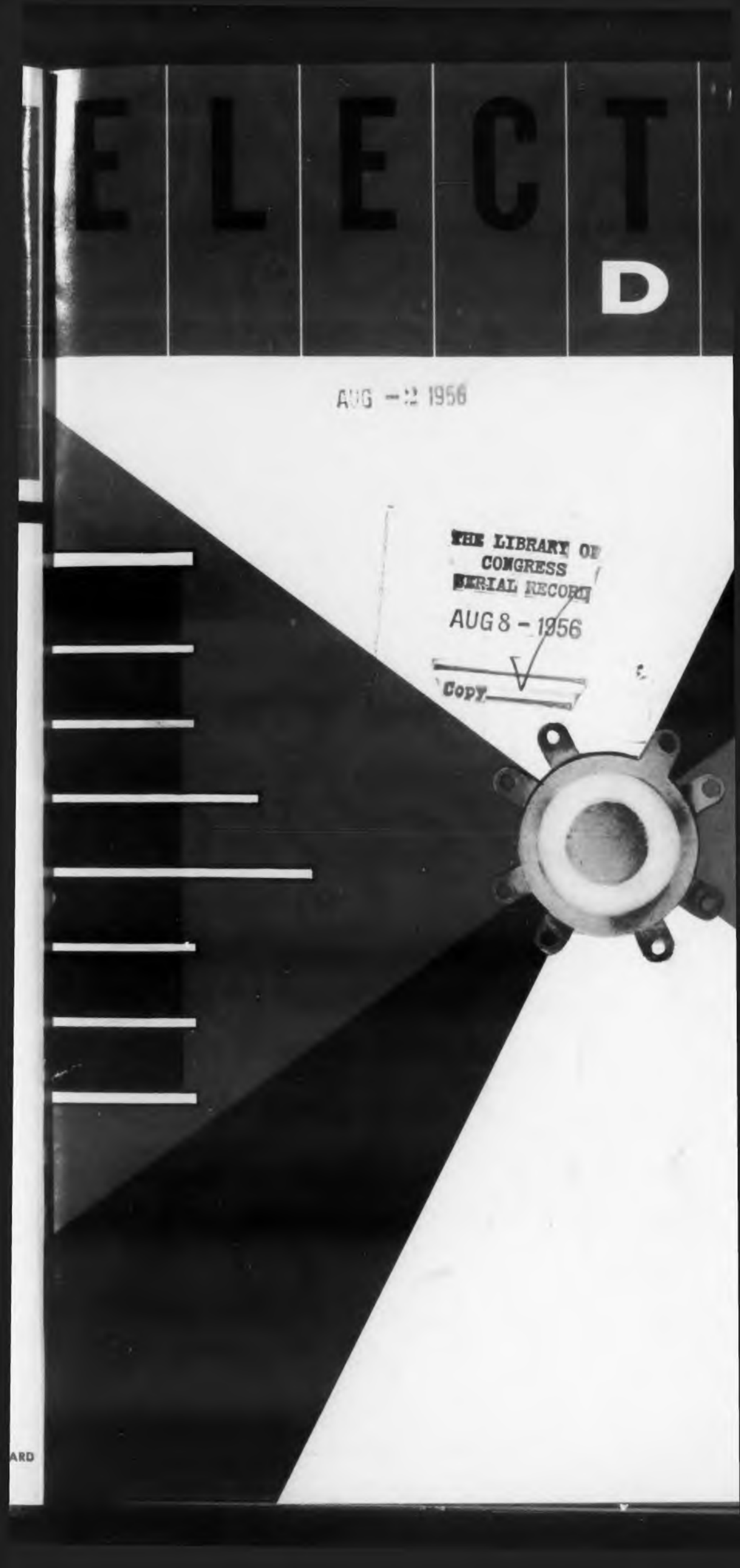

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ESIGN

AUGUST 1, 1958

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CIRCLE 2 ON READER-SERVICE CARD FOR MORE INFORMATION

Editorial

Rules and the Engineer

Since our early years, we've been taught to conform. Basic laws of society must be obeyed. Basic laws of nature conform to certain set conditions. Basic scientific principles prescribe certain effects for certain causes.

Engineering, more than other professions, conforms rigidly to certain rules. Thus the tag "exact sciences" placed on various branches of engineering. For example, there is only one right answer to a problem in mathematics. There is only one right answer to a problem involving a-c or d-c networks.

With this as a background, its no wonder many engineers stick closely to their handbooks and rely strongly on the formulas set down by previous experimenters. Naturally these rules must be followed if the right result is to be achieved. But the danger lies in being afraid to step beyond the boundaries of the rule books and meet challenges involving unusual situations.

Everyone can't be born with this ability. The answer then, is to train the engineers to meet the challenges of the ever changing requirements of the electronic industry. New problems in guided missiles, aircraft electronics, u-h-f communications and many other fields require a mind trained to try the unusual.

Training at the college level aimed at the solution of unorthodox problems is obviously required. Laboratory experiments outlining basic principles are still necessary. But laboratory exercises involving original thinking on the student's part should be required.

A rigid training period in which the student's ability is developed to think "around" the rules should be part of every technical curriculum. Then, upon meeting the challenge for the first time in industry, the new engineer will be prepared; he'll have more confidence in his own abilities. Along with this, he'll need less supervision and will be able to pay his own way in less time. Most important however, is that our technology will move forward even faster.

Electronic News

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

Silent Sound Controls TV Set . . . Supersonic sound generated by a new hand-held remote-control unit operates three functions of a standard television set.

Remote tuning, switching the set on or off, and muting the sound are accomplished by sound waves in the 40kc region. Vacuum tubes, batteries, or electrical connections are not necessary.

Heart of the device, developed by Zenith Radio Corp., is a group of four tuning forks. Small hammers, actuated by keys, strike the tuning forks. Sound waves generated are picked up by a microphone in the front of the receiver. Circuits following include a 40kc amplifier and relay control tubes.

Pressing one key of the control unit turns the channel selector to the left; a second key causes the selector to rotate to the right. A third key mutes or restores the sound, while the fourth key turns the set on or off. Range of the control device is about 50 ft.

American Eye on European Industry . . . Eighteen companies are participating in a plan to keep American industry informed of European technical development. Observers for the program, known as the European Technological Observation Group, will cover Western Europe seeking ideas, developments, and methods that will help sponsoring companies improve their competitive positions. Observers will spend the major portion of their time attending all important and relevant seminars, conferences, trade shows, expositions, and technical meetings.

The fields of mechanical, electrical, and chemical engineering, metallurgy, and chemical production will be covered. Participating firms in the electrical engineering field of the plan are Amphenol Electronics Corp., Louis Allis Co., Warwick Manufacturing Corp., and Texas Instruments, Inc. The program was established by Armour Research Foundation of Illinois Institute of Technology.

Venus Contacts Navy . . . On June 4, 1956, scientists at the Naval Research Laboratory announced the detection of weak radio transmissions emanating from Venus, the Earth's sister planet.

Very weak radio emissions from Venus had been observed several weeks before that date by three NRL radio astronomers, using the 50-foot radio telescope of the Naval Research Laboratory. The Venus transmissions were received on a waveband of approximately 10,000mc.

Data Processing Network Feeds Computer . . . A nationwide 18,000-mile private communication network and a data processing system were recently placed in operation.

Leased from Western Union, the network consists of 71 Sylvania Electric Products Inc. stations linking various facilities in 61 cities and towns in 20 states. Its focal point is the company's new data processing center near Syracuse. Heart of the center is a Remington Rand "Univac" electronic computer.

Overall purpose of the data processing center is to supply the entire Sylvania organization with a wide variety of vital information on their many phases of operations in more detail, more accurately and more quickly than has been possible.

The specialized communications facilities are used to feed financial and production information to the data processing center. At the center, the giant "Univac" computer and subsidiary electronic equipment quickly converts the information into summarized data on which can be based decisions at the corporate, divisional, or plant level.

This electronic panel controls operations involved in obtaining a massive calculation from the "Univac" central computer at the new data processing center of Sylvania Electric Products, Inc. at Camillus, N.Y.

Each of these units carries magnetic tape to and from the computer. In effect, they "read" instructional information and transmit it to the "Univac". After the computer digests the information and solves the problem, the Universos "write" this new information back on to the magnetic tape and carry it along to the printer.

Electronic Computer Writes Popular Songs . . Mathematicians succeed in programming a computer to write melodies automatically at a rate o 1000 per hr, based on arithmetic note selection.

Officials at Burroughs Corp., Electronic Div., disclosed that music-by-the-numbers has been carrie out by Datatron, their super-fast computer.

After being fed a formula, which substitutes numbers for notes, and equations for tempo, the machine prints melodies on an electric typewriter in the form of capital letters and rhythm symbols. Each tune contains eight bars and repeat, an eight-measure bridge, and a theme restatement. The music can be performed as it comes from the machine's circuitry. Mathematicians Douglas Bolitho and Dr. Martin Klein, who put the machine to music, declare that once inspired by the formula, Datatron will continuously write more than 10-billion tunes without human intervention.

The computer's prime inspiration is a random number introduced from the keyboard. The signals start a chain reaction by which Datatron generates thousands of other numbers, each representing one of the eight diatonic notes in the scale with two allowable accidentals. The machine then automatically picks a series of numbers at random, testing each for melodic acceptability. When a note is incompatible with the program, Datatron rejects it and chooses another.

At present, ElectroData mathematicians are refining the program so that Datatron can pick its own rhythm pattern. A further logical development would allow the computer to orchestrate the music also, or to write four-part chorals. It is not impractical to translate computer output automatically into punched paper tapes which could be rendered directly on a player piano.

Electronics Spots Heart Conditions . . . Diagnosis of blue-baby conditions and other cardiac diseases is facilitated by a new electronic instrument.

The device, made by Colson Corp., is an optical instrument which gives the physician continuous information on the variations in the oxygen saturation of the blood taken from specific regions of the heart through a catheter. The catheter, a thin plastic tube, is passed through an arm vein.

By ascertaining the position of the catheter in the heart by x-ray, the physician can determine the positions in the heart at which the patient's blood departs from the normal oxygen saturation.

Blue baby conditions can be caused by several different malformations of the heart, its valves, or the blood vessels feeding into or carrying blood from it. Location of the specific region of the heart where oxygen saturation of the blood departs from normal, is an important key to the diagnosis of the malformation.

More Versatile Transistors Promised . . . Among the more promising semiconductor materials are intermetallic compounds with a wider range of electrical properties than obtainable with silicon or germanium.

Described in a recent issue of Bell Laboratories Record, the new class of materials exhibits diversified electrical properties which should be useful in constructing a broader variety of transistors and transistor-like devices. One compound which has been investigated is indium antimonide.

First SAGE Production Unit Shipped . . . The first large-scale computer for the nation's vast, new electronic air warning network system, SAGE *(ED, Feb. 15, p 5)* is being shipped from IBM's Kingston plant to McGuire Air Force Base in New Jersey. This is the first of the giant computers going into the immense project known as the Semi-Automatic Ground Environment (SAGE) system. The computer and display equipment presents an instantaneous graphic picture of the location, speed, and direction of all planes within radar range. With a knowledge of flight plans of friendly planes available in the computer, hostil planes can be identified immediately and the most effective defense action taken—again on the basis of computer information and instruction. The plans for production were laid in 1953 by IBM, in cooperation with Massachusetts Institute of Technology Lincoln Laboratory, and the first equipment, called the AN/FSQ-7, is being completed and shipped in accordance with the schedule.

200 Channel Recorder

Pinboard programmer for simplified operation and a digitizer attachment for greater versatility is a feature of this Beckman 200-channel recorder. With the use of the pinboard; thus a change from 1000 microinches per inch to 2000 microinches per inch is "pinned" to the board. The digitizer converts analog signals to digits in the form of punched cards and paper tape for immediate use in the computer. All 200 channels can be sampled in about 70 seconds.

Ultrasonic Method Used To Detect Corona . . . An ultrasonic technique was recently described for locating and detecting impulse and low-frequency corona and breakdown in some types of insulation and electrical apparatus.

J. G. Anderson of the General Electric Co., Pittsfield, Mass., told a symposium on transformers that this method is of considerable value, particularly in liquid-immersed apparatus. Such techniques can supply the developmental engineer with information on corona and spark discharge in some apparatus which would be very difficult to obtain by other methods.

He added that the technique is relatively insensitive to external disturbances, and is not influenced by the test piece capacitance. Thus, it can serve as a valuable adjunct to other methods of discharge detection and measurement.

FCC Establishes Radio Facilities Division . . . Federal Communications Commission recently established a Domestic Radio Facilities Division in the Common Carrier Bureau. It will handle that Bureau's functions concerning the radio services and facilities of domestic carriers, which are now under the Telephone and Telegraph Divisions.

Dr. W. R. G. Baker Elected President of RETMA . . . Dr. W. R. G. Baker, a General Electric Company vice-president and general manager of its Electronics Div. at Syracuse, N.Y., was elected president of the Radio-Electronics-Television Manufacturers Association at its 32nd annual convention held in June.

He succeeds H. Leslie Hoffman, president of the Hoffman Electronics Corp. of Los Angeles, Calif.

The new RETMA president is one of the world's pioneers in the field of electronics with 40 years of experience in telecommunications work. He has been a member of the Board of Directors of the Association and director of its Engineering Dept. since 1934.

CBS Completes Basic Plans For Convention Coverage . . . The overall planning for the broadcasting of the 1956 Presidential conventions from Chicago and San Francisco over the CBS Radio and TV networks to the largest mass audience in the history of electronic reporting has been completed.

To serve the audience, CBS News is marshalling the largest force of men and machinery in the history of the communications industry, including more than 325 reportorial, production and technical personnel, and millions of dollars worth of equipment—approximately 22 tons—to be assembled first in Chicago for the Democratic convention and then moved to San Francisco for the Republican Convention.

Plastics To Aid Conquest Of Space . . . As a result of plastics materials and technology, man's constant dream of reaching distant planets will become a reality, possibly within the next ten years.

This prediction was made by Egmont Arens, a founder and former president of the Society of Industrial Designers, at the opening of the 7th National Plastics Exposition at the Coliseum. According to Mr. Arens, it appears inevitable that a new plastic, perhaps one not as yet even in test tubes, will have to form the outer shell of tomorrow's space ships. No known metal or alloy exists that can meet the heat-resistance specifications that will be set for space needs.

Convocation Planned On Shortage of Engineers . . . Cooper Union is presently planning a convocation to bring some of the best brains in the country together on Oct. 8th and 9th, 1956, to discuss the shortage of engineers and scientists and to consider ways in which education, industry, and government can cooperate to overcome that shortage.

Invitations to participate are currently being sent to outstanding people in various parts of the country.

CIRCLE 7 ON READER-SERVICE CARD ➤

Korea Doubles Telephone Capacity . . . The capacity of the Seoul, Korea, central telephone office will be doubled through the $2 million order of automatic dial equipment. The apparatus will add 8500 lines to the Seoul exchange when it is installed later this year. A 60-position toll board is also included to take care of the constantly increasing long-distance communications requirements. The equipment was manufactured by Federal Telephone and Radio Co., Clifton, N. J.

