dielectric hermetically sealed tubular capacitors with high insulation resistance, low power factor, and low dielectric absorption. Included are capacitance listings, dimensions and voltage, life test, power factor, insulation resistance, capacitance change, moisture resistance, vibration, and typical curves. Gudeman Co., 340 W. Huron St., Chicago 10, Ill.

Phase Measurements 376

A new digital method for fast, precise phase measurement is described in an 8-page data file. The simplified procedure reads directly in degrees, mils, or any other unit of angular measure. Basically, the procedure simply measures the time interval between the zero crossover point of a reference signal and the zero point of the shifted signal. Comparing the time interval with one period of the signal frequency determines the phase lag magnitude. Sample problems illustrate the method. Beckman Instruments, Inc., Berkeley Div., 2200 Wright Ave., Richmond 3, Calif.

Time Measuring System 377

This company's Model B-4 Time Measuring System is described in a technical data sheet. The instrument can be used in measuring the delay time of delay lines, networks, and the rise and fall times and widths of pulses to an accuracy of 2millimicrosec. A block diagram and scope patterns are shown. Rutherford Electronics Co., 3707 S. Robertson Blvd., Culver City, Calif.

Multiple V-Belt Drives

The 24-page revised manual of recommended "Engineering Standards Multiple V-Belt Drives" is available. The data in the manual indicates the proper sheaves and belts to be used for the attainment of optimum efficiency and economy of the drive with relation to the particular duty to be performed. Basic changes in the revised manual include 10 pages of new horsepower ratings. The basic horsepower formulas used in obtaining the new ratings are shown. Manufacturing tolerances have been shown for basic sheave groove profile dimensions both for standard and deep groove sheaves. Matching limits for sets of belts have been revised. $1.00. Rubber Manufacturers' Association, Inc., 444 Madison Ave., New York 22, N. Y., or Multiple V-Belt Drive & Mechanical Power Transmission Association, 27 E. Monroe St., Chicago 3, Ill.

Delay Lines 387

The sceond technical paper on delay lines, "Criteria and Test Procedures for Electromagnetic Delay Lines", is available. Technical paper No. 491 discusses general types of fixed and variable electromagnetic delay lines and defines conventional terminology. Common delay-line distortions are illustrated, methods for correction are analyzed, and test procedures, both pulse and sinusoidal, and methods for measuring linearity and phase shift are described. Technical Information Service, Helipot Corp., 916 Meridian Ave., S. Pasadena, Calif.

Computer Building Blocks 388

A 12-page brochure describes electro-mechanical general purpose analog computer components. Called the Servomation Building Blocks, various component combinations provide the means for industrial control, design and mathematical problem solving, classroom demonstration, and data processing. Featured are amplifiers, modulators, assembly units, signal generators, demodulators, corrective networks, power supplies, jack panels, and cabinetry. Servo Corp. of America, 20-20 Jericho Turnpike, New Hyde Park, L. I., N. Y.

Rubber Parts Chart 389

A complete data chart on rubber insulated metal parts and dipped rubber parts is available. The chart shows diagrammed applications and provides an outline of the industries in which these parts serve. Tables indicating die sizes and available standard design and size of grommets are also included. Automotive Rubber Co., Inc., 12550 Beech Rd. at PMRR, Detroit 39, Mich.

NEW FIELD VOLTMETER 10 CPS to 1 MC

Now! Voltage measurements to 1 MC with ±5% accuracy, no ac power supply. Temperature stable 0 to 120° F. Transistorized, rugged printed circuitry. Battery powered, weighs 32 oz. $250.00.

From 10 cps to 1 MC, the revolutionary Alto D-21 provides highest accuracy, up to 1 millivolt full scale sensitivity and complete temperature stability from 0 to 120° F. 12 decade ranges, front panel meter readings direct in db from −20 to +2 db, volts 0 to 1 or 0 to 3. Battery powered, 130 hours continuous duty. Output terminals for monitoring with 1,000 ohm and higher impedance devices. Printed circuits, transistors and heavy duty aluminum case insure ruggedness, long life and dependability under most demanding field use. Manufactured by ALTO SCIENTIFIC COMPANY, 855 Commercial Street, Palo Alto, California.

CIRCLE 394 ON READER-SERVICE CARD FOR MORE INFORMATION

A complete small tubing service

SMALL TUBING—*Fast!*

Aluminum, Copper, Brass
O.D.'s from ⅝" down to .010"

These and other analyses, including low carbon steel and precious metals, delivered within three weeks or less in most cases. Complete facilities for forming and machining. Special equipment for close tolerance, burr-free cutting—especially on hard-to-handle thin wall such as ½" O.D. x .003". Separate "Pointer" tubing department, drawing your choice of six aluminum alloys, with walls as fine as .0010"; tolerances as close as .00025".

Whenever you need small tubing or small tubing components—for electronic devices, instruments, or other precision equipment—contact Uniform Tubes. Catalog, quotations or further information on request.

Straight

Formed

Machined

UNIFORM TUBES, INC.
1200 Level Road, Collegeville 2, Pennsylvania
Agents in Principal Cities

CIRCLE 395 ON READER-SERVICE CARD FOR MORE INFORMATION

Molybdenum 396

Molybdenum is the subject of this 24-page brochure. Among the aspects discussed are processing; properties, both chemical and physical; products, such as powder, wire, rod, and wire; conversion factors; molybdenum-tungsten alloy; and versatility. A graph illustrates the processing from oxide to finished products and tables are provided giving physical constants of elements, decimal and metric equivalents, and weights and measures. Tungsten and Chemical Div., Sylvania Electric Products Inc., Towanda, Pa.

Selenium Rectifier Design 397

"Federal Selenium Rectifier Design Data Guide" is the title of this 12-page booklet. The publication gives engineers the factors that should be considered in the design of industrial and military rectifiers and tells why these factors are important. These cover a wide range of rectifier applications. The complete line of industrial rectifier products made by this company is also described. Components Div., Federal Telephone and Radio Co., 100 Kingsland Rd., Clifton, N. J.

Phosphors 398

Phosphors for color and black-and-white TV and other cathode-ray tube applications are described in this 26-page booklet. Tables give the types of phosphors used in these various applications and graphs show spectral energy distribution, chromaticity diagram, screen strength, persistance characteristics, visual brightness, etc. Chemicals for screen settling, like potassium silicate and barium acetate, are discussed. Tungsten and Chemical Div., Sylvania Electric Products, Inc., Towanda, Pa.

Terminations and Couplers 399

Four models of coaxial directional couplers, offering complete power measurement from 225 to 4000Mc, are described in Catalog Sheet No. 282. The firm's new line of fixed and sliding coaxial terminations, covering the frequency range from S to X bands are described in Catalog Sheet No. 302. Photographs, applications, features, specifications, and prices are included in both catalog sheets. The Narda Corp., 160 Herricks Rd., Mineola, L. I., N. Y.

Coaxial Transmission Line 400

A coaxial transmission line used for conducting TV transmitter signals to the transmitting antenna is described in a 2-color, 8-page bulletin. The bulletin, No. 431, fully describes lines and accessories. It is complete with photographs, outline drawings, efficiency graphs and charts showing attenuation, velocity, voltage breakdown, diameters, weights, and bead spacing. Prodelin Inc., 307 Bergen Ave., Kearny, N. J.

120 MC GRID D

New portable, tran instrument Model G mits measurements MC, ±5% accuracy circuitry, rugged con No plug-in coils. Bat en, weighs just 18 oz. Cradle this unbelievab weight new Grid Dip O your hand—and make t receiver or system frequ urements with conveni known before! Operate with one hand—with y tips. Obtain 1 KC modu a flick of modulator s phones). Increase gain front panel meter. Oper resin case; study the ra that makes this possible The price? $150—much laboratory instrument w Why not check the brief for complete details! M TIFIC COMPANY, 855 California.

CIRCLE 401 ON READER-SERV

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THE TOUGH

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PRODUCED TO SPECIFICAT

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WHATEVER YOUR PROBLEM Y
OUR ENGINEERING DEPART
FOR LITERATURE OR CONSULT

CIRCLE 402 ON READER-SERVI

Fluorocarbon Lubricant 405

The chemical structure, specifications, properties, applications, and general description of a new group of fluorocarbon oils, waxes, and greases for industrial use are described in a 16-page booklet. The booklet discusses color and clarity, viscosity, specific gravity, surface tension, flammability, vapor pressure, dielectric properties, acidity, chemical stability, solubility and lubricity. Chemical Manufacturing Div., The M. W. Kellogg Co., P. O. Box 469, Jersey City 3, N. J.

Brazing Alloy Paste 406

A 3-page engineering data sheet (No. 12) describes Nicrobraz Paste, a stainless brazing alloy in paste form. The data sheet describes composition and properties and outlines some of the recommended brazing applications. Application procedure is explained as well as methods for removing flux and separating joints which have been brazed with the new paste. Stainless Processing Div., Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich.

Sampling Switches 407

A 4-page, 2-color brochure on high speed multicontact sampling switches illustrates three basic switch designs available in a variety of arrangements and integrated motor drives. Photos show applications of the switches in missile telemetering, signal simulation, amplifier drift compensation, automation, multichannel CRO display, high speed relay programming, function gating, and aircraft instrumentation. General Devices, Inc., P. O. Box 253, Princeton, N. J.

High Speed Potentiometer 408

Bulletin No. P1270 describes a new high speed recording dynamaster potentiometer. This recorder has a full-scale pen-travel across its 11" calibrated chart of only 0.4sec, without overshot on long or short traverses. The bulletin features a full-size reproduction of a sample chart which shows the dynamic characteristics of the new potentiometer. Bristol Co., Waterbury 20, Conn.

Wire Construction 409

"How Wire Construction Reduces Costs", showing the use of wire in improved product design, is a study of 36 illustrated case histories. The 11-page booklet covers many applications, including TV components and motor mounts. Descriptions of each before-and-after picture point out specific advantages. E. H. Titchener & Co., 67 Clinton St., Binghamton, N. Y.

HAS APPLIED RESEARCH AFFECTED COMPONENTS IN THE COMPUTER FIELD?

Manufacturing Facilities 415

A new bulletin describes this company's facilities for the fabrication of cables and electrical wiring harness assemblies including facilities for braiding and molding. The bulletin also tells of the company's activities in the assembly of electronic devices, design and manufacture of specialized electronic test equipment, power supplies, subminiature electronic assemblies, and etched circuit wiring. Electronic Products Corp., 322 State St., Santa Barbara, Calif.

Protective Coating Material 416

A 4-page brochure on this firm's new coating for metals that preserves chemically cleaned surfaces obtained directly after electro plating or a chemical cleaning operation is available. Illustrated in the brochure are applications of the material in the metal working, electrical, and electronic industries. The publication contains a physical and chemical data chart in relation to use. Fidelity Chemical Products Corp., 470-474 Frelinghuysen Ave., Newark, N. J.

Precision Bridge 417

The new L-C Precision Bridge, providing measurement of inductance and capacitance is described in a catalog sheet. The instrument provides a wide frequency range without correction factors or frequency compensation direct reading in terms of L or C and associated R and G, and single control selection of measuring circuit and range. Complete specifications are given. Instrument Div., Federal Telephone and Radio Co., 100 Kingsland Rd., Clifton, N. J.

Electromanometer 418

This company's type 37-103 electromanometer system is described in a 4-page brochure. Features, applications, operating principle, and specifications are discussed. Functional diagram and a diagram of readout methods are included. A cutaway drawing and photographs illustrate this precision, pressure-measuring instrument. Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena 15, Calif.

Tape Recorder Directory 419

The Vol. 11, No. 4 issue of "Audio Record" is a directory of tape recorders. A listing is given of all makes of tape recorders, price, frequency response, data specifications, and tape information. Each model is illustrated and all manufacturers' addresses are listed. Also listed are tape recording accessories. Audio Devices, Inc., 444 Madison Ave., New York 22, N. Y.

New Perma-Torq*
keeps coils tuned as set

It's new! Now CTC offers you Perma-Torq — a constant tensioning device for tuning cores of CTC ceramic coil forms.