Correction . . . Oops! We slipped on page 53 of the May 15th issue. The article is entitled "Radar Doppler-Frequency Nomograph" and refers to "Point A" on the nomograph; yet "Point A" was inadvertently omitted. It can be readily spotted on the nomograph as follows:

Draw a line from 900kc in column A on the f_D axis (left-hand axis) to 10MPH on the v_r axis (center axis); draw a similar line from 90kc to 100MPH and one from 9000cy to 1K MPH. The intersection of these three lines is "Point A."

Sorry if we confused anyone.

More Super Magnets Promised . . . Engineers have perfected a material that promises to yield more powerful permanent magnets.

Virtually 100 per cent pure manganese-bismuth, the material has a high coercive force that resists demagnetization. Developed by Westinghouse, manganese-bismuth may result in a variety of permanent magnets having novel shapes and uses. Thin wafers are one suggested form.

Highly purified manganese-bismuth catches fire spontaneously on exposure to air and must be processed in an inert atmosphere of helium.

Washington Report

Albert Warren

Spectrum Shuffling . . . Implications far beyond the TV industry are contained in FCC's new proposal for strengthening u-h-f TV and providing more competitive station facilities. Though it will be many months before Commission decides whether its proposal should actually be adopted and put into effect, here's what it proposes: (1) Examine capabilities of u-h-f to determine whether all or most stations can be shifted to it over a period long enough (7-10 years, possibly) to amortize existing receivers and transmitting equipment. (2) Invite nonbroadcast services, such as mobile radio and users of "scatter," to tell why they could put v-h-f to better use than TV. (3) Remove some v-h-f channels from predominantly u-h-f communities to give u-h-f stations fighting chance. FCC's proposal puts much of industry squarely on the spot. First, the hungry nonbroadcast services will put up terrific argument to get the new chunk of v-h-f spectrum, now that Commission has opened door a crack—something it has never done before. Second, Commission expects industry to tell it whether u-h-f can do the whole TV job. Last year, Radio-Electronics-TV Mfg. Assn. offered to collect u-h-f data for FCC. Though Commission indicated it would appreciate it if RETMA went ahead, the industry association was disappointed—because FCC declined to give project its firm stamp of approval the way it did for previous projects, such as formulation of black-&-white and color standards. Commission asks industry to file its comments on the u-h-f idea by Oct. 1, 1956.

Unauthorized TV booster problem continues to bedevil FCC. Latest development: Introduction of bill, by Rep. Don Magnuson (D-Wash.) to force Commission to legalize boosters. FCC has been insisting boosters are both illegal and dangerous (potential interference to air navigation, etc.) and has proposed that booster operators be given u-h-f Channels 70-83 as substitute. Rep. Magnuson says the u-h-f idea is too costly and inefficient.

Electronic time-pieces within 10 years were predicted by M. Fred Cartoun, chairman of Longines-Wittnauer Watch Co. in testimony before a Congressional committee considering watch tariffs. An importer of Swiss watches, Cartoun disputed claims that American watch industry has an essential defense role. "The watch of the future," he said, "may well have magnetic cells, resistors, transistors and other components found in the electronic industry, rather than that in today's watch industry. Once perfected, they may well be far simpler and easier to manufacture than present time pieces."

DX Programs Picked Up 6600 Miles Away . . . A spring and summer phenomenon is giving TV engineers a lot to think about in the hot weather over their mint juleps. The game is known as DXing—or getting reception from unbelievably distant stations.

The causes of this theoretically "impossible" situation are all concerned with sun spots and atmospheric conditions. One thing fairly certain is that the DXer must be near a large body of water that will carry the signals.

Although most TV transmitters have a useful range of 50 miles or so, DX programs have been picked up from 6600 miles away. In addition, reception from stations 2000 miles off is becoming more commonplace.

Diesel Engine Solves Capacitor Production Problem . . . Radio Materials Corp., Attica, Ill., one of the world's largest producers of ceramic disc capacitors, uses as its primary source of power a heavy-duty Fairbanks-Morse dual-fuel diesel driving a 265kw alternator. This move was taken to guard against interruption in power supply which could affect the product and disrupt production schedules. At least a quarter million ceramic capacitors would have to be discarded if electric power failed during the firing process.

There has not been a single interruption in power service since the diesel went into operation in the summer of 1954.

Frank A. Poor, Sylvania Founder, Dies at 76 . . . Frank A. Poor, founder of Sylvania Electric Products, Inc., died recently at the age of 76 after a short illness. At the time of his death Mr. Poor was vice-chairman of Sylvania's Board of Directors, having been elected to this post in 1950. His career in the electrical-electronics industry covered more than half a century.

Mr. Poor was noted for his loyalty and devotion to his employees and associates and his generosity in community, civic, and charitable affairs, to which he contributed unstintingly of his time and money.

CIRCLE 9 ON READER-SERVICE CARD ➤

William H. Roberts, Supervisor of Tantalytic Capacitor Engineering, and active member of the I.R.E., holds actual size Tantalytic capacitor against its greatly enlarged cut-away counterpart.

Since 1949, Roberts has worked continuously on foil-type, tantalum electrolytic capacitors, which he helped develop to their present stage of dependable performance.

CAA Certifies RCA Commercial Airborne Radar . . . The first certification by the CAA of commercial airborne radar equipment has been issued to the Radio Corp. of America for its weather-detection radar system which enables pilots to "see" storms up to 150 miles ahead.

The certification applies to the RCA AVQ-10 C-Band system which is carried in the nose of an aircraft and provides early storm warning. The system's radarscope, installed in the pilot's cabin, produces a constantly changing picture of weather ahead and enables the pilot to select airpaths having a minimum of turbulence.

Martin To Build Nuclear Power Plant For Dominican Republic . . . The Dominican Republic has contracted with the Glenn L. Martin Co. of Baltimore for a nuclear-powered electrical generating system to meet the growing requirements of the nation. Under President Eisenhower's atoms-for-peace plan, the contract is contingent on a bi-lateral agreement between the U.S. and the Dominican Republic before becoming effective.

The present generating capacity of the combined steam, hydro-electric and diesel plans supplying Ciudad Trujillo is 45,000kw. It is estimated that the Martin nuclear power plant will increase this output to 57,000kw.

Electronics Equipment Sales Set Record . . . Sales of electronics equipment since last summer have set a new all-time record dollar volume, according to Frank W. Mansfield, Sylvania Electric Products, Inc., New York, N.Y., chairman of the Statistical Policy Committee of RETMA.

During the 1955-1956 RETMA fiscal year, Mr. Mansfield estimated that electronics manufacturers sold equipments valued at $5.5 billion as against $5.25 billion during the 1954-1955 fiscal year. When distribution, service, installation, and broadcast revenue is added, the total billing of the electronics industry exceeds $10 billion.

◀ CIRCLE 9 ON READER-SERVICE CARD

Meetings

Aug. 20-21: National Telemetering Conference, Biltmore Hotel, Los Angeles, Calif. Sponsored by the IRE, AIEE, Institute of the Aeronautical Sciences, and the Instrument Society of America. Papers will be presented on novel industrial or military applications of telemetering in remote measurement systems, flight test data, remote guidance systems, remote monitoring, and air traffic control. New component developments such as transducers, multiplexers, data recorders, transmitters and receivers, pickoffs, and telemetering filters will be discussed. For information, write to IRE, 1 E. 79th St., New York, N. Y.

Aug. 20-24: Conference on Scientific and Technical Writing, Philadelphia, Pa. Sponsored by the University of Pennsylvania Institute for Cooperative Research. The conference, open to scientists, engineers, editors, writers, and administrators, will provide advanced study and experience-sharing in the art of making technical literature readable. The fundamental problems involved in the communication of technical information will be analyzed, and current systems for handling these problems will be evaluated. For information and applications, write to Dr. Harry F. Arader, 3400 Walnut St., Philadelphia 4, Pa.

Aug. 21-24: Western Electronics Show and Conference, Los Angeles, Calif. Sponsored by the Los Angeles and San Francisco Sections of the IRE and the West Coast Electronics Manufacturers Association. For information, write to Mrs. Jeanne W. Jarrett, WESCON, 344 N. La Brea Ave., Los Angeles 36, Calif.

Sept. 16-22: Second Pacific Area National Meeting and Apparatus Exhibit, Hotel Statler, Los Angeles, Calif. Sponsored by the American Society for Testing Materials. For information, write to American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

Sept. 24-25: Industrial Electronics Conference, Cleveland, Ohio. Sponsored by the Professional Group on Industrial Electronics, IRE. For information, write to G. P. Bosomworth, Firestone Tire & Rubber Co., Engineering Laboratory, Akron 17, Ohio.

Sept. 26-30: *New York High Fidelity Show,* Trade Show Building, New York, N. Y. Sponsored by the Institute of High Fidelity Manufacturers. The Audio Engineering Society will hold its annual meeting at the show. For information, write to Jack Gilbert Associates, 1186 Broadway, New York 1, N. Y.

Oct. 1-3: *Twelfth Annual National Electronics Conference,* Hotel Sherman, Chicago, Ill. Sponsored by the AIEE, IRE, Illinois Institute of Technology, University of Illinois, and Northwestern University. More than 100 technical papers and 240 commercial exhibits will be featured. For information, write to Victor J. Danilov, Illinois Institute of Technology, Chicago 16, Ill.

Oct. 1-3: *Canadian Institute of Radio Engineers Convention,* Automotive Building, Exhibition Park, Toronto, Canada. Technical papers are planned on medical electronics, scatter propagation, application of electronics to atomic energy projects, use of computers in automation and engineering problems, and transistors. An exposition will include many of the latest improvements in radio, radar, TV, control mechanisms, computers, and other electronic items.
For information, write to Grant Smedmor, Convention Manager, 745 Mount Pleasant Road, Toronto 12, Canada.

Oct. 1-5: *AIEE Fall General Meeting,* Chicago, Ill. For information, write to AIEE, 33 W. 39th St., New York 18, N. Y.

Oct. 3-5: *Fifth Annual Meeting of the Standards Engineers Society,* Hotel Willard, Washington, D. C. Theme of the meeting is "Standards—Guides for Tomorrow." Sessions are scheduled on standardization in the chemical industry, standards and the atomic energy field, the future trend of standards in the metals field, and creative engineering and standards. For information, contact the Standards Engineers Society, P.O. Box 281, Camden, N. J.

Oct. 8-9: *Second Annual Symposium on Aeronautical Communications,* Hotel Utica, Utica, N. Y. Sponsored by the IRE Professional Group on Communications Systems. The symposium will stress communication requirements in support of present and future aeronautical activities. The submission of papers on associated topics is invited. Titles, authors, and a brief abstract of 200 words should be submitted to Fred Moskowitz, 1014 N. Madison St., Rome, N. Y., before July 1. For information, write to R. C. Benoit, Jr., 138 Riverview Parkway N., Rome, N. Y.

Oct. 16-18: Conference on Magnetism and Magnetic Materials, Hotel Statler, Boston, Mass. Sponsored by the AIEE, IRE, American Physical Society, Amercian Institute of Mining and Metallurgical Engineers. Authors should submit titles of proposed papers by June 15 and abstracts by August 1. For further information, write to T. O. Paine, Measurements Laboratory, General Electric Co., W. Lynn, Mass.

Oct. 18-19: Third Annual International Meeting of the Institute of Management Sciences, Statler Hotel, Los Angeles, Calif. Theme of the conference is "Management Sciences—A Progress Report." Program plans include the presentation of technical papers on the latest developments in the application of advanced sciences to business and industrial management. For further information, please contact Al N. Seares, Vice President Remington Rand, Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y.

Oct. 22-24: AIEE Machine Tool Conference, Sheraton Gibson Hotel, Cincinnati, Ohio. For information, write to AIEE, 33 W. 39th St., New York 18, N. Y.

Oct. 25-26: Second Annual Technical Meeting of the IRE Professional Group on Electron Devices, Shoreham Hotel, Washington, D. C. Titles and abstracts of 100-200 words on papers to be offered for presentation should be submitted to R. L. Pritchard, Research Laboratory, General Electric Co., Schenectady, N. Y., before August 1. For other information, contact Prall Culviner, Sylvania Electric Products, Inc., 1740 Broadway, New York, N. Y.

Oct. 29-30: Third Annual East Coast Conference on Aeronautical and Navigational Electronics, Fifth Regiment Armory, Baltimore, Md. Sponsored by the Baltimore Section and Professional Group on Aeronautical and Navigational Electronics of the IRE. Theme of the conference is "Electronics in the Jet Air Age." For information, write to W. D. Crawford, Publicity Chairman, Westinghouse Electric Corp., Air Arm Div., Friendship International Airport, Baltimore 27, Md.

Nov. 7-9: Conference on Electronic Technology in Medicine and Biology, Governor Clinton Hotel, New York, N. Y. Sponsored by the AIEE, IRE, Instrument Society of America. For information, write to AIEE, 33 W. 39th St., New York, N. Y.

*Nov. 26-30: **Third International Automation Exposition,*** Trade Show Building, New York, N. Y. Clinic sessions will be offered in electronic computers, process automation, machine tool automation, office automation, automatic materials handling, servomechanisms, electromechanical components, and electronic components. More than a hundred exhibitors will participate in the clinics. For information, write to Richard Rimbach Associates, 845 Ridge Ave., Pittsburgh 22, Pa.

*Oct. 29-Nov. 2: **Convention on Ferrites,*** London, England. Sponsored by the Institution of Electrical Engineers. Program will include sessions on theory, preparation, and properties of ferrites, microwave application, square loop applications, radio and TV applications, and carrier frequency applications. For further information, write to W. K. Brasher, Secretary, Institution of Electrical Engineers, Savoy Place, London W.C. 2, England.

*Dec. 5-7: **Second IRE Instrumentation Conference,*** Biltmore Hotel, Atlanta, Ga. Sponsored by the Professional Group on Instrumentation and the Atlanta Section of the IRE. Sessions will be devoted to industrial applications, missile range instrumentation, and the application of solid state devices. Prospective authors are invited to submit abstracts of 200 words or less not later than Sept. 1 to the program chairman, M. D. Prince, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Ga. For further information, contact the IRE, 1 E. 79th St., New York, N. Y.

*Dec. 10-12: **Eastern Joint Computer Conference,*** Hotel New Yorker, New York, N. Y. Sponsored by the IRE, AIEE, Association for Computing Machinery. "New Developments in Computers" is the theme of the meeting. In addition to an extensive program of technical papers, the meeting will feature exhibits by many manufacturers in the computing field. For information, contact Al Forman, Room 639, 480 Lexington Ave., New York 17, N. Y.

*Jan. 14-15, 1957: **Third National Symposium on Reliability and Quality Control in Electronics,*** Hotel Statler, Washington, D. C. Sponsored jointly by the IRE Professional Group on Reliability and Quality Control, the American Society for Quality Control, and RETMA. For information, write to IRE, 1 E. 79th St., New York 21, N. Y.

Management's Responsibility to Reliability

Based on an address made before the RETMA Symposium, May 21, 1956, on Reliable Applications of Electron Tubes

J. M. Bridges
Director of Electronics,
Office of the Assistant Secretary of Defense
for Applications Engineering

LACK of emphasis on sound equipment engineering is one of the most significant causes of unreliability of military electronic equipment. However, regardless of how clearly design engineers understand the value of detailed engineering factors and the means for accomplishing them, they cannot apply their knowledge without the assistance of proper program objectives and the full support and understanding of management. A majority of the reasons for inadequate design engineering in military electronic equipment stem from shortcomings in management planning, policies, and direction. Some of the factors which have a major effect upon thoroughness and adequacy of design engineering are analyzed here.

Management includes both industry and government as equal partners. It is important to emphasize this point, because in the past there has been a tendency on the part of military people to lay most of the blame for unreliability on industry. Likewise, industry has generally tended to accuse military policies and procurement regulations. No worth-while progress in reliability improvement is likely to be obtained until each realizes his responsibilities and corrects his mistakes.

Design Contractor

The first factor is the selection of a design contractor. This function is extremely important in obtaining the kind of design engineering required for equipment reliability, yet the criteria upon which contractor selection is usually based do not give this factor adequate consideration.

The proper design of an intricate military electronic device is a difficult and painstaking task. It is usually well done only by a qualified contractor who is experienced in the specialized field involved.

There are many different specialties in the weapon electronics field, and specialized talents are required in each of them to do good and complete design engineering. A contractor may be competent in one or more of these specialties and have a record for doing excellent design work in these areas, yet he may produce an extremely poor design in another field. Experience and demonstrated capability in the specialized field involved should be a primary requirement for selection of a contractor to do a design job.

Another requirement which is significant in the selection of a design contractor is experience in engineering for production. Some of the most serious reliability shortcomings have arisen in producing equipment for service use which was designed in research and development laboratories having no production experience. This is not meant to infer that the military should not continue to support work in the many excellent research and development laboratories in our universities and the government. However, it is desirable that the efforts of these research and development groups be confined to the research and exploratory development phases of a program. As soon as the feasibility of the technical approach is established the job of design engineering can usually be done better by a contractor experienced in engineering for production.

Not enough emphasis is placed on these experience qualifications in selecting contractors. In far too many instances, companies are asked to bid on design work in an area where they have little or no competence. Experience indicates that a company unfamiliar with a job is very apt to underestimate its cost; often, one

What Bridges said about Reliability and Weapons Leadership

". . . the effectiveness of all offensive and defensive weapons now available or under development can be seriously impaired by unreliability of their electronic components. This may very well represent a greater threat to the security of our country than the fact that we may be behind in the development race in a single weapon field." ***This statement, originally made to RETMA, March 18, and quoted in*** **ELECTRONIC DAILY,** ***March 20, 1956, was repeated.***

On Vacuum Tubes, "Better application of electron tubes is a vital requirement for reliability improvement. This has not been widely enough recognized by either the electronics industry or the military organization. Until quite recently, equipment designers and military people in general have placed most of the blame for equipment unreliability on tubes and other component parts." Adequate emphasis has rarely been given to the true relationship between equipment design and reliability.

There have been good reasons for blaming the tube for a major part of equipment unreliability in service. Analysis of statistics obtained on existing military electronic equipment in service does show the electron tube to be a very unreliable device, and a major cause of equipment failure. However, the conclusions drawn from these analyses should not be accepted as a valid representation of the basic reliability of present-day vacuum tubes, because it is known that substantial percentage of tube failures in service are caused by equipment design deficiencies or tube misapplication.

Equipment design factors that have a most significant bearing upon reliability of electron tubes are:

(1) The selection of the proper tube type for a particular application.

(2) The use of the most reliable version of the tube types selected.

(3) The design of circuits so as to assure their proper operation over the maximum range of tube characteristics expected during the normal life of the tube types selected. This should take into account the uniformity and long-time variations in characteristics of other component parts.

(4) Mechanical and electrical design that will assure tube envelope temperature well below that recommended by the tube manufacturer. This shoud be determined under the most severe operating conditions specified for the equipment.

(5) Design of mechanical structures in a manner to minimize the transmission of shock and vibration to the tube mounting.

of these companies is awarded the contract on the basis of low bid.

Many companies may be asked to bid on a research and development job where only a few of them are actually well qualified to do thorough design engineering in the particular field involved. On the basis of the lowest bid, the contract may be awarded to one of the unqualified companies. The result can be a completely unacceptable design, several overruns in cost and repeated extensions of the delivery date, in spite of the fact that the successful bidder may pirate several engineers from one of the really qualified losing companies.

Buying electronic equipment design at cut-rate prices is the same thing as buying unreliability deliberately.

The responsibility for contractor selection obviously rests with military management, although the contractor has a secondary responsibility in not undertaking design work in an area in which he knows he is not qualified. In any event, the solution to the problem must come from a change in military management policy, which may possibly require some improvement of procurement regulations.

Time Factor

The second factor having a major influence upon the thoroughness of design engineering is the planning of the program schedule. One of the most serious shortcomings in the planning for new weapons has been unrealistic time allocation to the design phase of a program. This has been a major cause of unreliability.

Obviously, time scale is very important to our entime defense effort, and every reasonable step must be taken to compress it. Experience has proved, however, that short-cutting design engineering is not a good way to save time in a program. This does not mean that we should condone the extension of a developmental program by continually introducing design changes to provide only marginal improvements in function. The design engineering and testing required for operational reliability should be completed in every program before an equipment or system is introduced into production for service use.

In practice, it has been found that time saved by failing to do a thorough and complete design job is usually more than lost by the increased time required to establish quantity production and to make in-production design changes in an attempt to make the item acceptable for service use.

The responsibility for assuring that adequate time is allowed for a program's design phase rests primarily with military management. Usually, the problem arises from a lack of sound long-range weapon planning. It is also true that the contractor is often a party to the establishment of time schedules which cannot be met without resorting to dangerous engineering short-cuts. He may realize that he cannot accomplish a thorough

engineering job within the time schedule he quotes, but he knows from experience that, in selecting contractors, military procurement agencies have placed considerable emphasis upon quoted completion date.

For this reason, "promised" completion dates should not be a major consideration in contractor selection. It would be far more accurate to base military plans involving a new electronic equipment or system on a development time scale determined by a contractor *after* he has been selected to do the job. His schedule could then be established in an atmosphere free from the influences of competitive pressure or arbitrary edict from the military agency involved.

Pilot Production

The third important factor in this struggle to obtain thorough design engineering is obtaining proof of producibility and reliability through pilot production and reliability testing. This is as vital a part of proving the completeness and adequacy of design as environmental and operational tests are.

By pilot production is meant the controlled manufacture of limited numbers of an item, using the manufacturing drawings and specifications which have been developed for quantity production, and with tooling which is at least representative of that to be used in full production. The principal objectives of pilot production are: (1) to verify the producibility of the design including the accuracy and adequacy of the manufacturing drawings and specifications, (2) to provide sufficient numbers of the new equipment or system to permit a realistic evaluation of performance and reliability, and (3) to permit the determination and correction of design deficiencies affecting producibility before production for service use is undertaken. The number of equipments produced in pilot production will depend upon many factors, such as item cost and the quantities required to meet the service use demand. Pilot production as used here should not be confused with the initial pilot line which is set up by a final production contractor to prove the adequacy of "hard" tooling and manufacturing line layout, procedures, and controls.

One of the significant reasons behind unreliability in equipment has been the introduction of a new item into a competitive manufacturing status before the producibility of the design or the correctness of the manufacturing information has been determined, or before deficiencies affecting producibility or reliability have been determined and corrected.

In addition to revealing design problems affecting manufacture, the availability of pilot-produced quantities of an equipment will permit a much more accurate statistical measure of the inherent reliability of the design than can be obtained from only one or two prototype models. It will also allow the establishment of a firm specification for reliability which can be included in procurement specifications for quantity production contracts.

Since pilot production represents the first proof of a design's producibility, as well as permitting the first statistically sound determination of reliability, it is important that it be performed by the design contractor—or, at least, under a contractual arrangement where the design contractor can provide close cooperation and assistance. Pilot production should not be subject to competitive bid. It is essential that the design contractor have this close relationship with the pilot-production line so that he can correct design deficiencies as they appear.

It is a military management function, to assure that this requirement for determining the completeness and adequacy of design is met.

Contractor Attitude

The fourth factor of importance to thorough engineering relates to the policies and attitude of contractor management. It is essential to the final equipment's reliability that contractor management thoroughly understand the importance of reliability to the defense effort and to the American taxpayer. The basic factors of design, test, and program scheduling that influence reliability must also be well comprehended. The contractor management must organize an engineering team having the competence, specialized skills, and supporting facilities commensurate with the program's schedule, magnitude, and technical difficulty. They must be willing to advise the Military Department honestly and completely regarding the effect upon reliability that might be a result of introducing major design changes or arbitrarily shortening the time schedule.

If management does not have this understanding, attitude, and policy, it is unlikely that the engineering design team will receive adequate support and direction to enable them to achieve the thoroughness of design required for reliability.

Approval

The fifth and last major factor discussed here is the approval of new electronic equipment and systems for production for service use. This military management function, without question, has more influence upon the service reliability of military electronic equipment than any other factor. It represents the "judge and jury" who determine whether a new item is suitable for production in the quantities required for service. If there is too much leniency in its performance, unreliable equipment will be produced; on the other hand, if the "judge and jury" are too strict and hold

Problem: How to destroy *reliable* equipment when capture is imminent?

up production because of minor deficiencies, unnecessary delays may deny the advantage of timely availability of advanced new weapons in service.

In general, there has been too much leniency. New equipments have frequently been introduced into full-scale production even before elementary engineering tests on a prototype model have been finished—in some cases, before completion of the engineering models.

The process of approving equipment for service use must receive greater attention at the higher command echelons of the military services, and much more consideration must be given to equipment reliability. To give greater assurance of the engineering readiness of new equipment and systems approved for service use, an improved policy is required.

Military management must give far greater consideration to the consequences of sacrificing design engineering thoroughness and evaluation testing in favor of earlier availability for service use. Operational military officers will always be confronted with situations where technological breakthrough or military emergencies may justify production of new equipments or systems before the design has been properly matured or adequately tested. However, this practice should be limited to such circumstances and not used as a method of compensating for poor advanced planning under normal programming.

What's Being Done

For the most part, the factors mentioned here require direct action on the part of the government. Much is already being done in these areas by the Department of Defense and by the three Military Departments.

Specifically, a draft directive to establish more adequate policy and procedures for approval of new electronic items for service use, including the requirement for pilot production and reliability testing, has been completed.

In addition, an intensive program was initiated a few months ago by the Office of the Assistant Secretary of Defense for Applications Engineering to seek specific solutions to some of the more pressing reliability problems. This program is being carried out, under the direction of the Advisory Group on Reliability of Electronic Equipment, by nine working groups involving 20 people from industry and 60 from the Military Departments. Solutions to some of these problems will permit the military to place numerical requirements for reliability on their contractors, to specify tests for measuring reliability quantitatively, and to specify design practices or techniques that will assist contractors in obtaining better reliability. Other problems for which solutions are being sought by these nine groups are in component specifications, procurement practices, transportation and storage methods, and operating and maintenance techniques.

△ Ceramic Receiving Tubes

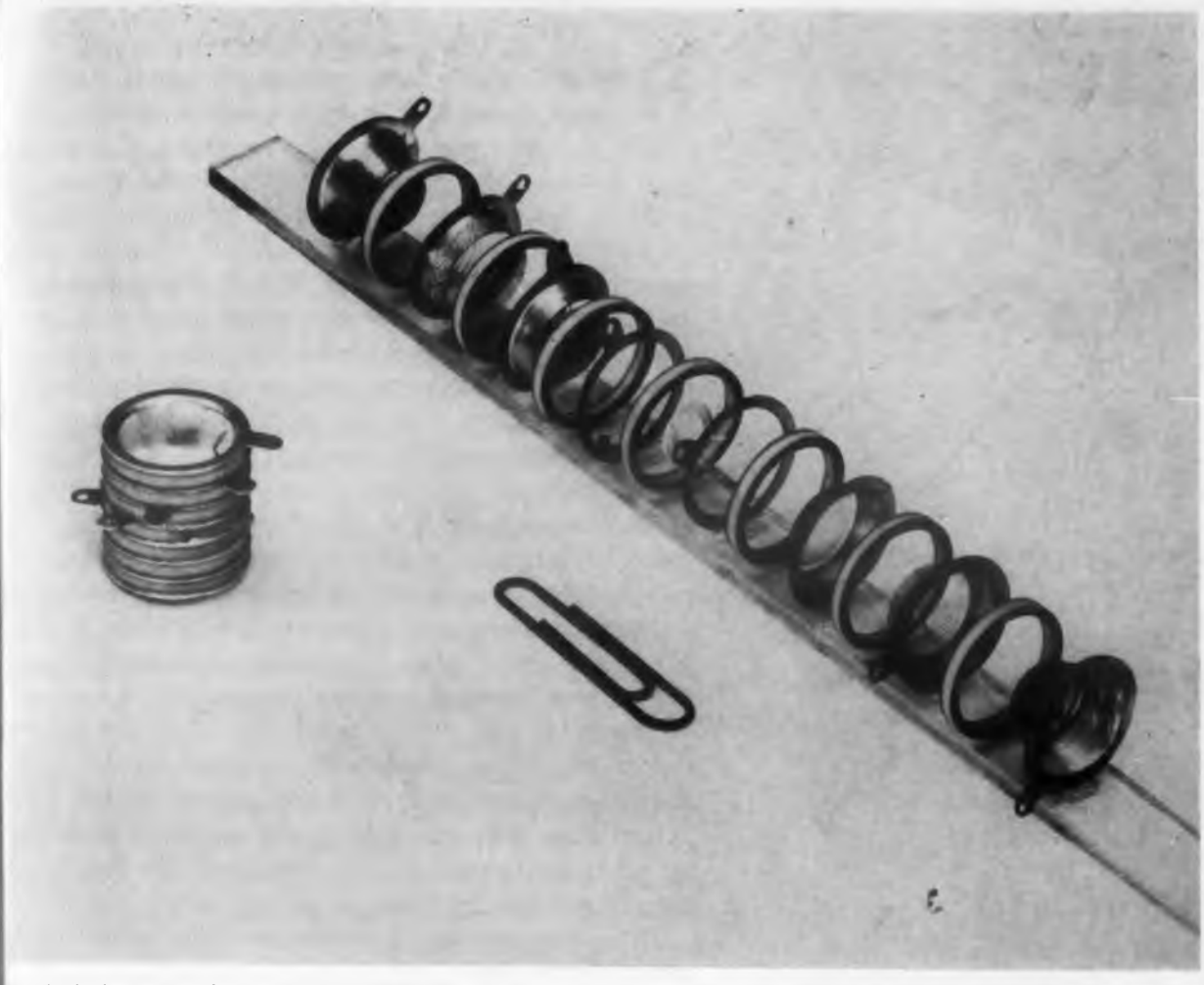
STACKED ceramic receiving tubes, equivalent to types *6SN7* and *6AK5*, designed to withstand temperatures up to 300°C and heavy accelerative forces from shock and vibration, are in production. A departure from normal tube design, these ceramic units are especially adaptable to aircraft and missile applications.