It also allows for immediate resetting without removal or loosening of any mounting nut or locking device.

New Perma-Torq units come completely factory assembled to mounting studs, eliminating the bother of assembling and adjusting separate locking springs. CTC coil forms with Perma-Torq are designated PLST, PLS5, PLS6, and PLS7, and are completely interchangeable with CTC's LST, LS5, LS6 and LS7 series.

Send for complete details. Cambridge Thermionic Corporation, 457 Concord Avenue, Cambridge 38, Massachusetts.

*Patent pending

CIRCLE 424 ON READER-SERVICE CARD FOR MORE INFORMATION

Laboratory Apparatus 426

The latest issue of this company's Apparatus Digest illustrates and describes a variety of laboratory apparatus and equipment including mobile air, conditioners, liquid coolers, portable refrigeration systems, flexible heating tapes, interval and signal timers, stop watches, and vacuum control instruments. A. Daigger & Co., 159 W. Kinzie Ave., Chicago 10, Ill.

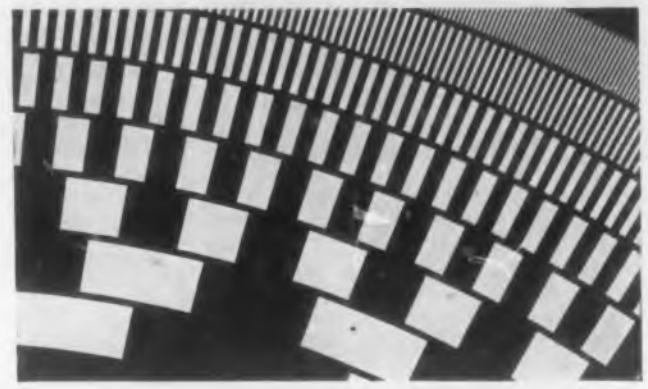
Recording, Playback System 427

This company's new magnetic tape recording and playback system for recording stress, pressure, temperature, and vibration is the subject of this 24-page brochure. The system and the various components are described and illustrated and a block diagram of a typical airborne system is included. Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena 15, Calif.

Subminiature Relays 428

This brochure illustrates rugged subminiature relays designed for a variety of high precision applications. These relays feature high performance and shock qualities. The brochure lists a variety of enclosures available and complete specifications. Elgin-Neomatic, Inc., 2435 N. Naomi St., Burbank, Calif.

Gurley Standard Binary Code Discs
Now Available in Four Versions



Gurley, manufacturer of the *standard* binary code disc for the electronics industries, is now able to supply four versions for use in either photo-electric, magnetic or contact types of pickups.

Containing concentric zones of information in the gray (reflected) code, the Gurley discs contain alternate clear and opaque sectors. Thin annular rings separating adjacent zones are opaque. Varying patterns record up to 8192 bits of information (65,536 on special designs!).

Four coatings are available: "Type T"—photoengraver's glue with colloidal (black) silver, essentially grainless; "Type R" with etched metal coating, for reflectivity and transmission contrast; "Type M" with chemically deposited ferrous alloy possessing both *magnetic* and optical transmission contrast; and "Type C"—metal bonded on glass for electrical *contact* use as well as in contrast of optical transmission. WRITE FOR BULLETIN 7000.

W. & L. E. GURLEY • 525 Fulton Street, Troy, N. Y.

GURLEY *since 1845*

CIRCLE 430 ON READER-SERVICE CARD FOR MORE INFORMATION

Production Facilities 436

This 24-page brochure illustrates this firm's facilities for design, engineering, and production of precision electronic and electromechanical equipments and some of the products made. A special section of the brochure is devoted to a description of new encapsulation techniques for transformers and high voltage power supplies and of Leadcast for atomic energy industries. Telectro Industries Corp., 35-16 37th St., Long Island City 1, N. Y.

Differential Pressure Switch 437

Series 6300 Differential Pressure Switches for aircraft and missile system applications that operate in systems utilizing inert gases and fluids, engine and hydraulic oils and aromatic fuels are described in an illustrated catalog sheet. Dimensional drawings and specifications are given. Southwestern Industries, Inc., 5880 Centinela Ave., Los Angeles 45, Calif.

Epoxy Resins 438

Filled epoxy resins are described in these data sheets. Properties, applications, and factors influencing pot life and cure times are tabulated. Furane Plastics, Inc., 4516 Brazil St., Los Angeles 39, Calif.

Gamma Ray Projectors 445

A portable gamma ray projector for industrial radiography is the subject of a 24-page booklet. The projector offers a high degree of penetration, costs much less than comparable X-ray equipment, is portable, and needs no electricity. The booklet gives operation and construction features of three models presently available. A gamma ray intensity and film exposure guide is included. Metal & Thermit Corp., 100 E. 42nd St., New York 17, N. Y.

High Voltage Terminals 446

A 4-page, 2-color brochure describes high voltage terminals which withstand operating temperatures over 1000°F. Dimensional drawings are given of 4 types and ratings and applications are discussed. Advanced Vacuum Products, Inc., 18-22 Liberty St., Stamford, Conn.

Photoelectric Pyrometer 447

Bulletin No. PT 556, "Photoswitch Photoelectric Pyrometer", contains descriptive data, specifications, and dimensions on this firms Type P2T photoelectric pyrometer. The instrument operates over a range of from 1000°F to 5000°F and will respond to temperature changes of 5°F. Photoswitch Div., Electronics Corp. of America, 77 Broadway, Cambridge 42, Mass.

Time Recorder Totalizer 448

A new brochure describes a time recorder-totalizer which provides a continuous operation record of any electrically operated machine or process. The instrument may also be used as a counting device and can be remotely installed for the convenience of supervisory personnel. Heat-Timer Corp., 657 Broadway, New York 12, N. Y.

Magnetic Counters 449

Both panel mounted and standard magnetic counters are illustrated and described in a 4-page, 2-color brochure. A cutaway photo illustrates characteristics and complete specifications and dimensional and mounting diagrams are given. Veeder-Root, Inc., Hartford 2, Conn.

WHAT'S NEXT IN SIGHT FOR COMPONENTS IN RADIO AND TV?
SEE "DESIGN '56"

Corrosion Resistant Equipment 455

Porcelain, stoneware, coatings, graphite, and alumina for corrosion resistant equipment are discussed in this bulletin. Physical properties, characteristics, and applications are described and illustrated. Chemical Equipment Div., General Ceramics Corp., Keasbey, N. J.

Axial-Lead Resistors 456

Bulletin No. 147 gives specifications and features of this firm's line of small wire-wound vitreous-enameled resistors with axial leads. The 2-page bulletin shows the two sizes, rated at 5 and 10w, that are carried in stock in a wide range of resistance values. Also shown is a price schedule. Ohmite Manufacturing Co., 3680 Howard St., Skokie, Ill.

Cap Nuts 457

Complete data on this firm's rustproof zinc-alloy cap nuts is given in this bulletin. The bulletin contains schematic drawings and tables of stock sizes and dimensions, for both closed-end and open-end types. Gries Reproducer Corp., 400 Beechwood Ave., New Rochelle, N. Y.

Instrument Cases 458

Catalog Supplement No. 5 gives complete information on drawn aluminum instrument cases with rounded corners and recessed front cover to protect controls and dials. The bulletin also lists new sizes of rectangular boxes and covers. Zero Manufacturing Co., 1121 Chestnut St., Burbank, Calif.

Test Equipment 459

Catalog No. R36A illustrates and describes this company's complete line of test equipment. It includes all instruments for servicing TV, radio, and other communications equipment, as well as all industrial electronic and electrical equipment. Weston Electrical Instrument Corp., 614 Freylinghuysen Ave., Newark 5, N. J.

Digital Computer 460

The Alwac III, a high-speed, low-cost fully automatic electronic digital computer, is described in a 4-page, 2-color brochure. The brochure contains a table of specifications, operation and maintenance requirements. Logistics Research, Inc., 141 S. Pacific Ave., Redondo Beach, Calif.

Selective Voltmeter 466

This company's Model 2170 selective voltmeter is described in a data sheet. The voltmeter is a highly selective measuring instrument employing the heterodyne principle with balanced modulation. A block diagram and specifications are included. Railway Communications, Inc., Raytown, Mo.

Portable Drill Press 467

This folder describes typical uses for this company's portable magnetic drill press. Complete dimensions, specifications, and weights of 11 standard models are listed. Portomag Sales, Inc., 1511 E. Nine Mile Rd., Ferndale 20, Mich.

Control Relay 468

A new line of sectional-pole heavy-duty 10amp control relays is described in an 8-page bulletin. The bulletin pictures each of the 10 models in the line; gives dimensions, enclosures, features, and data on maintenance and pole conversion from normally-open to normally-closed. Clark Controller Co., 1146 E. 152nd St., Cleveland 10, Ohio.

Contact Connector 476

A new 15 contact rectangular continental connector is illustrated and described in a data sheet. Mounting and clearance dimensions and hood dimensions are shown and electrical and mechanical ratings are given. Electronic Sales Div., De-Jur Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.

Vibration Mountings 477

Products for vibration control installations are illustrated and described in this catalog. A chart for determining the minimum deflection required for a selected vibration isolation efficiency is given and illustrations show typical installations. Vibration Mountings, Inc., 76-17 Queens Blvd., Elmhurst, N. Y.

Resistors 478

Type MW wire wound resistors are described in a 4-page bulletin. Data is provided on construction, tolerance, power rating, marking humidity, adaptability, frequency characteristics, etc. Detailed charts and graphs are included. International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa.

Stresses in Steel Bars 484

Bulletin No. 16 is a 32-page, pocket-size booklet entitled "Residual Stresses in Cold-Finished Steel Bars and Their Effect on Manufactured Parts". The booklet, illustrated with more than fifteen different pictures and curves, covers such subjects as residual stresses in cold drawn bars, turned bars, ground bars, and heat treated steel. Fatigue, cracking, machinability, tolerances and corrosion are other subjects of discussion. La Salle Steel Co., 1412 150th St., Hammond, Ind.

Sprayed Metals 485

Bulletin 120, a 6-page data bulletin on sprayed metals, illustrates and describes a wide range of applications of metallizing sprayed metal in the production of electrical and electronic equipment. Also to be found are enginering data on bond strength, conductivity characteristics, permissible coating thicknesses, circuit tests, surface preparation and spraying methods. Metallizing Engineering Co., Inc., 1101 Prospect Ave., Westbury, L.I., N.Y.

Liquid Phosphor Counting 486

This is a 12-page booklet entitled "Counting Soft Beta Emitters with Liquid Phosphor Techniques". The material gathered in this booklet is intended to make the reader become better acquainted with the principles of liquid scintillation counting, as well as the exact methods of sample preparation, instrument operation, and the accompanying advantages and limitations of the method. Technical Measurement Corp., 140 State St., New Haven, Conn.

Wire and Cable 487

Catalog 55 is a 40-page, 3-color publication which contains complete specifications, descriptions, and illustrations of the company's in-stock line of 1373 items of electronic wire and cable. Listed are 487 new items, full Government and MIL specification data, and special engineering cross-reference charts for easy determination of individual wire needs. Alpha Wire Corp., 430 Broadway, New York, N.Y.

Electronic Test Instrumentation 488

Various electronic test instruments such as expanded scale voltmeters and frequency meters, audio oscillators, resistance bridges, regulated power supplies, wide band amplifiers and others are described in Catalog S-55, an 8-page booklet. Operating characteristics and the uses for each particular instrument are also given. Shasta, Div. of Beckman Instruments, Inc., P.O. Box 296, Station A, Richmond, Calif.

496

Bulletin SD-1 is a 4-page publication containing a selection chart helpful for choosing a particular time delay or combination of time delay models in an electrical circuit. The chart presents methods of adjustment, operating voltage, type of operation, contact arrangement, type of contact, dimensions and weight for each model. Six diagrams describe various mountings and enclosures. AGA Div., Elastic Stop Nut Corp. of America, Elizabeth, N.J.

Carbon Resistors 497

Comprehensive data on deposited carbon resistors is provided in a 4-page bulletin. Information is given on tests, applications, specifications, tolerance, ranges, performance, and dimensions. International Resistance Co., 401 N. Broad St., Philadelphia, Pa.

Potentiometer 498

A data sheet gives features and specifications on this 1-5/8" precision ganging potentiometer designed for applications requiring high accuracy in limited space. Dimensional drawings and mounting diagrams are provided. DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.

Frequency Deviation Meter 556

A new instrument-type FT-FMV frequency deviation meter is described in a 4-page catalog sheet giving description, specifications, and applications. Another catalog sheet gives complete specifications on a new instrument-type FT-UBM tunable indicating amplifier. Federal Telephone and Radio Co., 100 Kingsland Rd., Clifton, N.J.

Potentiometer 557

Bulletin C54-1 is now available providing all the latest technical data on the type 2064 dual-element rectilinear-motion potentiometer. Markite Corp., 155 Waverly Place, New York, N.Y.

Precision Tools 558

A 4-page illustrated folder is offered listing several new products introduced by this company, including some new versions of the Mico Engraver for large panels and tall objects. Some of the items are designed for production work and all are useful for work in laboratories. Mico Instrument Co., 80 Trowbridge St., Cambridge, Mass.

Connector 559

A two page illustrated bulletin, CCC 20 has been issued describing features of the new, 37 contact Continental Connector suitable for airborne electronics. It includes electrical and mechanical ratings, mounting and clearance dimensions, and diagrams. DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City, N.Y.

Aircraft Tester 560

A new 4-page bulletin, GEA-6345, describes the operation, capabilities, and advantages of DYNAT, a dynamic accuracy tester developed for ground testing complete aircraft systems under fully simulated flight conditions. Apparatus Sales Div., General Electric Co., Schenectady, N.Y.

Drafting Templates 561

Catalog 57 is a new 12-page publication of drafting templates for engineers, draftsmen, architects and designers. Sixty-four templates are grouped for convenience into eight different categories. RapiDesign, Inc., Box 592, Glendale, Calif.

Castings 563

A 20-page illustrated brochure is offered describing a complete line of castings, giving chemical and physical properties of the various materials used in their manufacture. Also available is a 4-page bulletin on precision impellers manufactured by vacuum cast methods. Universal Castings Corp., 5821 West 66th St., Chicago, Ill.

Lower Manufacturing Costs 564

This is an 8-page booklet that discusses various uses for testing. It indicates how a non-destructive testing program can be instituted in the production departments, as a cost-reducing, money-saving tool. It also outlines how inspection should be considered productive machinery. Magnaflux Corp., 7300 W. Lawrence Ave., Chicago, Ill.

Processing Patents 565

The nature of an invention and the various steps necessary in processing a patent application are graphically detailed in a booklet entitled "Preparing for Patent-Hood", written by Elton T. Barrett, president of CGS Laboratories. CGS Laboratories, Inc., 391 Ludlow St., Stamford, Conn.

Variable Inductors 566

Catalog 9/55 is a 12-page publication on a series of electrically variable inductors. Schematic diagrams, graphic charts, and tabular data sheets are included in this catalog of "Vari-L" inductors, as well as illustrations and operating characteristics. Vari-L Co., Inc., P.O. Box 1433, Stamford, Conn.

Infrared Radiation Standard 567

A primary radiation standard against which infrared instruments can be calibrated and tested with confidence is described with complete specifications in a 2-page brochure TDS-IRS. Servo Corp. of America, 20-20 Jericho Turnpike, New Hyde Park, L.I., N.Y.

Epoxy Resins 568

A 14-page booklet is being offered to simplify the use of epoxy casting resins in the electronic industry. A series of single component formulations requiring no catalysts or hardeners is now available in this brochure. Aries Laboratories, Inc., 270 Park Ave., New York, N.Y.

Patents

John Montstream

Antenna . . . *Patent No. 2,694,778. H. J. Rowland et al. (Assigned to the United States of America as represented by the Secretary of the Army.)*

The microwave antenna discussed here can be made to radiate either a linearly or circularly polarized wave merely by turning the outer conductor of a coaxial cable with respect to the inner conductor.

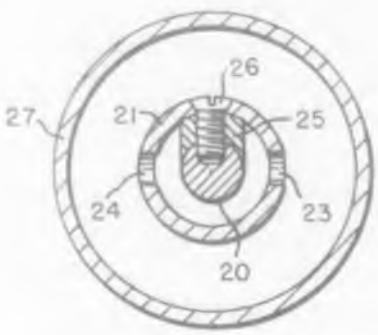
This antenna is carried on a coaxial line (*12*) which projects through the center of the reflector, which would be to the right in the illustration. It is offset slightly from the axis of the reflector so that upon rotation of the antenna, a conical beam will be radiated from the reflector. The antenna is rotated as a unit by rotation of coaxial line *12*. This coaxial line includes an inner conductor (*20*) and an outer tubular conductor (*21*), the end of which is shorted by a suitable plug (*22*). Spaced about a quarter wave-length from the plug are a pair of slots (*23*) that are diametrically opposite from each and pass through the circular wall of the outer conductor. A shorting stub (*25*) between the inner and outer conductors is located between slots *23*. The stub is displaced 90° with respect to the slots and is secured in position by a screw (*26*).

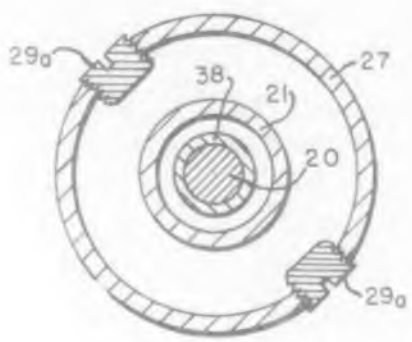
Surrounding the coaxial line and particularly outer conductor *21* is another tubular conductor (*27*) that forms a coaxial line with conductor *21*. The outer end of conductor *27* is shorted to conductor *21* by a plug (*28*). The other end of conductor *27* is closed by a dielectric window (*24*) which is suitably anchored to the end of the conductor and directed towards the reflector.

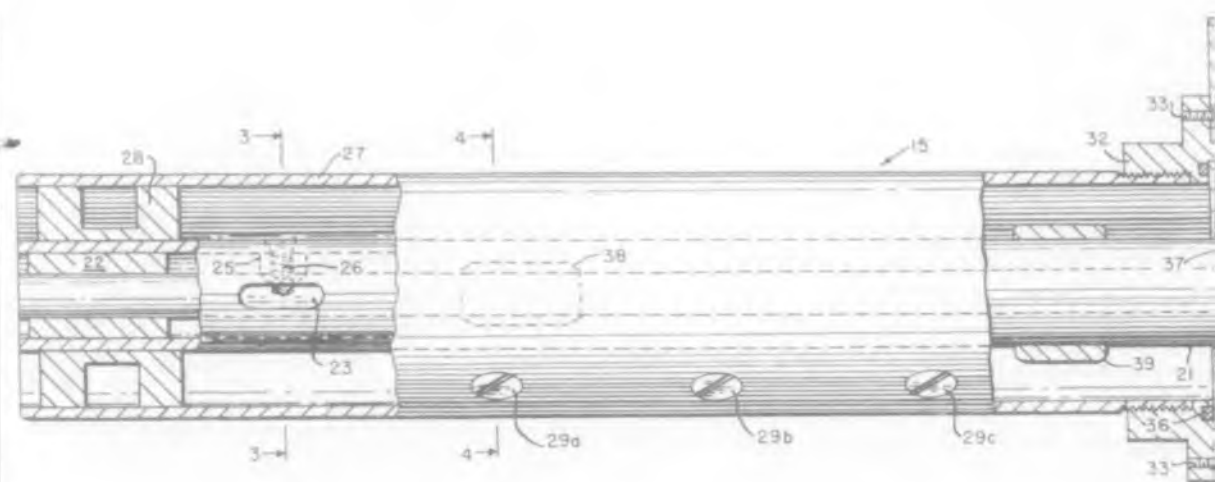
When coaxial line *12* is energized so as to propagate a wave in the TEM mode, slots *23* cooperating with shorting stub *25* cause outer coaxial line *27, 21* to be excited in the TE_{11} mode. A transformer (*38*) around central conductor *20* located about one-half wave-length from the slot compensates for any discontinuity existing because of the slots and shorting stub. The linearly polarized wave in the outer coaxial line may be regarded as being made up of two components at right angles to each other. In order to circularly polarize the wave, spaced lumped susceptances

(*29a*, *29b*, and *29c*) project inwardly from conductor *27*. These susceptances are located so that they are at a 45° angle with respect to the slots. Similar lumped susceptances are provided diametrically opposite those illustrated. These susceptances retard the phase of one component only and with three as shown, the retardation is 90° in space and in phase. This results in a circularly polarized wave which is radiated through the window (*34*).

If outer conductor *27* is turned so that the susceptances are in alignment with shorting stub *25*, the components of a linearly polarized wave will be retarded uniformly so that the radiated wave is also linearly polarized. Adjustment of the position of the susceptances so that they are angularly displaced with respect to stub *25* somewhere between 0° and 45° will result in the radiation of an elliptically polarized wave. It is at the 45° position that the circularly polarized wave is radiated. It may be a right-hand polarization or a left-hand polarization depending upon which side of stub *25* the susceptances are located.







Glass-Sealed Semiconductor Crystal Device . . . *Patent No. 2,694,168. H. Q. North et al. (Assigned to Hughes Aircraft Company, Culver City, Calif.)*

The patent describes a method by which the semiconductor crystal may be enclosed in glass whereby the entire diode may be subject to temperatures as high as 620°C without altering the characteristics of the crystal. Such a housing is dimensionally stable, non-water absorbing and reduces stray capacitance to a minimum. The patent claims cover not only the method of making the assembly, but also cover its structure as well.

High-Frequency Transistor Circuit . . . *Patent No. 2,695,930. R. L. Wallace, Jr. (Assigned to Bell Telephone Laboratories, Inc., New York, N. Y.)*

The construction of a high-frequency transistor with a low base resistance is described in this patent. This transistor can oscillate at as high as 55Mc. Its base resistance is 10 ohms.

Electric Discharge Device . . . *Patent No. 2,697,800 L. W. Roberts. (Assigned to Sylvania Electric Products, Inc., New York, N. Y.)*

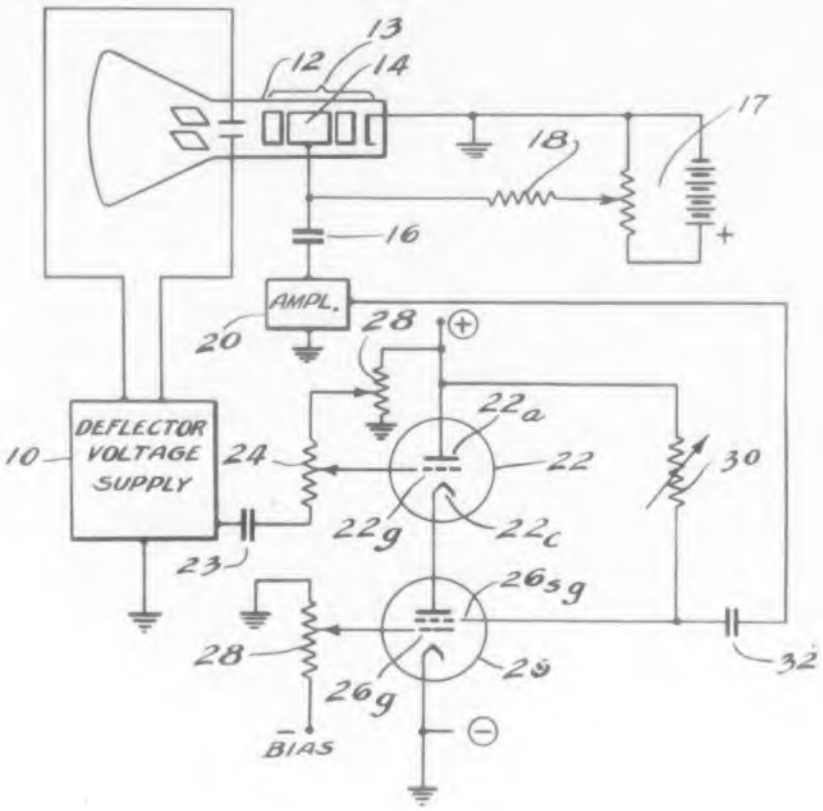
An improved form of gas filled discharge device is described for use with guided transmission systems. Such devices use opposed pointed conductors spaced apart with a small gap so that a signal of excessive value is discharged across the gap and blocks its transmission. One of the particular improvements of the patented structure makes use of such gaps extending at intervals along the wave guide portion of the device and spaced apart at intervals a distance substantially less than a quarter wave-length.