Internal insulators and spacers are eliminated. Electrode assemblies are self-supporting. Life expectancy of the tubes is so long that tube sockets need not be used. The units are designed to be wired directly into the circuit.

Two of these ceramic-type miniature receiving tubes have been made available by Eitel-McCullough Inc., San Bruno, Calif. These production models are a twin-triode amplifier, *33C3A2*, and a sharp-cut-off pentode, *5C2A*. In addition, two models, a medium-mμ triode and a beam power amplifier, are in the development stage.

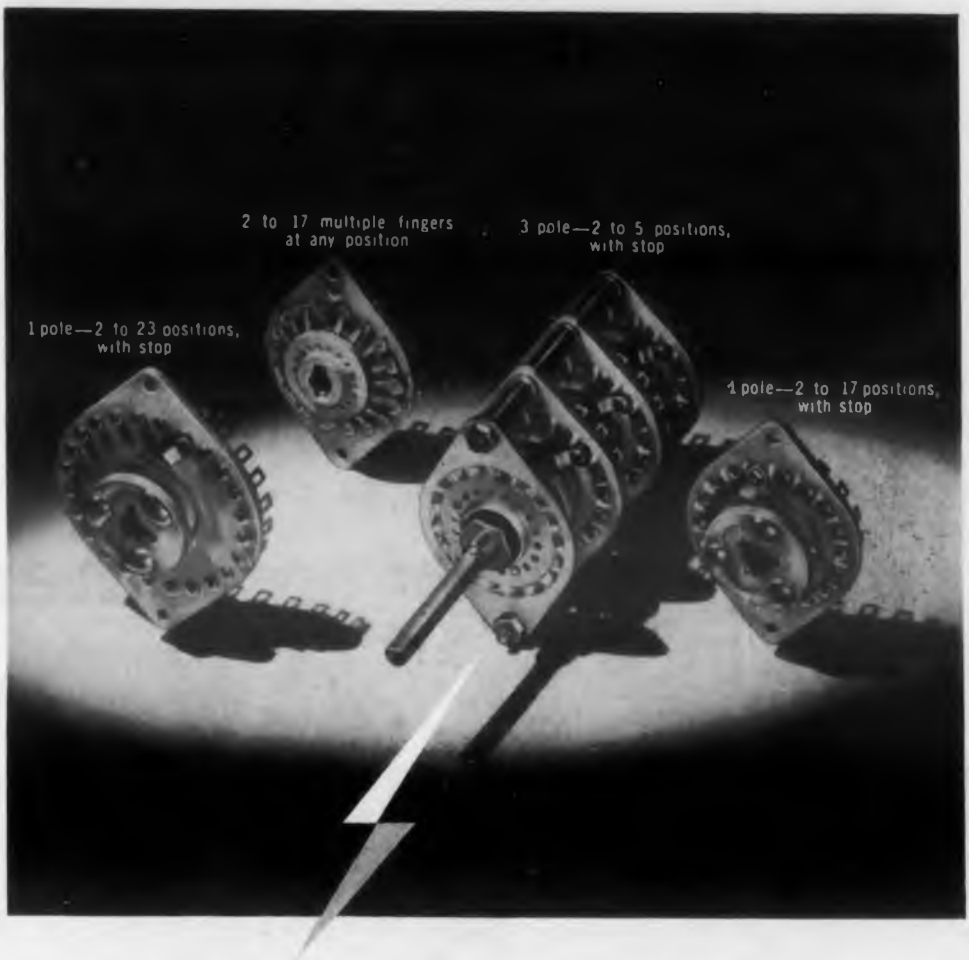
Filament voltage of all four tubes is 6.3. Amplification factor of the *33C3A2* is 20. At a plate voltage of 300, plate current per section = 20ma, plate dissipation per section = 2.75w.

Maximum ratings of the *5C2A* are: plate voltage = 200; plate dissipation = 2w, screen dissipation = 0.4w, and total current = 20ma. For more information on these ceramic receiving tubes turn to Reader's Service Card and circle **17.** *Wescon Show, Booth Nos. 834-835.*



Exploded view of an Eimac 33C3A2, dual triode ceramic tube. No tube socket is used.

Four ceramic tubes adaptable for environments found in aircraft and missile applications.



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Hybrid Auto Radios, the next step

William D. Bevitt
Commercial Engineer,
CBS-Hytron, Danvers, Mass.

NEWEST and most promising application of power transistors is in the audio output stage of 12v hybrid automobile radio receivers. The hybrid auto radio is the next most practical step in auto radio receiver design because of the introduction of new vacuum-tubes which function at full efficiency with only 12v on their plates. A *2N155* power transistor and the new series of 12v B+ tubes completely eliminate the need for the mechanical vibrator with its moving parts (and buzz), the power transformer and the rectifier tube. The circuit for the *2N155* power transistor is discussed in this article.

Fig. 2 shows the block diagram of such a hybrid auto radio receiver. The complement consists of four special tubes for the r-f amplifier, converter, i-f amplifier, detector, avc, and driver. These tubes operate at high efficiency with a plate supply voltage of only 12v. Their lower plate dissipations with correspondingly lower internal temperatures greatly contribute to longer life and greater reliability. The CBS, *2N155* power transistor, which was designed by semiconductor engineers and physicists especially for such hybrid auto radio receivers is pictured in Fig. 3. The power transistor and the set of special 12v B+ tubes cut normal battery drain in half.

The power output of any germanium power transistor is limited by the amount of internally generated

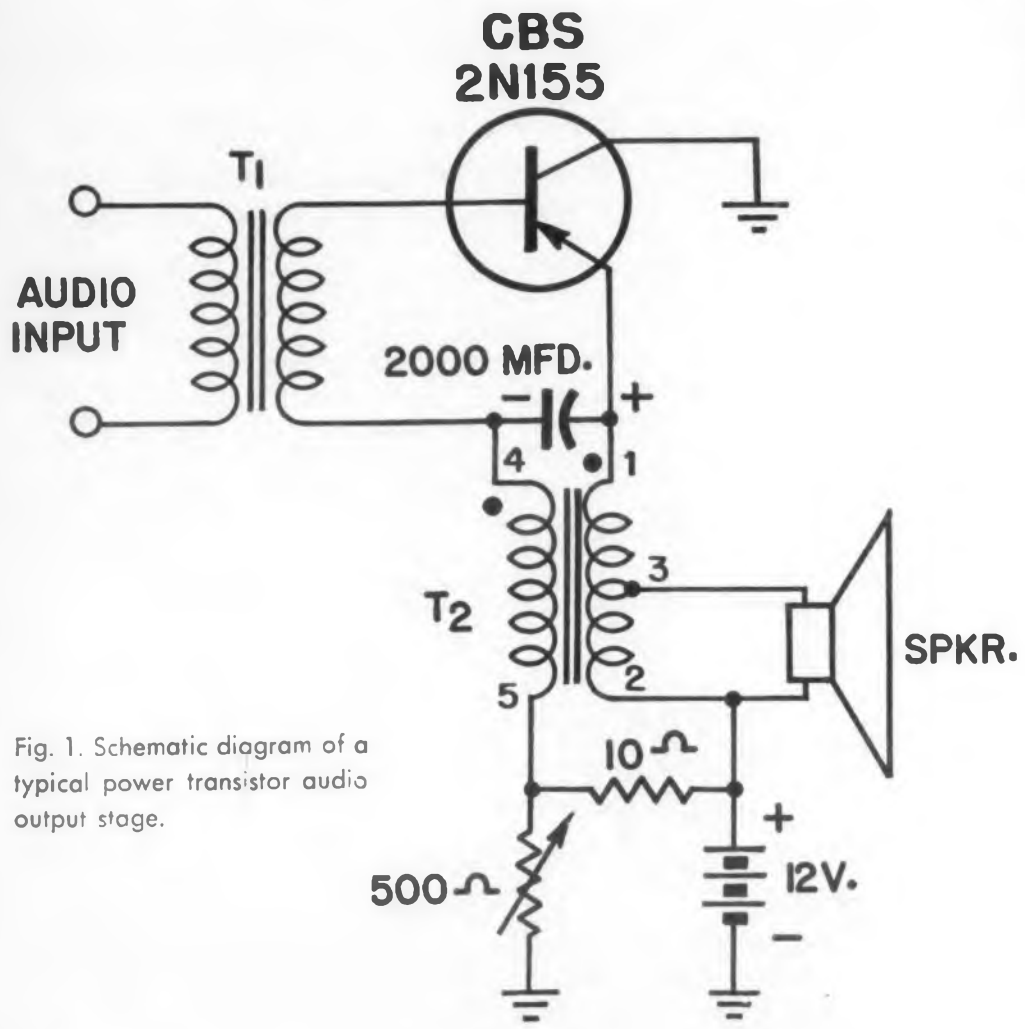

Fig. 1. Schematic diagram of a typical power transistor audio output stage.

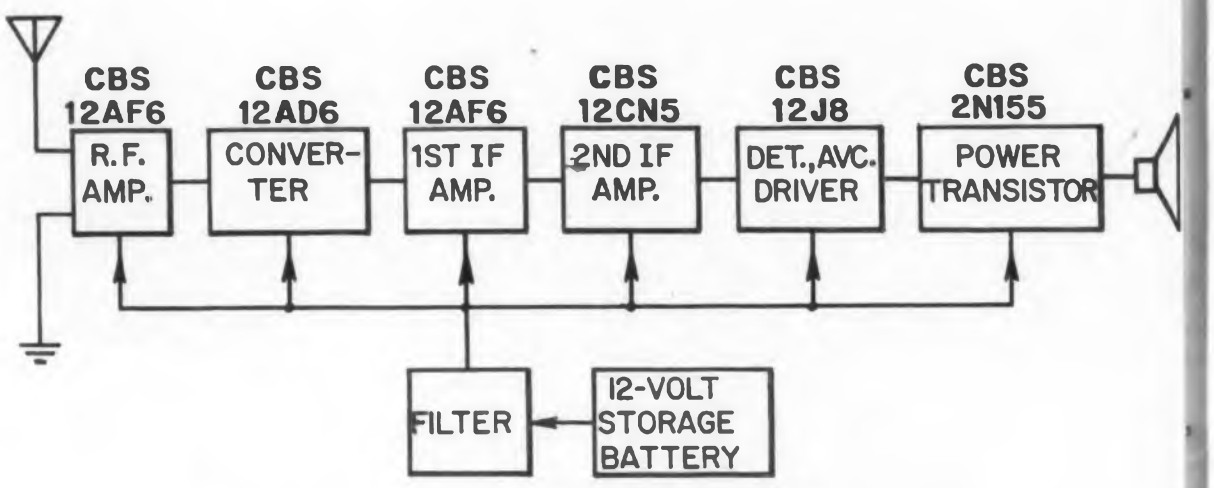

Fig. 2. Block Diagram of typical 12-v hybrid auto radio receiver.

Fig. 3. Power transistor with collector attached electrically and mechanically to case for good heat transfer.

heat which the transistor and its associated heat sink can dissipate without exceeding the maximum junction operating temperature.[1] For the *2N155*, this temperature is 85°C. Since most of the internal heat is generated at the collector junction, the collector of the CBS *2N155* power transistor is attached both mechanically and electrically to the metal case. This provides for the most efficient transfer of heat from the collector junction to the outside of the case. Hence the transistor may be bolted directly to an aluminum chassis or cooling fins through two mounting holes provided for this purpose. Accordingly, a grounded-collector circuit is required. The conventional grounded-collector circuit gives less power gain than the common-emitter connection, since the former provides no voltage amplification, but only current gain. The common emitter gives both current and voltage amplification. To offset this disadvantage a special circuit is used in which the collector is grounded for d-c, but which operates like a common-emitter connection for the a-c signal.

Fig. 1 shows the schematic diagram of such a circuit for the power output stage. Component *T1* is the input transformer, and *T2* is the output transformer. The output transformer has three windings. Winding *1-2* is the primary, winding 3-2 is the secondary, and winding *4-5* is the bias feedback winding. The secondary *(3-2)* and the primary *(1-2)* constitute an auto-transformer, which steps up the 3.2 ohm load impedance of the speaker voice coil to present a 30 ohm load impedance at 400cy to than transistor. The d-c operating point of the power transistor is stabilized in two ways. First, a d-c voltage drop occurs because of the d-c resistance of the primary winding *(1-2)* or *T2*, which is connected in the emitter circuit. This voltage tends to make the emitter negative with respect to the base, or to bias the emitter in the reverse direction for this p-n-p transistor. Secondly, across the 12v supply battery, there is connected a voltage divider, consisting of a 10-ohm fixed resistor and a 500-ohm potentiometer. The latter is adjusted by a screw driver to give an emitter current of 0.5a. The common point of the voltage divider is connected to one side *(5)* of the bias feedback winding *(4-5)* to supply bias current to the transistor base and to permit the emitter terminal to be common to both input and output circuits. The bias feedback winding *(4-5)* has a one-to-one turns ratio with the primary of the transformer, and the phasing of the bias feedback winding with respect to the primary winding should be as indicated to be degenerative to avoid instability or oscillation. In this circuit, the power transistor achieves a power output of 3w with less than 10% distortion at a power gain of 30db.

Reference

1. Transistors Handbook, Wm. Bevitt, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1956.

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Fig. B. Front panel of the printed-circuit switch provides a visual representation of the output. Each vertical slider connects one of the 31 poles to one of the 100 autotransformer taps. Panel is 6 x 7-1/2 in.

△ Adjustable Nonlinear Transducer

Fig. C. Exploded view of the Vernistat showing construction of the gear mechanism.

TRANSLATING shaft rotation into voltage can be accomplished with a tapped autotransformer to divide the total voltage into several levels. With the autotransformer taps equally spaced, voltage output is linear with shaft rotation. Providing a nonlinear output voltage with shaft rotation requires spacing the taps at irregular intervals or using a resistive network across the taps. Neither of these methods permit easy adjustment of the output curve.

Modifying their Vernistat a-c potentiometer, engineers at Perkin-Elmer Corp., Norwalk, Conn., have developed a transducer in which the curve of the output voltage is immediately adjustable. Instead of only 31 taps on the autotransformer winding, 100 taps are brought out. These are fed to a 31-pole, 100-position printed-circuit-switch. Any of the 31-poles can be switched to any of the 100 taps. Since each of the 100 positions provides a 1 per cent increment of voltage, potential on each of the 31 poles can be adjusted to within 1/2 per cent of any required voltage.

Straight-line interpolation between any two of the 31 points is provided by a toroidally-wound interpolating potentiometer. A gearing system standard in other Perkin-Elmer Vernistats, moves the potentiometer arm to co-ordinate with the movement of the shaft between the autotransformer taps.

Arranging the 31-pole switch in the form of a panel gives a visual representation of the output. The x-axis represents shaft rotation; the y-axis represents voltage output. Switch sliders can be instantly changed to accommodate requirements of the system.