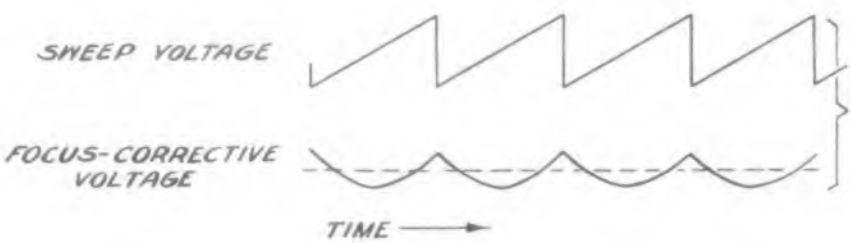
Generator for Dynamic Focusing of Cathode-ray Tubes . . . *Patent No. 2,698,400 W. F. Schreiber. (Assigned to Sylvania Electric Products, Inc., New York, N. Y.)*

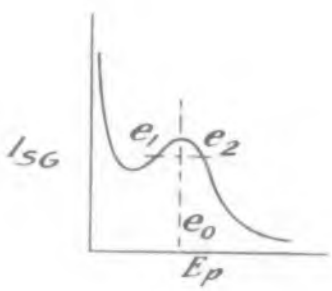
The circuit of this patent provides a means for sharply focusing the trace on all areas of a cathode-ray tube screen for photographic purposes. At present, if the beam is correctly focused on the center of the screen, it will be out of focus to some extent at the edges of the screen. Similarly if the beam is focused precisely for the edges of the screen than the beam is slightly out of focus at the center. A focus correcting voltage is applied to the tube focusing means. This focusing correcting voltage is controlled by the sweep signal generator so that it is in synchronism.

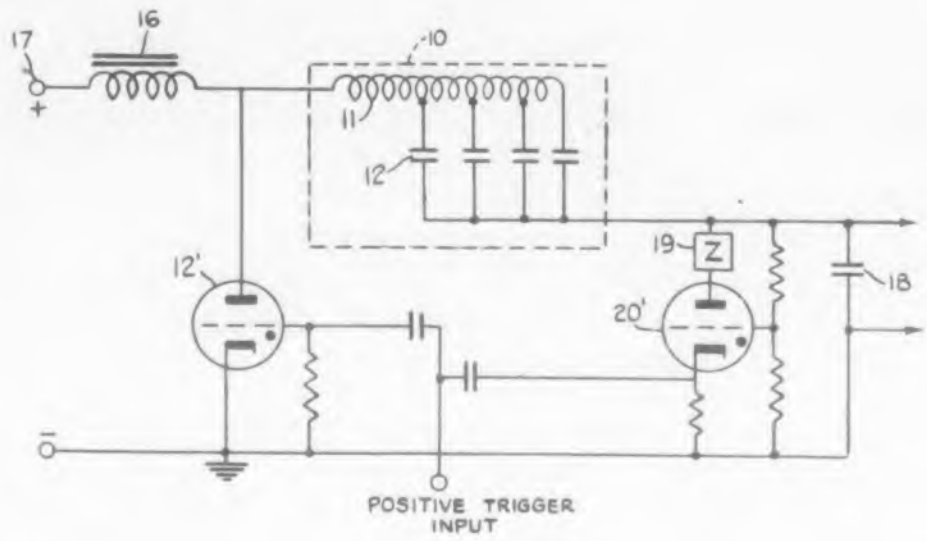
The focus correcting voltage is secured by the illustrated circuit. The deflector or sweep voltage supply is connected with the control grid of a triode (*22*) which has a screen grid tube (*26*) in series with the cathode. The two tubes serve somewhat as a cathode follower circuit with screen grid tube *26* providing in effect a non-linear resistor in the cathode circuit. The screen grid is operated in the region where the screen grid has a secondary emission giving the form of response shown in the chart. The voltage variations of the screen grid above line e_1, e_2 are applied through an amplifier (*20*) to the focusing electrode (*14*) of the cathode-ray tube. The focusing correcting voltage wave is superimposed on the potential applied by the voltage source (*17*) and changes the focusing potential in synchronism with the sweep voltage applied to the tube beam deflector plates.

The circuit described maintains the beam in focus upon all areas of the screen. The circuit which accomplishes this result is simple in that it uses two wellknown tubes for supplying the correcting voltage. Other well-known tubes can be used in place of screen grid tube *26*.









Linear Sweep Circuit . . . *Patent No. 2,697,784 R. H. Blythe. (Assigned to the United States of America, Western Hemisphere.)*

An improved linear sweep circuit, such as is used with high-frequency oscilloscopes, is the subject matter of this patent. Sweep voltages are customarily secured by using the linear change of voltage across a capacitor. Such circuits usually require a higher charging voltage than is commonly available for high speed beam deflection.

The improved sweep circuit uses an inductor (*16*) in series with an artificial line (*10*) of inductors and capacitors. A source of d-c potential (*17*) charges the artificial line, which in turn charges the capacitor (*18*). The deflection plates of a cathode ray tube are connected across this capacitor. In order to charge capacitor *18* at a uniform rate, a switch and impedance (*19*) in series shunts the capacitor to periodically discharge the same. A switch is also used to discharge the artificial line which switch is connected between the inductor (*16*) and the line. The switches may conveniently be thyratrons (*12'* and *20'*), which alternately become conducting. In other words, when thyratron *20'* is conductive to discharge capacitor *18*, thyratron *12'* is cut off so that source *17* charges artificial line *10*. At time intervals, determined by the circuit values, thyratron *20'* ceases to conduct current, whereupon the artificial line charges capacitor *18* and produces a linear voltage change for controlling the sweep of the beam of the cathode ray tube. The artificial line functions as a fixed voltage source. When thyratron *20'* cuts off, thyratron *12'* becomes conducting and discharges the artificial line until the thyratron is again cut off to repeat the cycle of operation.

The circuit provides a series resonance circuit having essentially no losses. It is d-c resonance charged. This effect provides an alternating potential across the capacitor with a voltage that is theoretically twice that of the applied d-c potential. The source of d-c potential may be negative without altering the circuit.

Methods and Apparatus for Welding Germanium Diodes . . . *Patent No. 2,693,555. H. Q. North et al (Assigned to Hughes Aircraft Co., Culver City, Calif.)*

This patent describes a method of welding leads to germanium in which shattering, melting, or cracking of the crystal is avoided. Present welding techniques require a high degree of precision and are time consuming.

AEC Patents For Industry

Additional patents owned by the Government and held by the Atomic Energy Commission have been made available for licensing on a non-exclusive, royalty free basis. Applicants should apply to the Chief, Patent Branch, Office of the General Counsel, U. S. Atomic Energy Commission, Washington 25, D. C. Of the 37 patents released, the following ones are particularly interesting to electronic design and development engineers.

Ion Source (Patent No. 2,710,354); M. G. Inghram and D. C. Hess, inventors. This patent relates to the reduction of background ion peaks which become objectionable as the sensitivity of mass spectrometers is increased. Tertiary ions, ejected from the filament by bombardment of negative ions released from the slit plate, are deposited, resulting in a reduction of background peaks.

Electromagnetic Pressure Gage (Patent No. 2,710,358); L. B. Vandenberg, inventor. The patent relates to indicating and controlling devices and in particular to an electromagnetic pressure gage in which pressure is indicated by the amount of current required to maintain a pressure equal and opposite to the pressure to be measured. This is obtained by providing an electromagnetic pump in which an end of the pump inlet tube is closed and the other end of the pump outlet tube is open and immersed in liquid metal in a chamber, the pressure of which is to be measured. The pump armature current enters the inlet tube and leaves the pump by the outlet tube. The resistance of the tube will vary depending upon the extent to which it is filled by liquid metal.

Marker Pulse Generator (Patent No. 2,712,114); W. R. Aiken, inventor. This patent relates to a high stability marker pulse generator which is made up entirely of sections of coaxial transmission line arranged in a plurality of parallel-connected sections of line. The coaxial cables will have graded lengths connected at one end to the output of a rectangular wave generator, the difference between the time delays being less than the duration of each rectangular wave output. A pulse forming stub, which has a time delay of less than half the minimum difference between the time delays of the cables is connected to the other end of the plurality of cables. A cancelling reflected voltage is produced during each period corresponding to the difference in delay times of the cables.

Electrical Control Circuit (Patent No. 2,712,074); H. G. Neil, inventor. The patent is concerned with electrical control circuitry adaptable for use in isotope separating devices. The small drain current flowing through the negative electrode as a result of the loss of charge of the ions which are deposited thereon, is used to control the volatilization of the charge material. Transformers having their windings connected in opposition are connected to the ion source. An electronic coupling responsive to the drain current controls the transformers and hence the potential of the electrode.

COMPONENT DESIGN Vs MARKETS AND THEIR INTERRELATIONSHIP DON'T MISS DESIGN '56

A NEW ALLISON FILTER . . . RANGING FROM 10KC TO 640KC

the model 2C CONTINUOUSLY VARIABLE PASSIVE NETWORK AUDIO FREQUENCY FILTER

Another significant engineering achievement . . . the model 2-C Allison Filter has been designed for telemetering and general electronics applications in frequencies ranging from 10kc to 640kc. It offers unprecedented technical advantages through precise performance, range and versatility of application and easy maintenance-free operation.

write for engineering bulletin with complete technical data.

FEATURES

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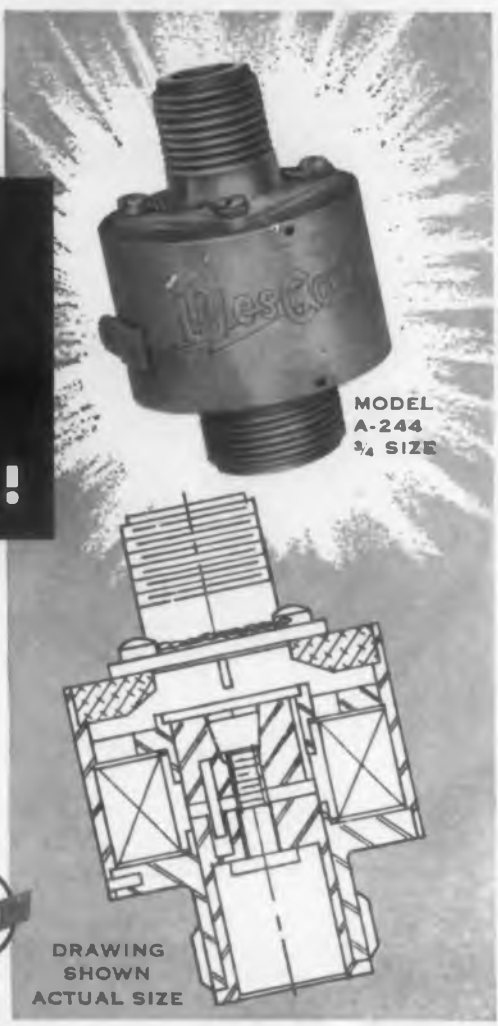

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Books . . .

Principles of Guided Missile Design . . . *Edited by Grayson Merrill, Captain, U.S.N. D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. 729 pages, price $12.50.*

This is one of several volumes, collectively entitled Principles of Guided Missile Design, which endeavor to set forth the underlying principles of guided missile technology. This volume, entitled "Guidance", deals with the devices and techniques that are employed to guide missiles. The series is designed to give a basis for instruction to professional engineers, technical officers of the armed services, and graduate students, to enable them to become well-grounded in the technology of guided missiles.

The completed work represents the coordinated writings of a group of specialists rather than the efforts of a single author. The "Guidance" section, comprising this volume of the series, was written by Arthur S. Locke and a group of associates of the Naval Research Laboratory, many of whom have served as consultants to the military in the solution of specialized problems relating to guided missile systems.

Chapters 1, 2, 3, and 4—covering the introduction to and the fundamental problems of missile guidance, the prior and presently available and related arts, terrestrial and celestial reference information, and the transmission of radio waves,—were written by Mr. Locke. Sixteen other chapters written by various other contributors, include such subjects relating to guided missiles as: Emission, Transmission and Detection of the Infra-Red; Servo System Theory; Measurements of Missile Motion; Detection and Information Gathering: The Analysis of Flight Paths; Prelaunching and Launching; and Missile Guidance Bandwidth Studies.

A Professional Look at the Engineer in Industry . . . *124 pages, paper-bound. National Society of Professional Engineers, 1121 15th St. N. W., Washington 5, D. C. $3.00. (NSTE members, $1.50.)*

The growing shortage of engineers in the United States, with its implications for national survival in the present technological race, has focused a great deal of attention on the conditions of employment of engineers in industry. This volume on the subject is the work of a committee of the National Society of Professional Engineers. It reviews the recent history of engineers as employees under the impact of various pieces of national legislation such as the Wagner Act and Taft-Hartley Act. The rise of engineering unions is carefully analyzed in relations to these two acts of Congress. A number of tables of engineers' salaries and definitions of professional status of engineers are presented.

The chapter headings alone give some insight into the content of this volume. They are: "The Impact of the Wagner Act"; "The Medicine of Taft-Hartley"; "Taft-Hartley in Action"; "The Causes of Dissatisfaction"; "The Influence of Unions"; "Professionalism vs. Unionism"; "The Middle Ground"; and "A Program of Action". This last chapter in general calls for an improvement in the professional status of engineers, an improvement that must be stimulated not only by the employer but by engineers as well.

This volume is of particular value to employers and managers of engineers. It is possible that the shortage of engineers can be improved by obtaining a greater creative output from our present engineers. This volume will also be of great interest to young engineers who are not familiar with the status of the professional position of engineers as it has developed in the last twenty years.

Wireless and Electrical Trader Year Book: Radio, Television, and Electrical Appliances 1955 . . . *Trader Publishing Co., Ltd., Dorset House, Stamford St., London, S.E.I. 304 pages.*

One of the principal aims of the Year Book is to assist traders to keep abreast of the constant changes in the names, addresses, telephone numbers and products of the firms engaged in the radio and electrical industries. It is the standard guide for all persons connected with sales or services, and is of great assitance to overseas buyers wanting to contact British sources of supply.

The new 1955 edition features condensed specifications of nearly 300 current commercial TV receivers and information on tube and cathode ray tube base connections, with over 300 tube base diagrams. A valuable addition is the special section giving both alphabetical and territorial lists of radio and electrical wholesalers in which association members are indicated. Principle contents include: Directory of Principal Trade Organizations; Legal and General Information; Wage Rates; Radio Receiver I-F Values; Addresses of Electricity Boards; Trade Addresses and others.

For easy reference, the Year Book is divided into sections printed on individually colored paper and each section is separated by a card, with thumb index, giving details of the contents.

Electron and Nuclear Counters: Theory and Use . . . *By Serge A. Korff, 363 pages, D. Van Nostrand Co., Inc. 250 Fourth Ave., New York 3, N. Y., $6.75.*

The amazing expansion in the use of electron and neutron counters in the last ten years has resulted in a second edition to this work first published in 1945. The most important addition to the book is a chapter on scintillation counters written by Dr. H. Kallmann of the Dept. of Physics of New York University. Obsolete material has been eliminated in this new edition. Although written primarily for the user of such counters, it contains valuable information for the designer.

When the gun failed, they used a tablespoon

HE LEARNED acting the hard way, barnstorming frontier towns by barge and stagecoach, playing in sheds and taverns.

Once a Texan even suggested the troupe tour through Indian country, carrying their stage weapons for protection. Joe Jefferson declined. He later said he shivered when he imagined himself facing a hostile Indian and armed only with a stage pistol whose tendency to misfire had several times "compelled our heavy villain to commit suicide with a tablespoon."

By the 1860's Jefferson was America's favorite actor. They loved him everywhere because he was a genius at making people happy. And his sunny outlook on life still sparkles in the spirit of modern America. Like Joe Jefferson, Americans still know how to travel a hard road to reach their goals, how to smile when the going's roughest.

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Basic Mathematics for Science and Engineering . . . *by Paul G. Andres, Hugh J. Miser, and Haim Reingold. 846 pages, John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $6.75.*

Closely resembling the common handbook in outside appearance, this work is a revision of a book first published in 1944 under the title "Basic Mathematics for Engineers". The needs of scientific as well as engineering curicular are met. The portion of the book devoted to analytical geometry has been expanded and all the exercises have been replaced.

Designed for the engineering student, this book presents all the mathematics required for the pursuit of elementary science and engineering courses and serves as a preparation for a course in calculus. The book is recommended for review purposes for the engineer in industry. Among the subjects covered are simple properties of numbers, algebraic operations, logarithms, elements of solid analytic geometry, and the elements of differential and integral calculus. There are more than 7000 exercises included in this volume.

Transistor Electronics . . . *by Lo, Endres, Zawels, Waldhauer, and Cheng of RCA Laboratories. Prentice Hall, Inc., 70 Fifth Ave., New York 11, N. Y. 521 pages, price $12.00*

In previous books written on transistors, too much emphasis had been placed on analogies between vacuum tube and transistor circuits, consequently, the unique circuit possibilities of the transistor were obscured.

This book, written particularly for design engineers and graduate electrical engineers, covers many fields from amplifiers to digital computers. Emphasis is placed on a basic understanding of the circuit aspects of the transistor, and description and analysis of circuits are directed towards the principles governing the operation of these circuits. Where it is believed that contrasts and parallels between transistor and vacuum tube circuits add perspective, they have been included in the text. Discussions of the physical principles governing transistor operation have also been included to facilitate intelligent use of the transistor.

Know Your Packaging Materials: Foils, Paper, Films, Boxboard, Foam Plastics . . . *American Management Association, 330 W. 42nd St., New York 36, N. Y. 123 pages, price $1.75 ($1.00 to AMA members).*

Of valuable interest to design engineers working in small factories is this booklet on packaging materials. It is a compilation of papers presented at the American Management Association Packaging Conference held in Chicago in April, 1955. Most of the papers include descriptions of make-up and manufacturing processes and a presentation of outstanding properties and typical applications of these materials.

Eighteen papers describe a wide variety of packaging materials, including: Aluminum Foil, Glassine and Greaseproof Papers, Label and Box-Wrap Papers, Boxboard, Acetate, Cellophane, Polyethylene, Saran, Rubber Hydrochloride, Vinyls, and many others.

A Catalogue of Devices Useful in Automatic Data Reduction . . . *by Robert S. Hollitch and Albert K. Hawkes, 73 pages, Armour Research Foundation, Illinois Institute of Technology, Chicago 16, Ill. $1.50.*

Design engineers called on to set up a program involving the reduction of considerable amounts of data for input to computers will find this catalog to be of great value. It is also valuable to engineers who are called on to design devices to work with the equipment listed in the book.

Included are analog voltage to digital converters, shaft position digitizers, digital plotters, digital to analog converters, digital voltmeters, and special tape recorders. Each device is listed on a separate page with the manufacturer's name and some technical specifications. Information on whether the unit is commercially available or only in the development stage is also given in the volume.

WHAT'S NEEDED IN '56?
The Industry Lists COMPONENT REQUIREMENTS in DESIGN '56

Abstracts

Pertinent condensations from foreign journals, house organs, reports, and periodicals of related technologies that frequently miss the attention of electronic designers.

New Russian Miniature Tubes

	Units	1A1P	1A2P	1K1P	1K2P	1B1P	1B2P	2P1P	2P2P	
Filament voltage	volts	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Filament current	ma	60	30	60	30	60	30	120	60	60
Plate voltage	v	60	60	60	60	60	60	90	90	60
Voltage on 3d grid	v	−1.0	−0.5	—	—	—	—	—	—	—
Voltage on 2d grid[1]	v	45	45	45	45	45	45	90	60	60
Voltage on 1st grid[2]	v	−12	−5	−0.5	0	0	−4.5	−4.1	−4.1	3.5
A-c volt on 1st grid	v	12	8	—	—	—	—	3.2	2.9	2.5
Plate current	ma	0.4	0.55	1.7	1.15	1.0	1.0	9.5	3.0	3.5
2d grid current[3]	ma	1.9	0.85	0.6	0.25	0.25	0.2	2.2	0.6	0.8
Current drain[4]	ma	2.3	1.4	2.3	1.4	0.06	0.06	1.7	3.5	4.3
Transconductance[5]	ma/v	0.19	0.19	0.65	0.65	0.5	0.55	2.0	0.95	1.1
Conversion transconductance	ma/v	0.825	0.5	—	—	—	—	—	—	—
Internal resistance	kilohm	1500	1500	1500	1500	1000	1200	85	160	120
Load resistance	kilohm	100	100	100	100	700	700	10	25	20
Amplification factor at load Z_L 100,000 ohm		18	18	61	61	—	—	—	—	—
Amplification factor at $R_L = 700$ kilohm		—	—	—	—	35	42	—	—	—
Output Power	mw	—	—	—	—	—	—	250	100	65
Coefficient of nonlinear distortion	%	—	—	—	—	—	—	7	10	10
Filament power	mw	72	36	72	36	72	36	144	72	72
Plate circuit power, [4] and [6]	mw	138	84	138	84	4	4	1050	324	258
Total power drain	mw	210	120	210	120	76	40	1194	396	330
Economy in voltage amplification[7]	mw^{-1}	0.085	0.15	0.29	0.52	0.46	1.05	—	—	—
Economy in power amplification[8]	—	—	—	—	—	—	—	0.210	0.252	0.197
Sensitivity to power amplification	mw/v^2	—	—	—	—	—	—	24.4	11.9	10.4
Input capacitance	picofarad	7.0	5.4	3.5	3.0	—	1.85	5.5	—	3.7
Mutual capacitance	picofarad	0.4	0.4	0.01	0.01	—	0.27	0.5	—	0.4
Output capacitance	picofarad	7.0	6.0	7.5	4.9	—	2.1	4.0	—	3.8
Life test	hours	1000	1000	1000	1000	1000	1000	500	—	1000
Tube life criteria:										
Transconductance[5]	ma/v	0.125	0.10	0.54	0.32	0.40	0.25	—	—	—
Output power	mw	—	—	—	—	—	—	135	—	35

Russian Symbols

S_{np}	conversion transconductance	ma/v
I_a	plate current	ma
I_{c2+4}	2d & 4th grid current	ma
U_{c3}	3d grid voltage	v
I_{c2}	2d grid current	ma
U_H	filament voltage	v
U_a	Plate voltage	v
U_{c2+4}	voltage on 2d & 4th grid	v

SEVERAL new miniature tubes, 19mm (0.75″) in diameter and up to 56mm (2.2″) high were recently developed in Russia. These include a heptode, 1A2P; h-f pentode, 1K2P; diode-pentode, 1B2P; and output pentode, 2P2P. The filaments in all but the last draw 30ma at 1.2v. The 2P2P pentode has two filaments, which can be used either in series (2.4v, 30ma) or in parallel (1.2v, 60ma).