Besides applications using linear Vernistat a-c potentiometers, the adjustable version may be

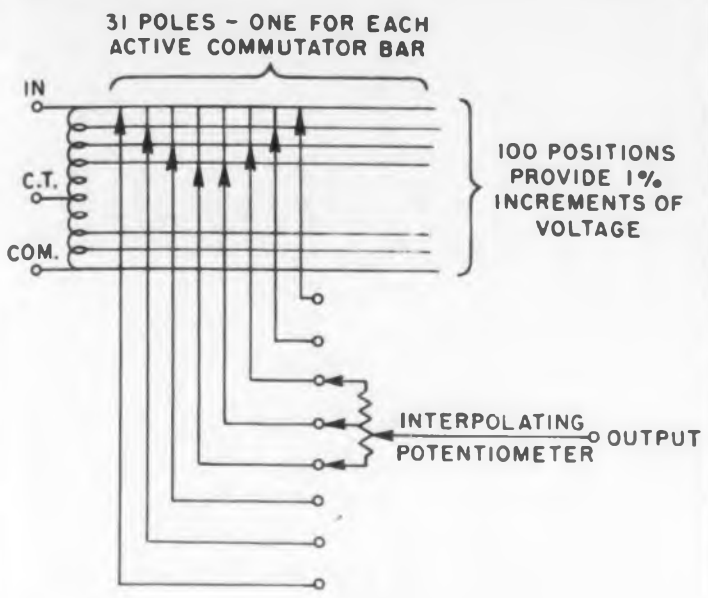


Fig. A. Schematic of the 31-pole, 100-position switch, permitting rapid adjustment of the output voltage curve.

used to correct nonlinear transducers. Basically, it introduces a nonlinear function in a system, such as a servo system. In a bombing computer, for example, where the exact nature of the function is not known in advance, a correcting nonlinear function may be introduced in the time it takes to adjust the sliders.

Minimum slope of the voltage output curve can be zero. Because of power dissipation limitations in the interpolating potentiometer, maximum slope is limited to 12v between adjacent poles.

Present models of the adjustable version of the Vernistat are available for use at frequencies up to 400cps at 130v. At frequencies below 60cps, input voltage rating is reduced. With special transformer cores, the device will operate at frequencies up to 10,000cps. Output impedance is about 130 ohms. Input impedance is of the order of 65,000 ohms, depending upon application. For more information on this function generator, turn to Reader's Service Card and circle number **21.** *Wescon Show, Booth No. 1328.*

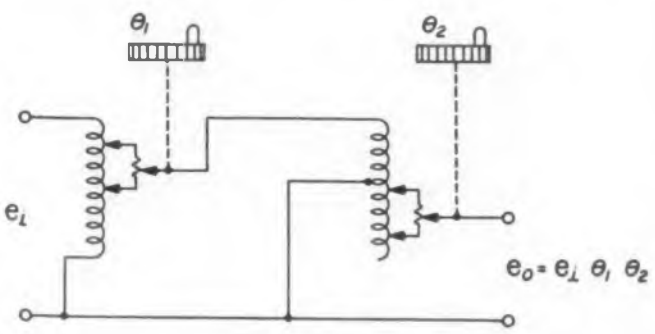


Fig. D. Schematic of the typical application as a voltage multiplier. Voltage e_1 is first multiplied by shaft angle θ_1. The result is then multiplied by shaft angle θ_2.

Packaging

MAXIMUM reliability, simple operation and convenient maintenance were major design objectives in "packaging" Consolidated's Type 1-127, 20kc four-channel carrier amplifier. To achieve the objectives, the designers used cellular construction, printed circuits, dip soldering, air blower with filter, and several restraining and locking devices.

The instrument includes four carrier amplifiers mounted in a single case with associated bridge-balancing circuits, control, metering, and calibrating systems, a power supply, and a 20kc oscillator. The 8½" high "package" is 17½" long, and 11½" deep. It weighs 50 pounds.

The system is used to amplify 0-3000cy signals produced by transducers to a level suitable for the operation of galvanometers in a recording oscillograph. This makes possible the measurement and recording of such physical phenomena as the pressure transients which occur in internal-combustion engines, the stresses and deflections which are present in an aircraft wing under various loading conditions, and high-frequency vibrations in many forms of motion. The design objectives were to obtain maximum reliability while providing simple operation and convenient maintenance.

It was decided to design each of the four amplifier channels to be constructed as individual units which could be easily removed for servicing. To obtain optimum stability in critical portions of the amplifier circuit, printed wiring was used on epoxy-glass base. A large number of materials were tested. Epoxy glass was selected for the printed circuit base material, chiefly because of its low moisture absorption. As the instrument is designed to operate at 95% relative humidity, the printed circuit is further protected by a final coating of epoxy resin after connections to the printed circuit board are made by dip soldering. Typical printed wiring is shown in Fig. 1.

The cellular type of construction used in the design of the amplifiers allows greater component density in the final package while admitting to easy assembly of the individual amplifier cells on the production line. One of the cellular units is shown in Fig. 2.

The use of germanium diodes in the circuit presented a problem of temperature-rise control. Because of the temperature-sensitivity of the germanium diodes they were given first priority on the cooling-air stream and located in a position nearest the blower. The blower output was then routed past the high-dissipation keying tubes inside the amplifier cells, around the

Roy Heath
Consolidated Electrodynamics Corp.
Pasadena, California

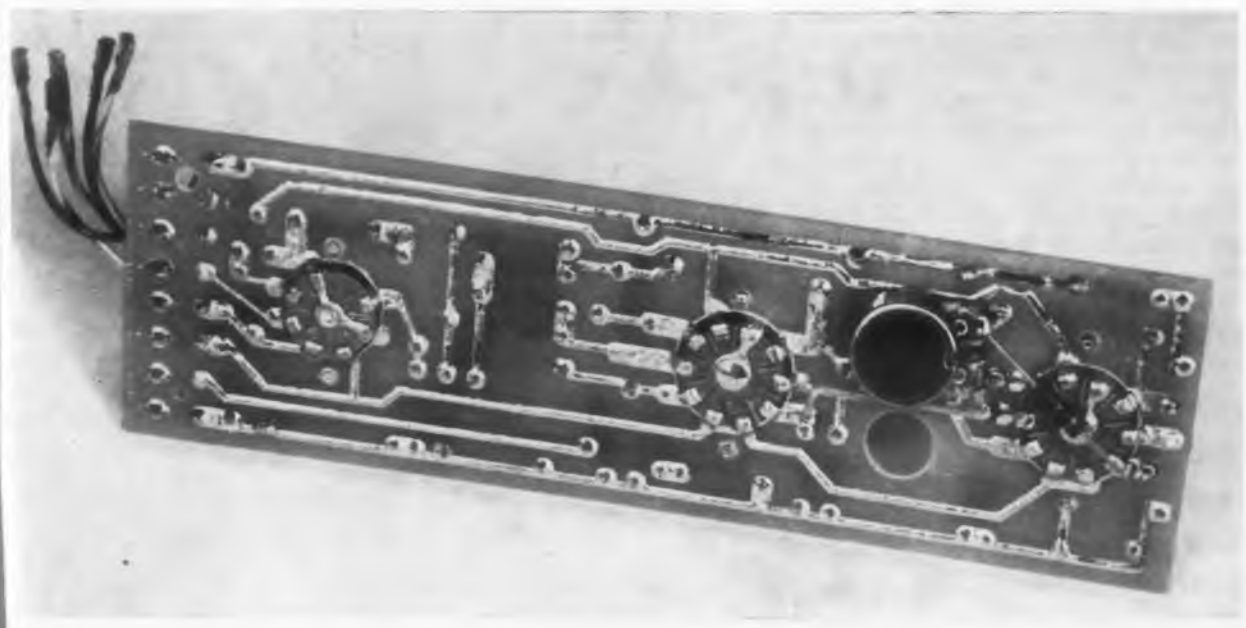
inside of the cabinet and bell and exhausted out the rear of the cabinet past the voltage amplification tubes. Thus by giving certain components priority on the cooling air, efficient cooling was obtained in spite of the high component density. Access to blower-intake air filter was provided by a hinged panel in the rear of the cabinet, Fig. 3. This panel also provides access to the amplifier tubes and displays a tube location diagram.

The effects of shock and vibration were given careful consideration in the design. To make the amplifier system suitable for blast measurement applications it was designed to withstand 25g horizontal or 30g vertical shock when used with its shockmount base. Because of this requirement the cabinet was designed with cast aluminum ends joined by extra-gauge sheet steel panels to form a rugged shock-resistant enclosure. All plug-in components, have been secured with restraining clamps to prevent them from losing contact or working out of their sockets under severe vibration, as shown in Fig. 4.

It was anticipated that the instrument would be used in different ways, also, stacking and rack-mounting possibilities were considered desirable. To provide for the stacking and latching requirement, the top and bottom panels of the enclosure were designed so that the bottom panel interlocks with the top panel of the unit below it in the stack, as shown in Fig. 5. A stainless-steel slide bar detented in locked and unlocked positions was incorporated in the rear of the bottom panel.

Fig. 2 Cellular type construction permits easy removal for servicing.

Fig. 1 Printed wiring and dip soldering on epoxy-glass base used for each of the four amplifier channels.



Two keyhole slots in the slide bar engage with two removable shouldered pins in the top of the lower unit, locking the instruments together. Engagement with the shockmount base is accomplished in the same manner.

A simple means of rack mounting was devised by providing a pair of tapped holes in each of the cast ends of the cabinet which accept the necessary screws for attaching an angle to each end. The cabinet is so designed that with the angles in place the resulting mounting surface dimensions match the RETMA Standards for rack mounting.

In the design of the instrument's control panel the objective was ease of operation and an appearance of simplicity. The first was attained by maintaining adequate operating clearance between adjacent controls and use of a large, well-lighted output meter.

The appearance of simplicity was gained by the individual grouping of each amplifier channel's controls on pads a deeper hue of the control-panel color. This color separation helps avoid the error of operating controls of other than the intended channel.

Cost Reduction

As in the design of any commercial product, the ultimate cost of producing the instrument was at all times kept in the minds of its designers. The cost of manufacturing was carefully balanced against the utility of its many features. Close coordination in the design phase between the design staff and the Manufacturing Division's personnel gave rise to many "built-in" production economies with no sacrifice of quality. For example, the case cabinet ends were designed to take maximum advantage of the company's new profile milling machine. Use of this machine materially reduces the cost of the finished castings.

Fig. 3 Rear view of the unit showing 4 amplifier cells and fan with filter (lower right).

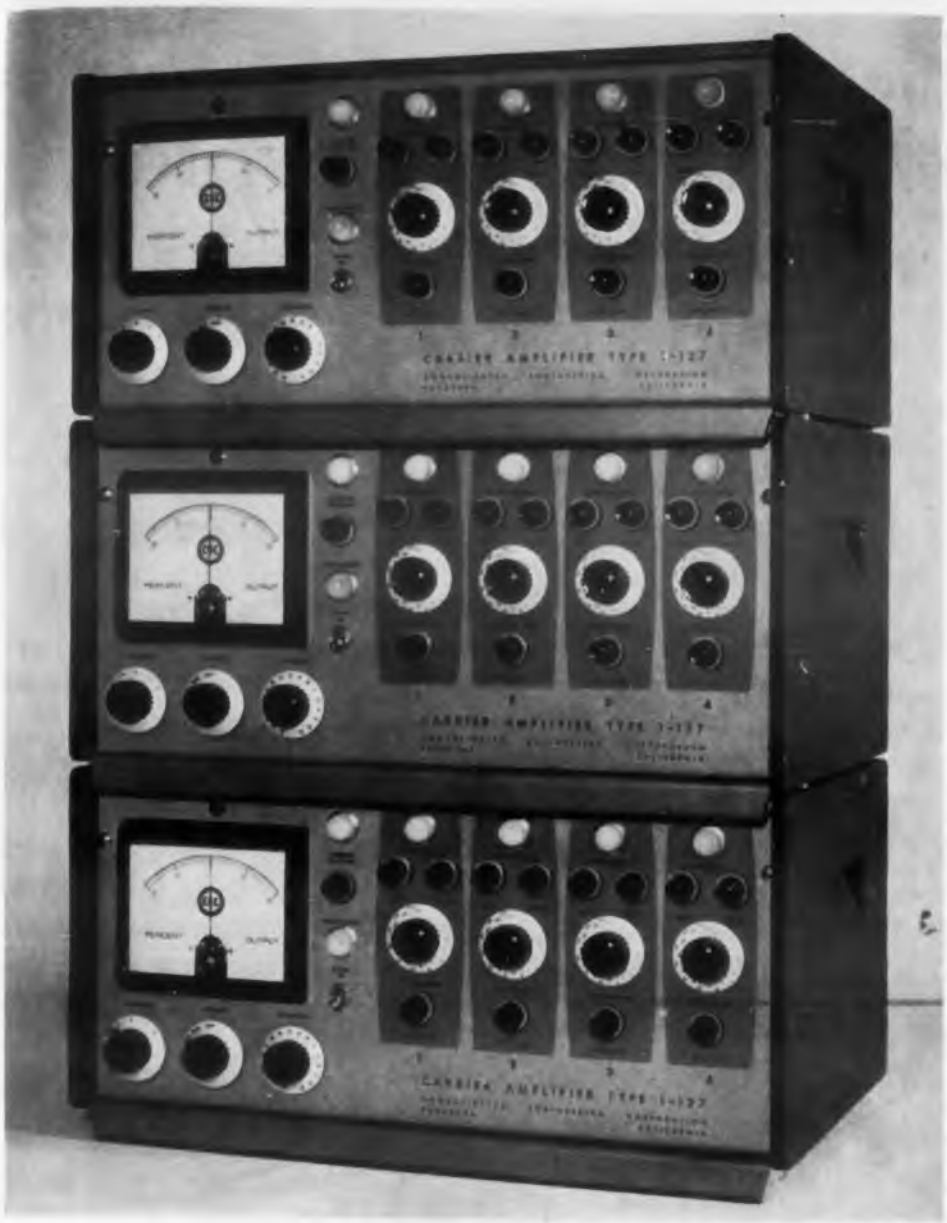


Fig. 5 Three of the amplifier units stacked to show use of latching system. The units can be rack mounted, if desired.