These tubes supplement existing similar tubes, namely 1A1P, 1K1P, 1B1P, and 2P1P. The characteristics of all the tubes are given in the two tables and four graphs below:

Maximum Ratings

Quantity	Units	1A1P	1A2P	1K1P	1K2P	1B1P	1B2P	2P1P	2P2P
Max. fil. volt	v	1.4	1.4	1.4	1.4	1.4	1.4	1.4 or 2.8	1.4 or 2.8
Min. fil. volt	v	0.95	0.9	0.95	0.9	0.95	0.9	0.95	0.90
Max. anode volt	v	100	250	100	250	100	250	100	250
Max. volt on second and fourth grids	v	75	60	75	60	75	60	100	60
Max. d-c component of cathode current	ma	6.5	3	6.5	3	4	2	13	5
Max peak value of cathode current	ma	—	6	—	—	—	—	—	10
Max. dissipation	w	—	0.2	—	0.2	—	0.15	—	0.3

Footnotes to table:

1. For heptodes 1A1P and 1A2P—voltage on second and fourth screen grids.
2. For heptode 1A1P—resistance in circuit of first grid, $R_{C_1} = 100$ kilohm; if the tube is used in a typical oscillator circuit with normal feedback, the current in the first grid is $I_{C_1} = 0.12$ ma. The corresponding figures for the heptode 1A2P are $R_{C_1} = 50$ kilohm, $I_{C_1} = 0.10$ ma.
3. For heptodes 1A1P and 1A2P—current in second and fourth screen grids.
4. For diode-pentodes 1B1P and 1B2P the "current drain", "amplification factor" and "plate-circuit drain" are given for $R_p = 1.0$ megohm, $R_{C_2} = 3.5$ megohm, plate voltage 60 volts, and resistance in the control-grid circuit of the next tube is $R_{C_1} = 2.2$ megohms.
5. For heptodes—slope of conversion characteristic.
6. Including the power drawn by the screen-grid circuit when the latter is fed through a suppressor resistance from the full plate battery.
7. For heptodes—economy of voltage amplification with frequency conversion (Gain/power dissipation).
8. Overall efficiency, taking into account the power consumed by the filament and by the grid circuit of the second grid.

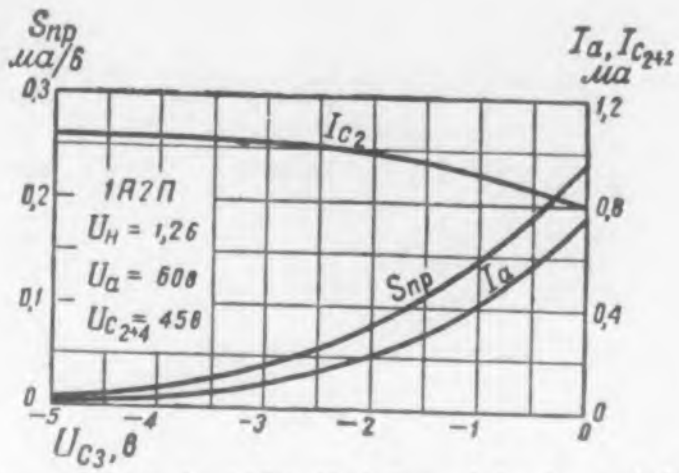


Fig. 1. Heptode 1A2P. Variation of I_a, I_{c2} and S with U_{c1} [U_{c3} on abscissa is in error].

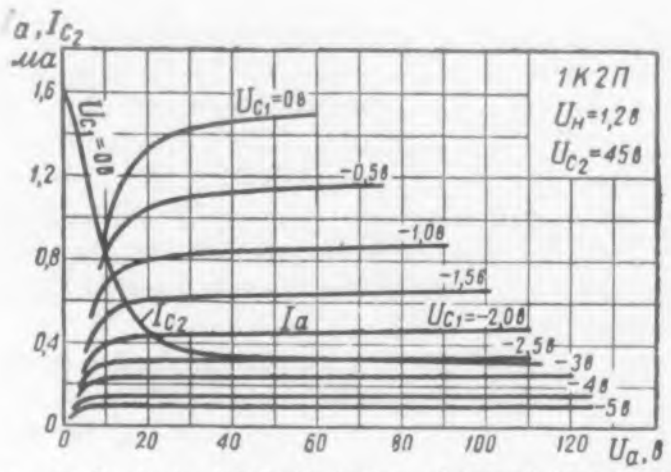


Fig. 2. Pentode 1K2P. Variation of I_a and I_{c2} with U_a

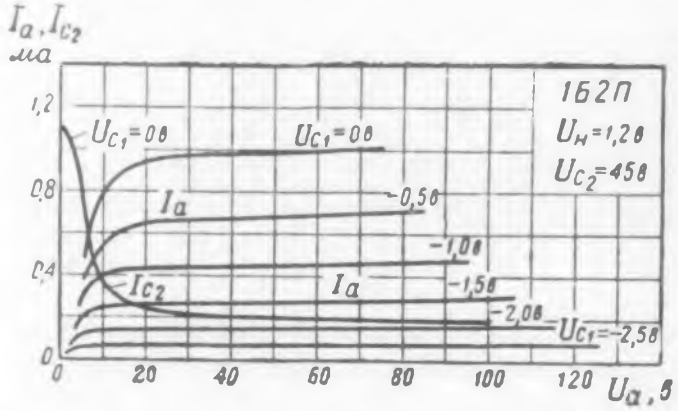


Fig. 3. Diode-pentode 1B2P. Variation of I_a and I_{c2} with U_a

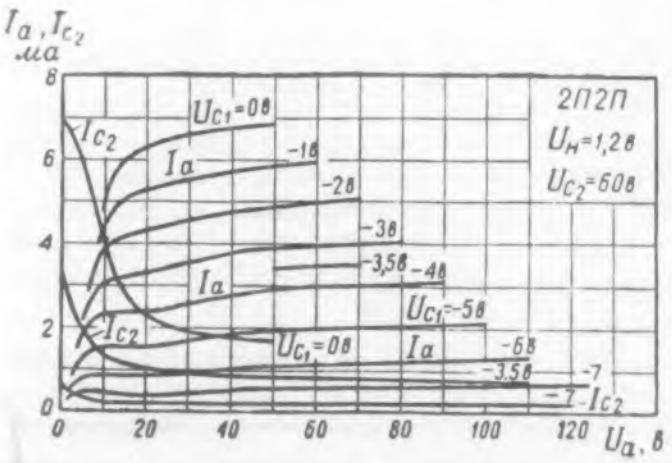
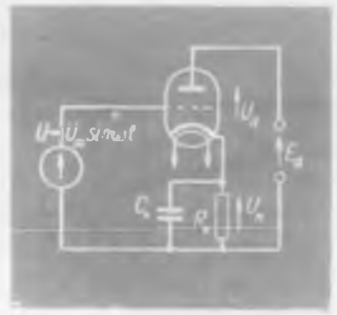


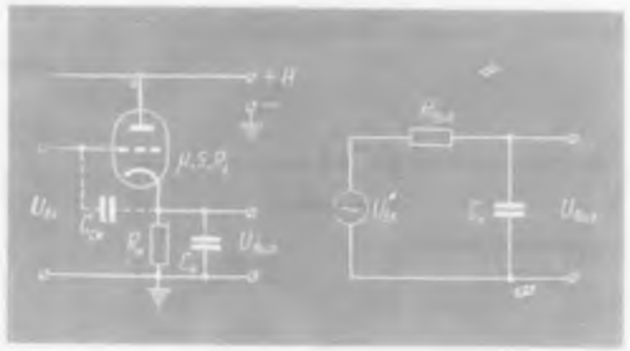
Fig. 4. Pentode 2P2P. Variation of plate current and screen-grid current with plate voltage.



Design of Cathode Detector

PRINCIPAL advantages of a cathode detector are that it has a low output impedance and a high input impedance that remains constant over the entire period of the detected voltage. Another advantage is a linear detector characteristic over a rather wide range of input-signal variation. The cathode detector is much more suitable for transmission of the d-c component of a signal, an important factor in video-signal detection, and is less affected by overloads. These properties of the cathode detector permit a considerable reduction in distortion produced in the detector stage, particularly frequency distortion—again of considerable advantage in television receivers. Among the disadvantages of cathode detectors are a reduced sensitivity to weak signals (below 1-3v); this is hardly significant with modern signal levels.

The design of cathode detector stages involves certain pitfalls, which undoubtedly contributed to slow adoption of this type of circuit. This article contains a procedure for design of a cathode detector, taking into account the effect of zero-load current in the tube. The article points out that the static characteristic of the tube cannot be approximated in this case by a quadratic or exponential curve, since the input signal varies of a rather wide range and the load resistance is low; a better approximation is to employ two approximations for the static characteristic of the tube. For weak signals, the characteristic is assumed to consist of a quadratic portion and a straight line portion; this agrees well with the physical phenomena that take place in the tube and gives theoretical results that agree well with experimental values if the signal amplitude is relatively low. For stronger signals, the characteristic is better approximated by a broken line, at which the calculations become simpler and the agreement with the experimental results is even better. Graphs showing these approaches are included.



Design of Cathode Follower

ANALYSIS of the operation of the cathode follower operating with trapezoidal signals and feeding an RC load is the subject of an article on designing cathode followers for pulsed operation. The article takes into account the time-delay of the wave front and the distortion of the pulse shape at the output signal, as well as the transients associated with the leading and trailing edges of the voltage pulse applied between the grid and cathode of the tube (these transients may cause the cathode follower to lose partially or totally its usual behavior with high feedback).

The article derives the equations relating the parameters of the cathode-follower circuit under optimum conditions with the pulse parameters of the input signal. The analysis is made on the assumption that the input signal is a unipolar trapezoidal voltage pulse (results of the analysis are also valid for bipolar input signals). In practice the fronts of the input pulses may be closer to exponential than to trapezoidal, in which case the operating requirements imposed on the cathode follower are considerably less stringent.

The author remarks, in passing, that even if the input signal is a h-f sine wave, it is still necessary to take into account the phase shift between the input and output voltages when calculating the maximum allowable input voltage, input capacitance, etc. The phase shift between the input and output voltages may have effects that are analogous to those produced by pulse signals.

A second article is entitled "Parallel Balanced Followers" and gives an extensive tabulation of the design equations for three types of followers: symmetric with large signal swing, asymmetric and asymmetric with large signal swing. The article also gives the calculation of the bias required to obtain the maximum permissible input signals to maintain linearity of the output signal, and to obtain optimum tube operation. The values of the resistance ratios required for maximum power sensitivity and for maximum power delivery to the load (at maximum input signal) are also computed.

The calculations show that a symmetric follow-up with large signal swing delivers considerably more power to a load than an ordinary symmetric follower, with other characteristics (such as drift, bandpass, etc.) remaining unchanged. At the same time the anode current drawn is independent of the value of the input signal.

The asymmetric follower circuit is shown to be suitable for those cases, when one terminal of the input signal is best connected to the minus terminal of the B supply. The anode current drawn by the asymmetric follower circuit depends on the input signal—this is one of the disadvantages of the circuit, for it may cause a multi-stage amplifier to oscillate.

The asymmetric follower circuit with wide signal swing is suitable for use as an output stage of a power amplifier, operating with a d-c driver stage. The per-

Either approximation yields a theoretically linear detection characteristic for strong signals, in complete agreement with experiment.

Unlike earlier calculations, the design computations given in the article take into account the current flowing in the tube between signals, making the design procedure given here more general. The resultant expressions for the parameters of the cathode detector and its equivalent circuit indicate that it is, looking into the output terminals, analogous with the equivalent circuit of the diode detector.—*Design of Cathode Detector by L. Ia. Miziuk*, Radiotekhnika, *June, 1955, 10 pages. Translated by J. George Adashko.*

missible negative input signals are considerably larger than those with a simple asymmetric balanced follower. The permissible positive signals are also considerably larger, provided the load resistance is low and optimum positive bias is applied to the grid.

All the follower circuits feature low internal impedance but they are more sensitive to variation in filament voltage than to variation in plate voltage; the lower the load, the greater the sensitivity to voltage fluctuations. Once the load resistance exceeds 15,000 ohms, the normal tolerances of voltage fluctuation become acceptable.