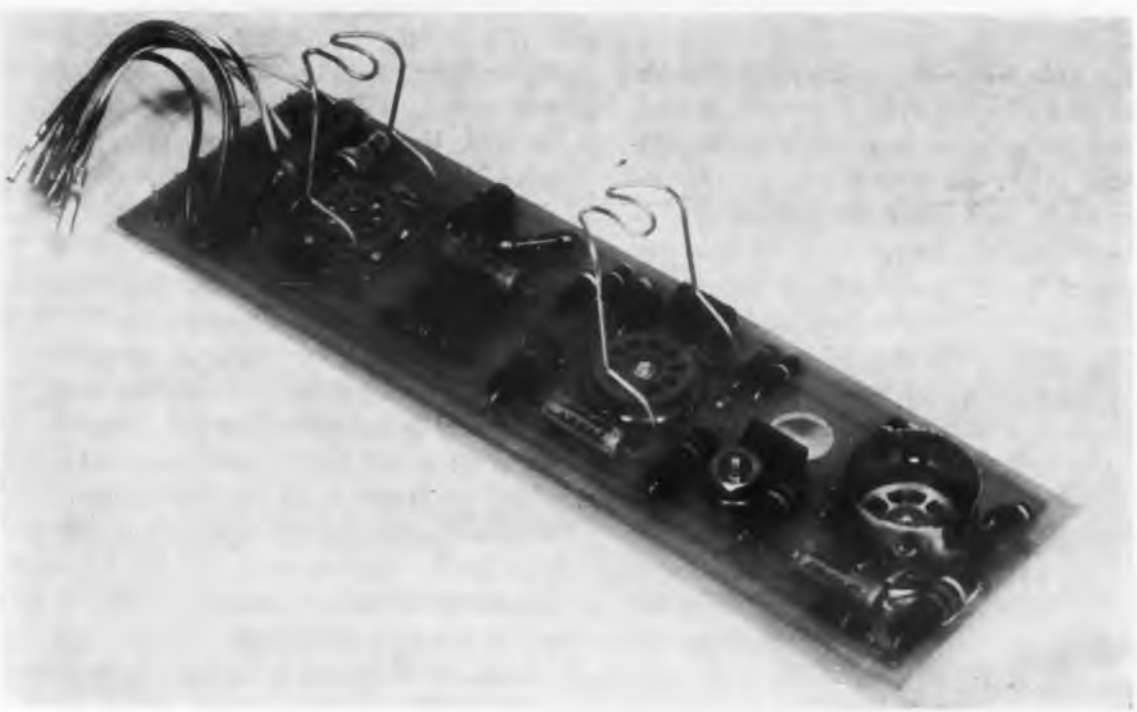


Fig. 4 Top side of circuit board showing wire retainers for holding tube in place.

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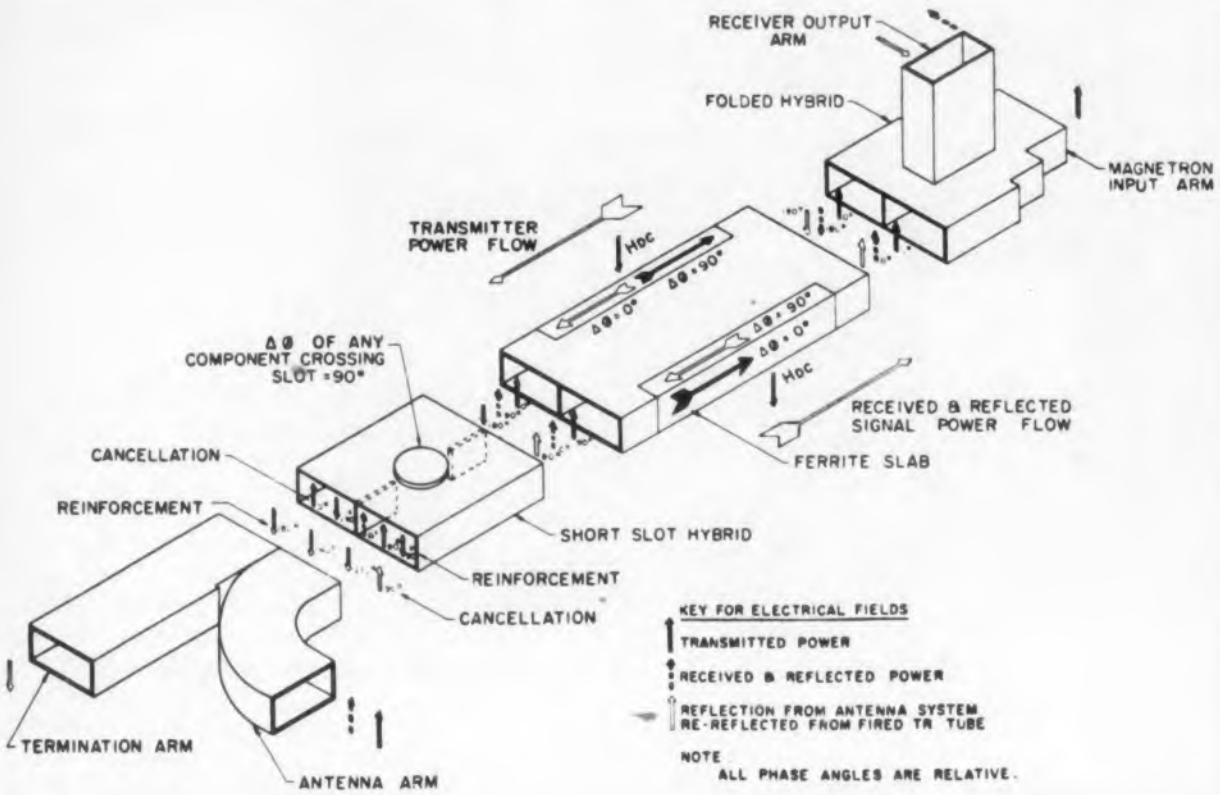
CIRCLE 26 ON READER-SERVICE CARD FOR MORE INFORMATION

△ X-Band Ferrite Duplexer

acts as switch and isolator



How It Works—Power from the magnetron enters the folded hybrid at the shunt arm where it splits into two equal parts having the same relative phase (solid vectors). As this energy continues through the ferrite sections, one part shifts 90° in phase with respect to the energy in the other line. By virtue of the 90° quadrature phase property of the short slot hybrid and since the power entering the short slot hybrid differs in phase by 90°, all of the energy will leave the antenna arm with only a small transmission insertion loss.

The returned signal energy (dotted vectors) again divides into two equal parts in the short slot hybrid, shifts 90°, and enters the ferrite section. Because of the non-reciprocal property of the ferrite elements, the two signals leave the ferrite sections with a total relative phase differential of 180°. The signals are then combined in the series arm of the folded hybrid and appear at the receiver output arm.

The magnetron to load isolation action is realized when the TR tube, placed at the receiver output arm, is ionized and short circuits this terminal. Under this condition, the energy received from load mis-matches is reflected by the short circuit to the junction of the folded hybrid. By virtue of the series junction action of the folded hybrid, this energy enters the magnetron side of the ferrite sections with a relative phase difference of 180°. The energy proceeds through the ferrite section which causes an additional 90° differential phase shift. Thus this energy leaves the ferrite section with a relative phase difference of 90° as illustrated by the open vectors in the diagram. Again, the short slot hybrid causes all of this reflected energy to appear at the load termination which is connected to the opposite arm of the short slot hybrid.

Since all of the energy is split into two equal parts, the duplexer will operate at higher power levels without forced air cooling than would a ferrite duplexer of the Faraday rotational type.

THIS ferrite phase differential X-band duplexer, incorporates in a single device both duplexer and load isolation action. It functions as a switching device between magnetron, receiver and antenna, and also furnished effective isolation between the magnetron and r-f energy reflected from line mis-matches. The unit achieves optimum magnetron spectrum and power output with consequent good AFC performance.

An added advantage of the unit, developed by Airtron, Inc., 1103 W. Elizabeth Ave., Linden, N. J., is that the design does not need an ATR tube in its operation nor does it require the use of a high power TR tube since there is a degree of isolation between the magnetron and receiver input arms. Therefore, this type of unit can operate at high power levels as a duplexer with great reliability. Also, since magnetron to load isolation is a built-in feature, the need for mechanical adjustment of a phase shifter to correct for "long line" effects is not required.

In operation, the duplexer has a nominal one way insertion loss of 0.5db maximum over its frequency range of 8500-9600Mc. The RG-67/U (1.000 x 0.500 waveguide) design has been operated at peak power in excess of 250kw at atmospheric pressure and average power levels of 250w without forced air cooling. A more important feature, though, is the inherent magnetron-to-load isolation of a minimum of 20db. With these characteristics, the unit has wide application in all high power radar designs.

When used in a radar system, the duplexer can aid in giving lower receiver recovery time since a low power TR tube can be used even with high level transmitted power.

The assembly consists of a folded magic tee, the ferrite section and a short slot hybrid coupler with a dual adapter which connects a matched load and the antenna to the hybrid. This duplexer is designed to meet repeated temperature cycling from –55°C to 71°C and can be pressurized. By using other designs of these components, the configuration of the duplexer can be altered. The WR-90 unit described here measures approximately 10-1/2″ long. For more information, turn to the Readers' Service Card and circle **27**. *This product will be displayed at the Wescon Show, Booth No. 957.*

miniaturized Dictating M

DESIGNING a miniature version of an office-size dictating machine requires more than just reducing the size and weight of the mechanical parts. Other problems involve reducing space occupied by tubes, transformers, and other components, and reducing heat generated within the cabinet. Each of these problems has been considered in the design of the Sound-Scriber Model 200 portable.

In some of the previous models of the Sound-Scriber machine, the low-impedance microphone required an input transformer. By substituting a high-impedance reluctance-type microphone cartridge, it was possible to eliminate this transformer. In addition, the microphone can be used as a low-level playback speaker. Other advantages of a reluctance-type microphone-speaker unit include ruggedness, and resistance to moisture and humidity.

Although the output transformer could not be completely eliminated, SoundScriber engineers were able to reduce its size considerably. This size and weight reduction was accomplished by designing a recording head requiring only 50mw drive. Previous recording heads required a driving power of about 1.5w.

Elimination of push-pull power output tubes was a by-product of the new low-power recording head. In the new machine, one *12AU7* connected in parallel supplies sufficient power to the head. Heat dissipation is reduced, allowing reduced physical dimensions of the cabinet. Of course, space occupied by one *12AU7* is considerably less than that required for the pair of output tubes used in previous models. Lower current requirements of the tubes permit using a smaller and cooler operating power supply, again reducing space requirements.

Automatic volume control has been incorporated into the amplifier circuit. Thus, constant voice level is maintained on the recording. Extra power required to operate a neon or similar type of indicator is eliminated. Negative feedback is used to reduce distortion in the amplifier.

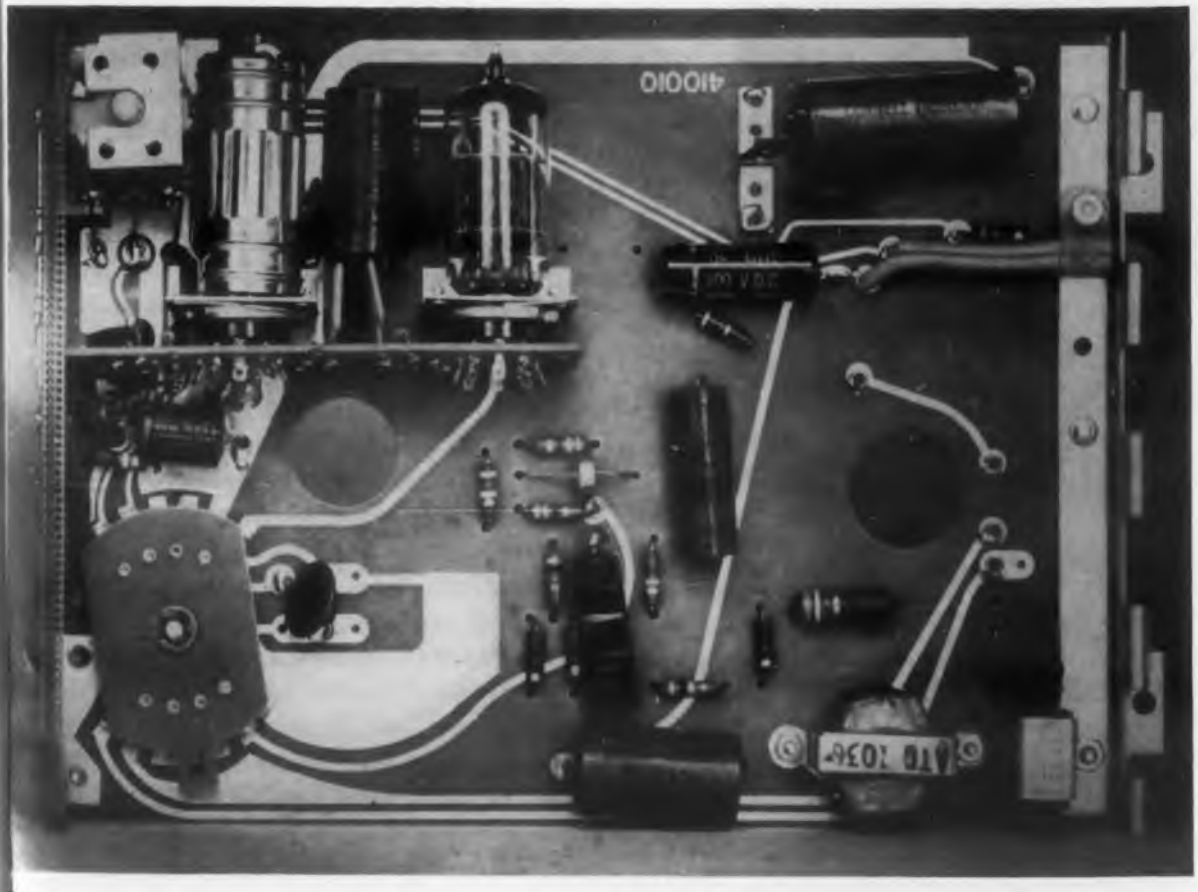
Machine

Two printed circuits eliminate bulky wiring. One large printed-circuit board makes up the main part of the assembly. Another smaller board, mounted at right angles on the larger board, holds the tube sockets.

Besides reduction in size and weight of the electronic components, mechanized changes were made to reduce the bulk and complexity of the turntable drive. Recordings are made on 3-7/8" plastic discs at 33-1/3 rpm. This recording speed permits playback on an ordinary home phonograph. Recording time is 7-1/2 min.

Weight of the complete unit has been reduced to just under 6 lb. Physical dimensions are about 6" wide by 10" long and 3" high.

Inside of the miniaturized SoundScriber showing placement of parts. Printed circuit boards are in the lower half of the cabinet. The mechanical drive components, including the recording head lead screw are in the upper half.



Two printed circuit boards are used in the machine. Smaller board, upper left, mounted at right angles to the main board, holds the tube sockets.

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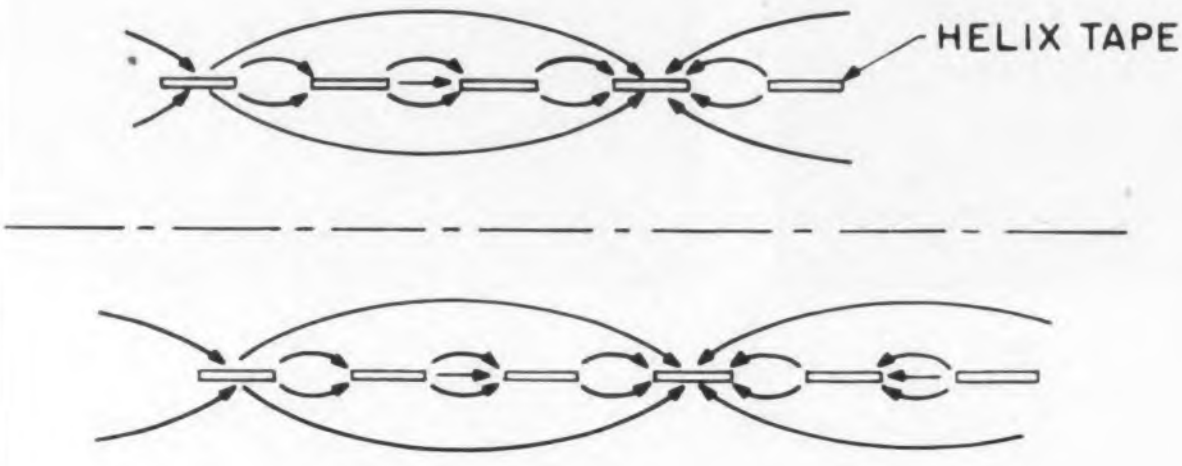
△ Backward Wave Oscillator

BACKWARD Wave Oscillator, Model VA-161 is the first backward wave oscillator emitter tube completely practical for use in production equipment. It offers advantages of instantaneous voltage tuning and compactness; it is also rugged, and has steady power output—limitations heretofore unobtainable. It is intended for local oscillator operation in radar sets, signal generators, test sets and countermeasure receivers in the frequency range of 8.5 to 9.6kMc on less than 300v. The miniature tube combines ruggedness and low voltage operation in a 5 lb package that takes up the space of a 4″-cube including the built-in permanent magnet. The overall size of the tube is approximately 4″ long by 3/4″ diameter. It is expected that these tubes will replace the older mechanically-tuned and thermally-tuned klystrons in many applications, as well as opening new fields of equipment design.

To achieve ruggedness, the tube, built by Varian Associates, 611 Hansen Way, Palo Alto, Calif., utilizes a tape helix which is only 1″ long and glazed to sapphire rods for rigidity. This assembly is placed inside a close-fitting metal tube equipped with ceramic end seals. The complete tube assembly includes a waveguide output. To achieve low voltage operation, with all voltages totaling less than 600v at the maximum frequency (12.4kMc) and less than 300v at the usual radar frequencies, a hollow electron beam, spaced closely to the helix, is used. Tests have shown that these tubes contribute negligible noise to receivers and no spurious oscillations have been detected. For more information on this device, turn to the Reader's Service Card and Circle **32**. *See it at the Wescon Show, Booth 1054-1055.*



Background on Backward Wave Tubes

The r-f circuit consists of a flat tape wound into a cylindrical helix as shown in the cross sectional view. Such a structure will support a traveling wave in which the velocity is nearly that of light in the helical direction. The r-f electric field lines (illustrated at the cross section plane) rotate in the helical direction and progresses axially at a velocity much less than that of light. An electron moving in the axial direction in close proximity to the tapes will be affected by the longitudinal electric field while it is opposite a gap, but will see none of this component when opposite a tape. If the electron sees the r-f field in the same phase every time it passes a gap, it will experience a cumulative effect.

The approximate requirement for cumulative interaction is then that an electron travel a pitch distance in one r-f cycle in less than the time required for the wave to travel a similar distance. It is this phase criterion that produces the voltage tuning of the backward wave oscillator. Earlier models have been fragile because they are made up of glass and are up to 10" long and have large electromagnets requiring separate power supplies. Voltages up to 2000v have been required. Wide variations in output power have been experienced. The VA-161 is thus a note-worthy advancement. Models for frequency up to 40kMc are being developed.

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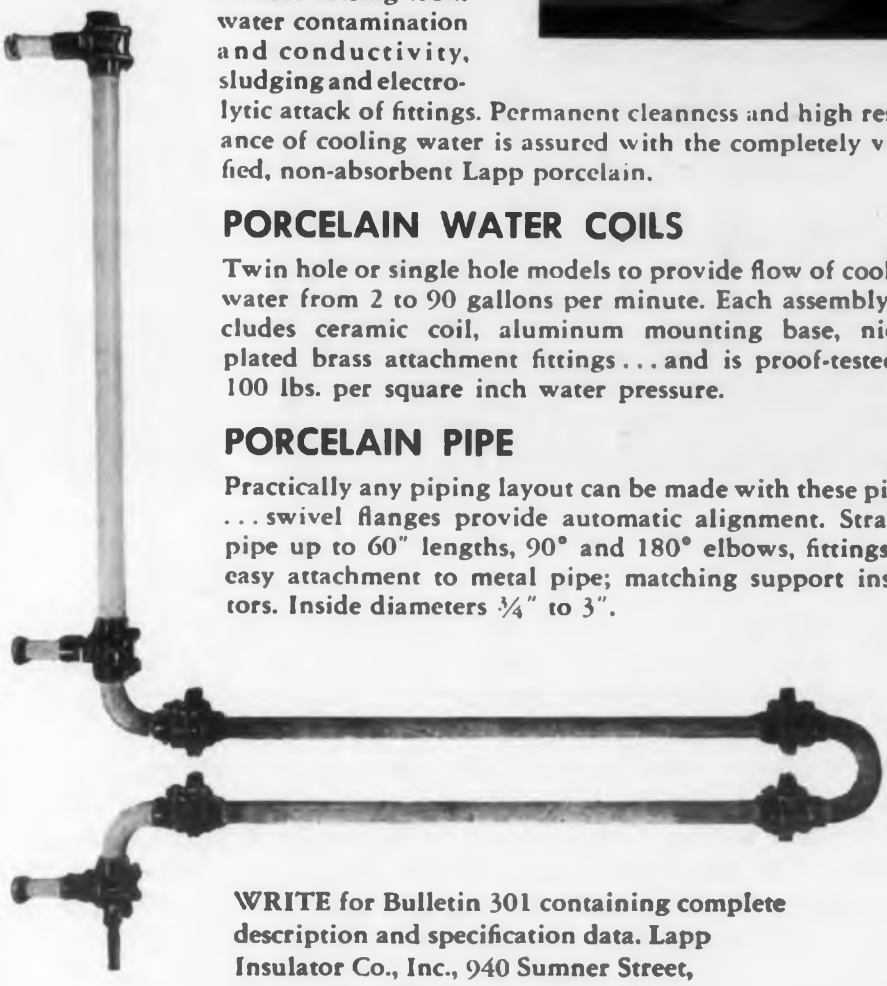

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WRITE for Bulletin 301 containing complete description and specification data. Lapp Insulator Co., Inc., 940 Sumner Street, Le Roy, New York.

Lapp

CIRCLE 33 ON READER-SERVICE CARD FOR MORE INFORMATION

Fig. 1. EngineScope in operation.

Modified Oscilloscope Analyzes Engine Performance

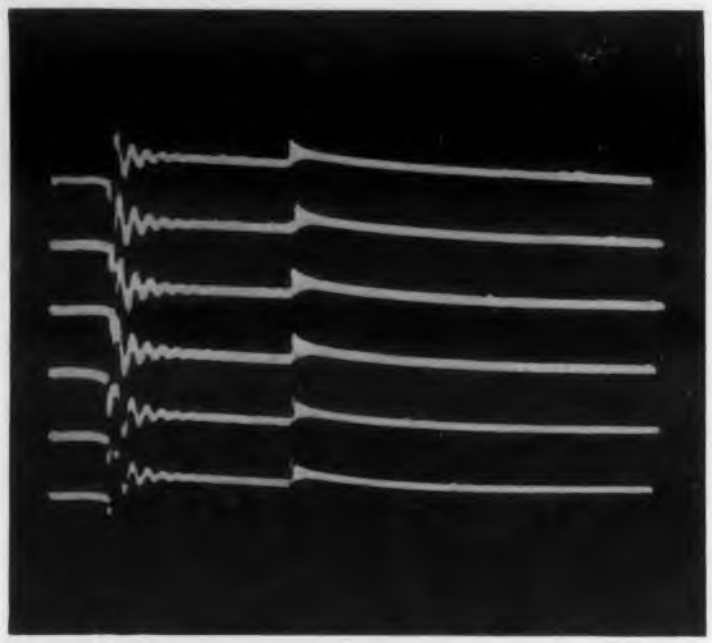


Fig. 2. (a) Normal six cylinder ignition presentation. Large transients (left) are spark plugs firing. Smaller transients are distributor points closing.

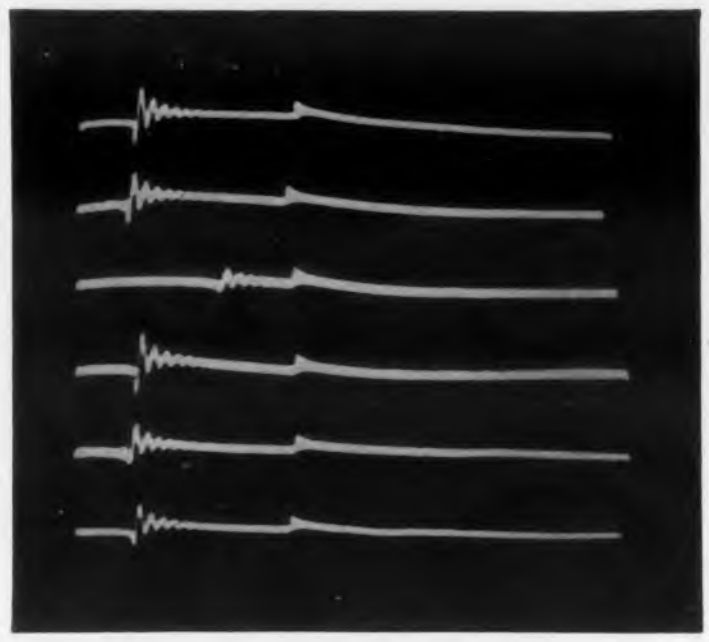


Fig. 2. (b) No. 3 spark plug not firing; distributor working ok.

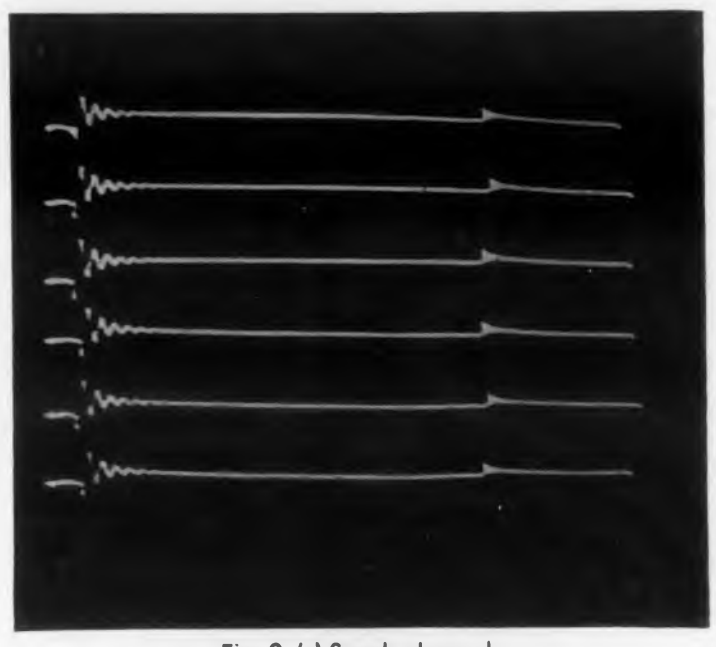


Fig. 2. (c) Spark plugs ok; points closing late (insufficient dwell angle).

QUITE often equipment designed for one purpose or phase of activity finds application in seemingly unrelated fields. Described here is one such device, and it shows how through relatively simple modification of a cathode-ray oscilloscope, a whole new market and service is opened up for this electronic product. It is our purpose to briefly describe the requirements placed on the equipment by the new application and the important changes made to the basic oscilloscope to fulfill the need.

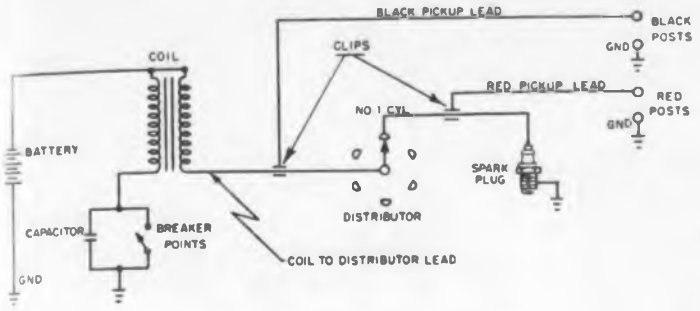
In the automotive field, a complete analysis of the electrical ignition system heretofor required removal of the distributor and spark plugs from the car. A dynamic test of engine performance might show the electrical system to be at fault; yet, the specific ailment could often be traced only by the process of elimination and by expenditure of costly labor time. The problem for the oscilloscope, therefore, was to provide a complete ignition system analysis with engine intact and running.

Some of the specific requirements that the analyzer needed to provide were the following: ignition testing under actual operation; no effect on engine performance by connection of test equipment, complete information on each cylinder separately or in concert with the others; measurement of engine rpm; convenience in switching between engines having different numbers of cylinders; provision for permanently recording test results; and adaptability to other than ignition problems by use of appropriate transducers. The oscilloscope was ideally suited for this, and the unit that evolved and is now in commercial production is shown in Fig. 1. It is manufactured by Allen B. DuMont Labs., Inc., of Clifton, New Jersey and is called The DuMont Type 901 EngineScope.

By employing a raster pattern on the oscilloscope screen, information about each cylinder is conveniently presented as shown in Fig. 2. To give a raster pattern, *two* sawtooth generators are required instead of the usual *one*. The second generator supplies the vertical sweep which allows information to be stacked vertically by cylinders. In addition, it is necessary to synchronize the pattern on the screen in some predetermined manner. The vertical sawtooth generator is synchronized by pulses from the No. 1 cylinder; thus the vertical saw frequency is half the engine revolution frequency. Horizontal sweep, on the other hand, is synchronized with the opening of distributor points and thus occurs for each cylinder in order. To prevent downward tilt of the various baselines, a special "tilt correction circuit" is incorporated. Tachometer recording of engine rpm is a by-product of phenomena occurring in the horizontal sync circuit. Only a meter and a few components are required.

Oscilloscope Modifications

Because the engine analyzer is designed for testing a vehicle on the road as well as in the shop, it was found necessary to protect the instrument against vibration effects. In particular, it was necessary to shock



Engine ignition system showing hook-up for analyzer.

mount the input stage (*V101*) and vertical deflection amplifiers (*V102* and *V103*). These are shown on the block diagram (Fig. 3).

By connecting the deflection amplifiers (*V102* and *V103*) in a balanced circuit (see schematic Fig. 4), the vertical sweep voltage is mixed with the deflection signals. The stage is self-inverting due to the large value cathode resistor; thus both signal and raster components are effectively inverted to provide balanced deflection for both. The "line spacing" control adjusts the amplitude of the vertical raster component.

Locking-in of the horizontal and vertical sync is done at the input to the respective sync amplifiers, where the spark signals are capacity-coupled to the 1st sync amplifier grids. The grids in turn are returned to the positive supply to discriminate in favor of the negative components of the spark signals.