The large-swing circuits exhibit u somewhat better linearity of the amplitude characteristic, because of the higher values of the load resistance and to the higher cross-coupling coefficient.—*From articles "Design of Cathode Follower for Pulsed Operation" by B. N. Fay-Zulayev, Radiotekhnika, June 1955 and "Parallel Balanced Followers" by A. A. Sukalov, Automatika I Telemekhanika, No. 2, 1955.*

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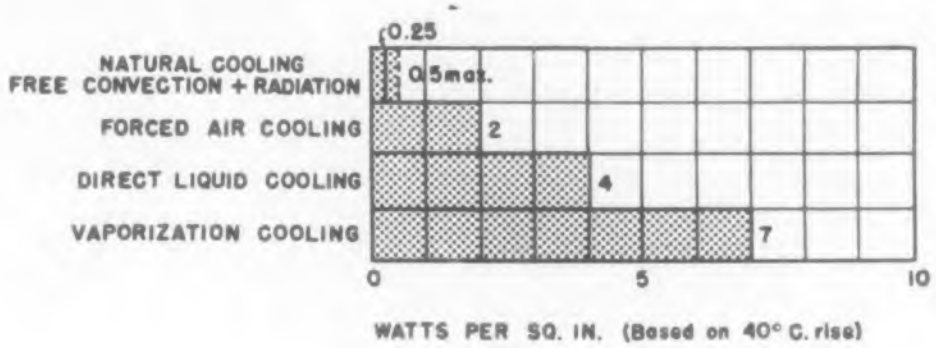
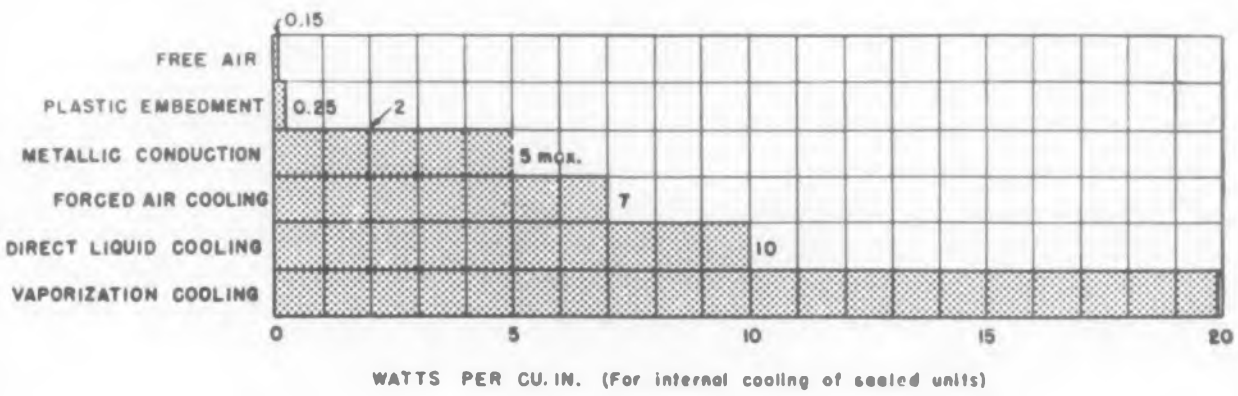
Heat Transfer Problems





ELECTRONIC heat removal can be divided into three phases: The removal of heat from the source; the intermediate phase of transferring the heat along a thermal path to the ultimate sink; and the dissipation of the heat at the ultimate sink.

Natural methods of heat removal have been suitable for electronic assemblies in free air with power densities smaller than 0.5 watts per square inch. Plastic embedment, especially of vacuum tubes, has been found to be applicable to equipments of low power densities, but the poor conductivity and other thermal properties of the plastics are not compatible with high power densities, especially when service is continuous.

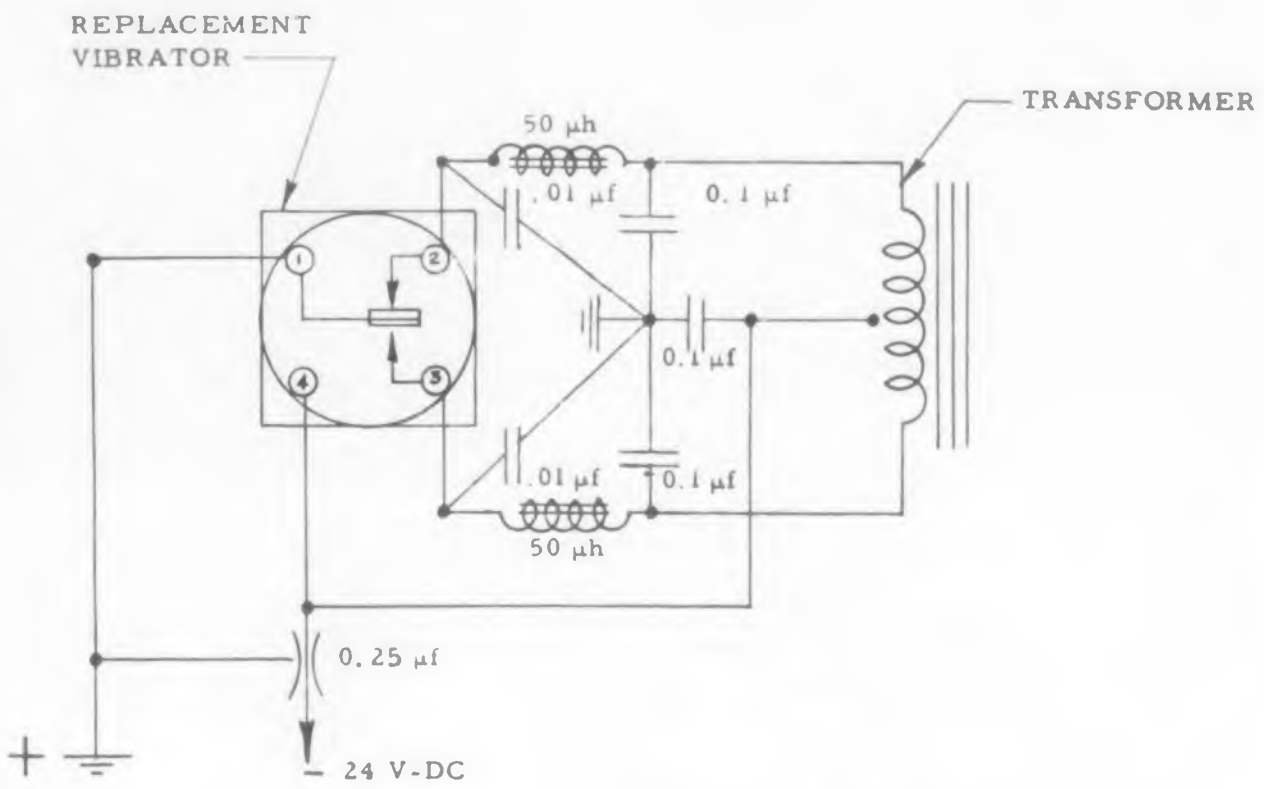
Convection cooling of heat sources in electronic equipment is used by some, but the general trend is toward higher power densities which require the use of other cooling methods. Radiation cooling has not been used as a primary means of heat removal.

Forced air cooling is frequently used. Special air-to-air heat exchangers with forced circulation have been developed for airborne electronic assemblies. Turbulent air cooling has been applied to devices of higher power densities.

Liquid cooling has found acceptance for heat removal in several new equipments. Direct or indirect liquid cooling can be used depending upon the compatibility of the coolant with the electronic parts and circuit performance. Here again the disadvantages of these techniques with respect to maintenance must be considered. Heat has been transferred efficiently in high power density devices with silicone fluids, petroleum base oils, and water.

Vaporization cooling of electronic equipment can be accomplished by direct, indirect, expendable, or nonexpendable cooling systems. The absorption of the latent heat of vaporization of the coolant makes possible an efficient means of heat removal, especially in equipment of high power densities. Tables show the various types of cooling appropriate for different power densities. The graphs illustrate two methods for determining power densities: Watts per square inch (using surface area as a basis); and watts per cubic inch (using the volume as a basis). Heat has been removed from vacuum tubes by many methods. However, improved means of cooling subminiature vacuum tubes, without the use of liquid or vaporization cooling, are required for equipments of medium power densities. The relationship of tube life to tube temperature has been found to be of the utmost importance. To answer the need for some standardization of procedure in temperature determination, the Bureau of Ships has published a "Manual of Standard Temperature Measuring Techniques, Units and Terminology for Electronics Equipment," NavShips 900, 187.—*From an article "Heat Transfer Problems in Electronic Equipment," p. 27-29,* Bureau of Ships Journal, *Oct. 1955.*

Radio Interference Suppression



The suppression system applied to the vibrator in a 20-cycle ring includes a pi-type filter network on each line to the transformer; a feed-through capacitor on the d-c input to prevent interference from being conducted by the d-c line. Filter network can be mounted on the d-c input. In addition capacitors are installed just before the exit of the output leads from the shield, (not shown) to by-pass any residual interference that might have been coupled back into the leads.

Comparison Table for Relay Voltage-Surge Suppressors

Surge Suppressor*	Release Time Milli-Seconds	Peak Volts
Unprotected	7.6	617
Selenium Rectifier	55	57
Selenium Rectifiers (Back to Back Construction)	10.5	160
Varistor	12.8	131
Resistcr-Capacitor Networks		
0.5uf + 510 ohms	10.9	160
0.1uf + 510 ohms	7.6	617

*relay coil for 48v operation has 1650 ohms resistance and inductance of 3.45h.

ELECTRONIC devices cause radio interference either because they are used as switching devices or because they act, purposely or incidentally, as alternating-current generators.

Transmitters may radiate interference at frequencies just above or below the assigned frequency or at its harmonics or subharmonics. Radio-interference problems must be considered during the design stages. Suppression measures may include: *a.* use of a high-stability oscillator, preferably crystal-controlled; *b.* shielding of the component parts and interconnecting wiring; *c.* feed-through capacitors or filters in the power and control leads; *d.* harmonic-suppression filters in the antenna circuit.

Radar modulators produce large amounts of pulsed energy and can be severe sources of interference at all radio frequencies. Suppression measures include: *a.* feed-through capacitors or filters in the power and control leads; *b.* complete shielding of the unit; *c.* electrostatic shield between the primary and secondary windings of the power and filament transformers; *d.* individual shields on the power leads. Adequate filtering, may reduce shielding requirements.

Local oscillators in superheterodyne receivers may radiate interference from the chassis or the antenna. Chassis radiation is usually caused by poor choice of ground points. Antenna radiation is best prevented by the insertion of an r-f amplifier stage ahead of the mixer or by careful shielding of the oscillator and mixer stages.

Parasitic oscillations may often be suppressed by minor circuit modifications, as adding a small resistor or replacing the choke coil.

Vibrators are suppressed by use of: *a.* complete shielding; *b.* feed-through capacitors mounted through the shield on both d-c and a-c leads; *c.* filter networks on both d-c and a-c leads if capacitors are inadequate.

Relays are one of the worst offenders and are suppressed by *a.* shielding, *b.* R-C networks, *c.* selenium rectifiers or varistors, *d.* filters.

Thyratrons are essentially high-speed switches and may be treated like relays and vibrators.

Since proper bonding and installation of bypass capacitors count for more than two-thirds of all suppression, over 30 pages are devoted to this topic. Bonds, types of capacitors and low leakage shielding are discussed and amply illustrated. Approved suppression components are tabulated. The 270 page report includes also sections on rotating machinery, ignition systems, fluorescent lamps and instruments. Complete suppression of such equipments as vehicles, aircraft, etc., are discussed.—*Report PB 111611*, Radio Interference Suppression Techniques, *dated November, 1953. OTS, U. S. Department of Commerce, Washington 25, D. C.; $6.75.*

What the Russians are Writing

Books

NAVAL RADIO NAVIGATION EQUIPMENT . . . *E. Y. Schegolev, 225 pages (in Russian), State Publishing House for Water Transport, Leningrad, 1954. Available from Four Continent Book Corp., 882 Broadway, New York 3, New York.*

This book is a general survey of electronic navigation systems used for ocean and river travel in the Soviet Union and other countries. Simple loop direction finding systems, Adcock antennas, goniometers, the radio compass, visual indicating devices, deviation errors, night effect, Mercator projection, gnomonic projection and types of radio beacons are discussed.

Considerable space is devoted to radar as an aid to navigation. Pulse formation, u-h-f techniques, magnetrons, klystrons, lighthouse tubes and radar antenna systems are also discussed in a succinct manner. Several radar-scope photographs are included to explain proper scope interpretation. The use of passive reflectors and radar mapping are also covered.

The Loran system and associated equipment is explained, although it is not used in the Soviet Union. The Russians prefer the phase-differential system for long distance navigation. Individual RF cycles are compared rather than difference in arrival times of pulses. Various systems employing this basic principle, including the English Decca Navigator system, are also described. The autor claims that the Soviet scientists Papaleksi and Mandelshtam did the pioneering work in this field in the early thirties and chides the British for not giving them due credit.

The concluding section of the book is a critique of the various electronic navigation systems and includes a unique chart listing their operational characteristics.—*Reviewed by Richard E. Daniel, Electronic Engineer, Hoffman Laboratories, Inc.*

Soviet Editorials

The Russian radio amateurs are organized in a "Voluntary Society for Cooperation with the Army, Air Force, and Navy (DOSAAF). From an editorial entitled "Let us Expand Construction by Radio Amateurs," published in the August 1955 issue of *Radio,* a popular-technical monthly, it appears that the activities of Soviet amateurs are not restricted to communication or construction of communication equipment. In addition to usual "ham" gear, amateurs construct television and radio receivers, measuring instruments, and a variety of electronic equipment that would normally be developed in the USA by commercial laboratories. Thus, the editorial calls on the amateurs to redouble their effort in applying electronics to agriculture, transport, construction, and industry in general. It also urges them to help expand the use of radio and electronics in automatic-control and measuring techniques.

Among the highly praised products shown at the 12th All-Union Exhibit of equipment constructed by DOSAAF members are a television set, an automatic record changer, and an electro-encephalograph. Photographs of the exhibited articles seem to indicate that the amateurs pay considerable attention to the external finish and cabinet work—none of our breadboard or rack-and-panel type of construction is shown.

Another article in the same magazine urges the amateurs toward extensive study of semi-conductor technology. The author's opinion is that this is the science of the future, and states that it can "already be predicted that a considerable portion of steam, refrigerating, and dynamo machinery and perhaps even central-heating systems will be replaced by semi-conductor thermocouples, that semi-conductor instruments will replace vacuum-tubes in radio engineering, with accompanying reduction in size, cost, and energy consumption of radio apparatus. It will become possible to automatize extensively all technical process and to control them from a single point. Stored daylight will be used for night-time illumination. Sunlight will yield electric energy for radio reception and for domestic needs. Electricity will be obtainable not only from atomic electric stations, but directly from radioactive radiations."

Including annotated tables of contents of leading Soviet journals that publish papers on electronic circuit design and behavior.

Avtomatika I Telemekhanika, March-April, 1955, No. 2, 112pp.

Simulating Automatic Control Systems having Typical Non-Linear Characteristics, by B. Ia. Kogan. Typical non-linear characteristics of an automatic-control system can be obtained entirely with combinations of a resolving amplifier and diode limiter. Simulation of backlash and transmission and of friction can be realized by various circuits even in the absence of an inertia load. In the presence of an inertia load, on the driven shaft of the actuating mechanism and of end play in the transmission, it is best to construct simulating circuit so that it can automatically transfer from one set of equations to another set with the aid of diode switches. American references are cited.

Synthesis of Optimal Systems with the aid of Phase Space, by A. A. Feldaum. Develops a procedure for synthesis of optimum systems of automatic control using the first of the methods indicated in another work by the author. The synthesis process proves to be closely associated with the study of the character of the optimum trajectories in the phase space of the system. By the way of results, structural diagrams are given for optimum systems with limitations of the second and third order. The entire synthesis method is based on solution of the problem concerning the form of the optimum process, given by the author in another reference in the form of a theorem on intervals. Cites Transactions of the IRE, article by L. M. Silver.

One Method for Improving the Dynamic Properties of Certain Automatic Control Systems, by V. K. Chichinadze. A method is given for determining the characteristics of feedback networks for the purpose of obtaining prescribed transient processes. References Transactions of AIEE.

Automatic Control of Groups of Compressor Apertures, Interconnected through a Common Supply Line, Part II by A. A. Abduiav. Mathematical considerations of the interaction of regulated compressor apertures, interconnected to a common supply line.

Static Power Converters by S. A. Ginsberg. Consideration of a general theory and classification of static power converters used as primary measuring devices for telemetering and automatic control of power in power systems. A review is given of the static converters of various types. Description, theory principle and technical characteristics of devices include: magnetic power converter; bismuth resistor; bolometric and thermocouple power converters; rectifiers, vacuum tubes, and non-linear magnetic units.

Wattmeter Using Carborundum Resistance by V L. Benin. Suggested circuit of a measuring power element (wattmeter) using carborundum resistances for automatic power control systems. Conclusions claim that the wattmeter has a high stability and can be used as a measuring element in automatic control and telemetering circuits.

If you are interested in the translations of any of these articles, write to the Editor of ELECTRONIC DESIGN. *We can refer you to a competent technical translator. Some sources have translations on hand at modest costs.*

Standards and Specs

Sherman H. Hubelbank

This department surveys new issues, revisions, and amendments, covering military and industry standards and specifications. Our sources of information include the Armed Services Electro-Standards Agency (ASESA), the cumulative indexes to Military Specifications, Vols. II, IV, American Standards Association (ASA) and other standards societies.

Transistors

MIL-T-2380(USAF), General Specification for Transistors, 5 July 1955 . . . This spec covers transistors for use in electronic equipment. This spec covers various transistor definitions, materials, performance, markings, transistor abbreviations, quality assurance, qualification tests, acceptance tests, mechanical tests, electrical measurement tests, and degradation tests.

Handbooks

MIL-H-6544A(USAF), Handbook; Installation Instructions (for Communications - Electronics Equipment Items), 26 July 1955 . . . Requirements for the preparation of a handbook of installation instructions for communications—electronics equipment items are covered by this spec. These instructions are intended to provide for data for planning the installation as well as for the actual installation. Two new section headings have been introduced by this spec, Logistic Data and Installation Engineering.

Meters

MIL-M-10304A, Meters, Electrical Indicating, Panel Type, Ruggedized, 27 September 1955 . . . Preproduction tests have been deleted and qualification approval tests have been included in this spec. An appendix has been added covering the procedures for qualification approval and a plan for submission of samples. The list of referenced specs and the requirements for packing, packaging, and marking have been revised. This spec supersedes MIL-M-10304 (SigC).

Filters

MIL-F-15733C, Filters, Radio Interference, 21 September 1955 . . . The requirements for vibration, temperature and immersion cycling, and moisture resistance have been changed to conform to MIL-STD-202. Detailed requirement paragraphs for six filter types have been added. Information concerning mounting brackets has been added. Marking is now required to be in accordance with MIL-STD-130. The insulation requirement after vibration has been deleted.

Attenuators

MIL-A-3933(AMENDMENT-1), ATTENUATORS, FIXED (COAXIAL-LINE AND WAVEGUIDE), 8 SEPTEMBER 1955 . . . Prereproduction tests are now mandatory instead of having to be specified on each individual MIL-STD.

Cables

MIL-C-17B, CABLES, RADIO FREQUENCY; COAXIAL, DUAL COAXIAL, TWIN CONDUCTOR AND TWIN LEAD, 7 SEPTEMBER 1955 . . The list of referenced specs and the requirements for packing and packaging have been revised. The preferred characteristic impedance has been stablished at 50 ohms for 12 cable types. Specific tests are now included for attenuation, velocity, and transmission unbalance tests. The attenuation requirements have been tightened and Type III jackets have been eliminated. Nineteen new cable types have been added and 59 cable types have been deleted. This revision supersedes spec JAN-C-17A and Amendment-3.

Resistors

JAN-R-19 (AMENDMENT-7), RESISTORS, VARIABLE WIRE-WOUND (LOW OPERATING TEMPERATURE), 18 JULY 1955 . . . The list of referenced specs and publications, the requirements for packing, packaging, and marking for shipment have been revised. The methods of packing and packaging have been simplified and economies effected by establishing three groupings: immediate use, short time storage, and overseas shipment.

MIL-R-8781 (USAF), RESISTORS, FIXED, WIREWOUND, POWERTYPE, CHASSIS MOUNTED, (TENTATIVE SPEC) . . . The Electronic Components Laboratory, Wright Air Development Center, is processing this spec and is inviting comments on it. The spec covers power type, wire wound, fixed resistors that utilize the principles of heat dissipation through a metal mounting surface. These resistors have a resistance tolerance of 1% and are capable of operating at unusually high ambient temperatures when suitably derated. They are not suitable for applications where alternating current characteristics are of critical importance. Copies of this tentative spec may be obtained from Wright Air Development Center, Attn: WCREG-4, Wright-Patterson Air Force Base, Ohio.

Switches

MIL-S-6807A(ASG), GENERAL SPECIFICATIONS FOR ROTARY SELECTOR SWITCHES, 3 JUNE 1955 . . . Although this spec is an ASG spec, it is intended for use in aircraft electrical systems. The spec covers details of design, construction, interchangeability, performance, workmanship, and quality, including tests and testing procedures.

Federal Cataloging Publications

CATALOGING HANDBOOK H2-1, FEDERAL SUPPLY CLASSIFICATION GROUPS AND CLASSES, MAY 1955 . . . This first part of the handbook describes the structure of the Federal Supply Classification (FSC) and shows the 73 groups and approximately 517 classes in the arrangement of the new 4-digit code numbering system. Available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. for 40 cents.

CATALOGING HANDBOOK H 4-1, FEDERAL SUPPLY CODE FOR MANUFACTURERS, PART 1, NAME TO CODE . . . This book is an alphabetical listing of the names of manufacturers referenced to the applicable nonsignificant 5-digit code which has been assigned to those manufacturers who provide items used by the military. This code is used in supply management and other functions within the Department of Defense. Available from GPO for $2.75.

CATALOGING HANDBOOK H 4-2, FEDERAL SUPPLY CODE FOR MANUFACTURERS, PART 2, CODE TO NAME . . . This numerical listing of the nonsignificant 5-digit code referenced to the name of the manufacturer to whom it has been assigned. Available from GPO for $1.25.

Miscellaneous

MIL-E-7894A(ASG), CHARACTERISTICS OF AIRCRAFT ELECTRIC POWER, 17 MAY 1955 . . . This spec covers the general requirements for the characteristics of the electric power to be supplied airborne equipment and the general requirements for the utilization of electric power by airborne equipment. Complete specs are included for equipment design power requirements covering voltage, frequency, phase, power factor, power tolerances, standby power, warm-up, conversion devices, and load transients.

MIL-A-8064A(USAF), GENERAL REQUIREMENTS FOR ELECTRO-MECHANICAL AIRCRAFT ACTUATORS AND ACTUATING SYSTEMS, 8 JULY 1955 . . . Electro-mechanical actuators, both linear and rotary, and the mechanical portions of all electro-mechanical actuating systems are covered in this issue of the spec. This spec calls for the contractor to prepare a detail design and test spec for each new actuator design and submit this to the procuring activity for engineering approval.

Specifications lsited on this pages are for information only and government contractors should be guided by their contracts. Copies of military specs should be obtained from sources recommended by procuring officers. ASESA bulletins may be obtained from Fort Monmouth, N. J. ASA standards may be obtained from American Standards Agency, 70 E. 45th St., New York 17, N. Y., unless otherwise noted.

Advertising Index

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