Raster generating voltages are obtained by thyratron saw tooth generating circuits (*V203* and *V302*) and constant current pentodes (*V204* and *V303*). Raster tilt correction is accomplished by feeding a suitable amount of horizontal sweep voltage to the vertical sweep circuit through tilt amplifier *V205-B*. The vertical raster generating circuit and the tilt circuit are in addition to circuitry normally required for general-purpose oscilloscopes.

The engine rpm tachometer consists of an ammeter (*M301*) in series with the constant current horizontal sweep tube (*V303*). This meter reads average current flowing, which is directly proportional to engine speed. The meter is directly calibrated in engine revolutions. To keep meter calibration the same regardless of number of cylinders, appropriate capacitors *C309* through *C314* are switched in accordance to engine cylinders.

Early development of this engine analyzer was done in cooperation with Socony Vacuum Oil Company Engineers. It has been finding wide-spread acceptance in garages and filling stations where tune-up work is performed. Labor time is often reduced many-fold, and a service is performed not possible with any other presently existing equipment.

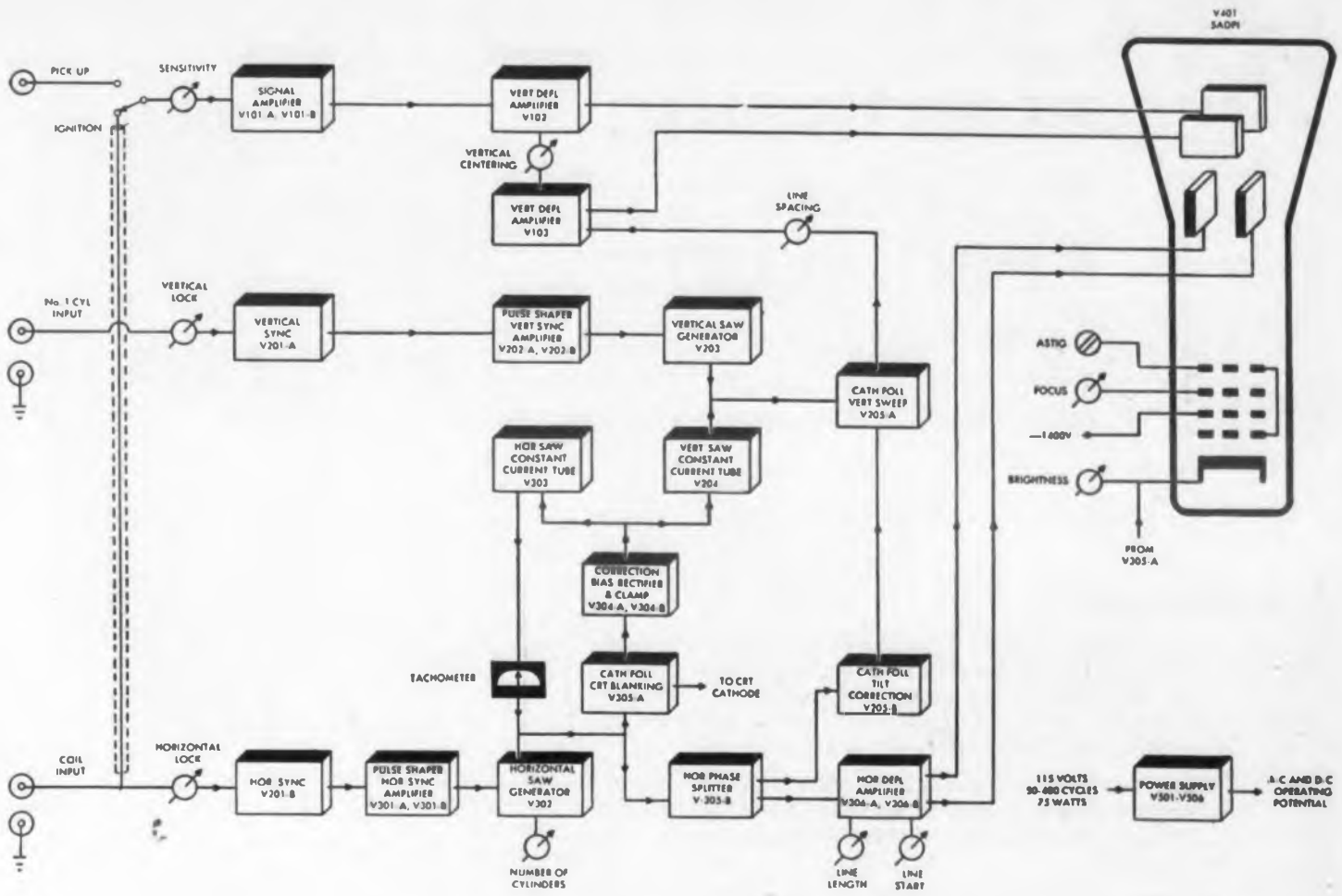


Fig. 3. Block diagram of Du Mont EngineScope.

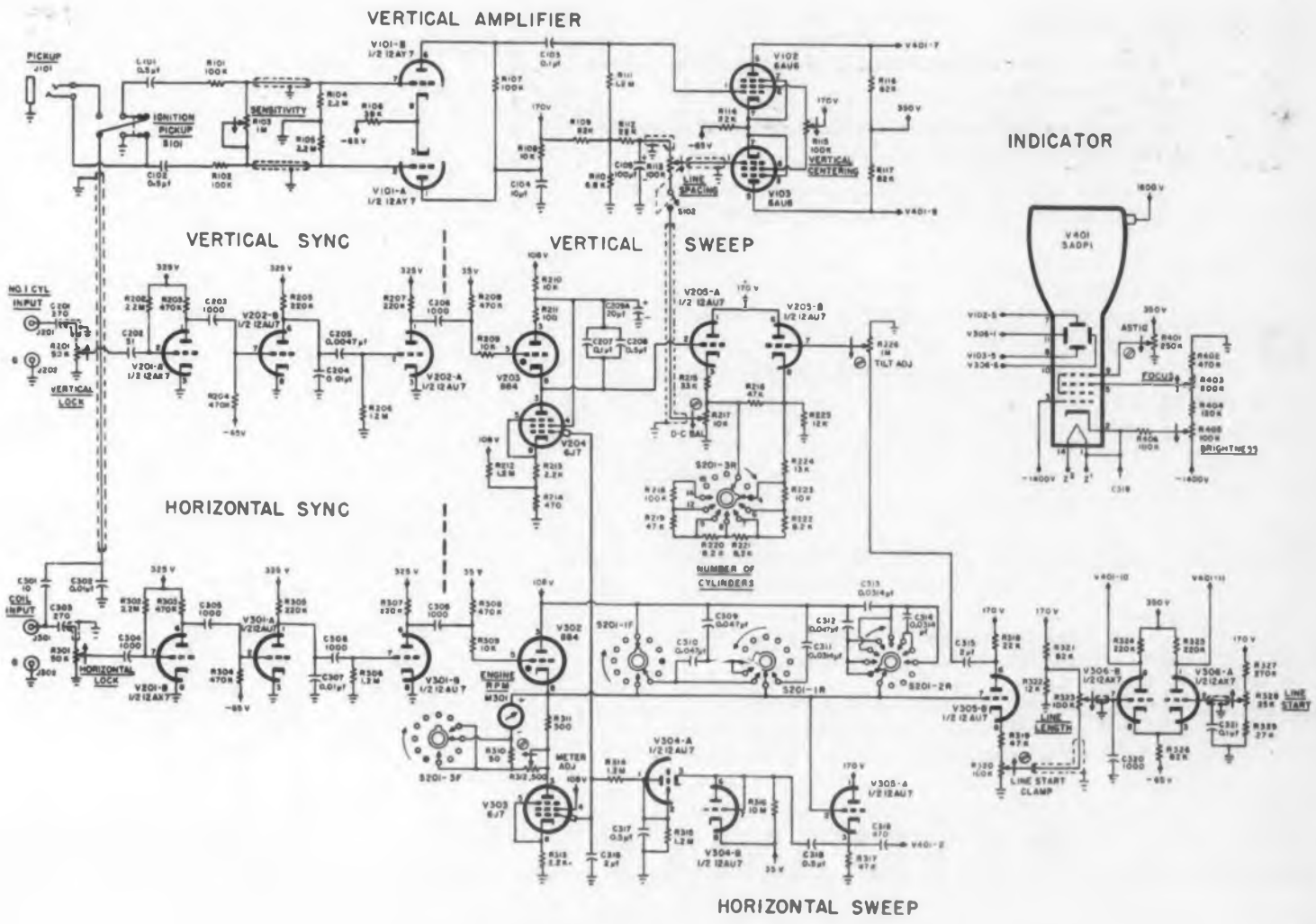


Fig. 4. Schematic diagram.

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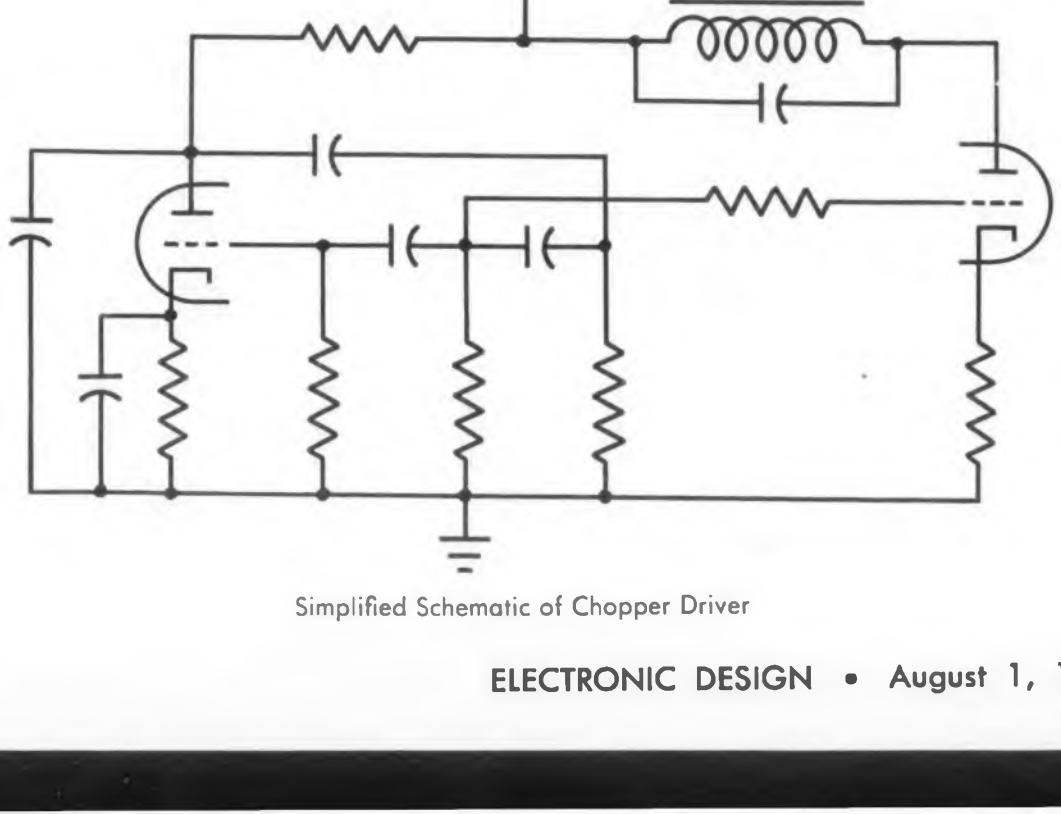
△ Plug-In Driver

THIS plug-in one-tube oscillator inverter provides 400cps power to drive one or two miniature choppers, such as the Airpax type 300. It enables the designer to use a 400cps chopper in equipment powered by dc or 60cps voltage, and avoids any possible interference from 60cps pickup. The driver produces 6.3v at 400cps ±20cps over an ambient temperature range of −65 to 100C.

Available from Airpax Products Co. of Middle River, Baltimore, 20, Md., the driver selected may



Simplified Schematic of Chopper Driver

for 400-cycle Chopper

be of one or two types depending upon application. The Type 202-1 drives one (Airpax Type 300) chopper; the Type 202-2 drives two. Power required for these drivers is generally available in the associated electronic equipment. That required for the Type 202-1 is 6.3v at 0.3a or 12.6v at 0.15a and 225v d-c plate voltage at 5ma. The Type 202-2 draws 7-1/2ma plate current. A *12AT7* or *12AT7WA* ruggedized tube is used in both.

Overall size of the driver is 1-1/2 in. in diam x 4-3/16 in high. Total weight is 4.4 oz. Power output is 125mw for Type 202-1 and 250mw for Type 202-2. The oscillator circuit is potted and withstands as much vibration as the ruggedized version of the *12AT7* dual triode. The unit plugs into standard octal tube sockets.

There are two principal advantages of a 400cps chopper in equipment powered from a 60cps source. Chopper frequency is well removed from the power frequency thereby greatly reducing interference from the power supply in the signal channel. Also the faster chopper action increases the bandwidth in the signal channel thus making possible more rapid equipment response with the 60cps chopper. Although an interrupter could be included inside a chopper structure to enable it to operate directly from dc, the unavoidable arcing at the interrupter contacts and the relatively high drive-coil current passing near the signal contacts would produce an intolerable noise level inside the chopper. The chopper driver avoids all these complications.

For additional information on this product, fill out the Reader's Service Card and circle No. **35.** *Wescon Show, Booths, No. 1001-1002.*

New Products

Products marked with a triangle are being exhibited at the Wescon Show and include the company's booth number. Additional Wescon items will be shown in the August 15th issue.

△ Klystron

For 8,500 to 10,500Mc Range

This is a new "x" band, waveguide output, two cavity klystron oscillator which features excellent frequency stability and extremely low microphonics. This tube design has been made available in any of the three power classes—the type DX122 for 5w, the DX123 for 20w and the type DX124 for 150w min. It covers any fixed frequency in the 8500 to 10,500Mc range, and satisfies the application requirements of guided missiles, radar, telemetering devices and microwave relay links.

Extremely rugged in construction, the klystron is so simple in operation that no mechanical adjustments are required. It is electrostatically focused with easily modulated a-m or f-m and has an a-m/f-m new "dispenser" type cathode for long life.

Amperex Electronic Corp., Dept. ED, 230 Duffy Avenue, Hicksville, L.I., N.Y.
Wescon Show, Booth No. 1203.

CIRCLE 37 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Printed Circuit Receptacles

For 1/16" to 3/16" Thick Boards

Pictured above both in top and bottom view is one of the many new microminiature printed circuit receptacles and its mating plug. These receptacles are easily assembled to all printed circuit boards from $\frac{1}{16}$" to $\frac{3}{16}$" thick, and provide coaxial or shielded cable connections in a most efficient manner.

Microdot, Inc., Dept. ED, 1826 Fremont Ave., S. Pasadena, Calif.
Wescon Show, Booth No. 1327.

CIRCLE 38 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Static Converter

Transistorized "D-C Transformer"

The "D-C Transformer" is an efficient 80 to 90% static converter of 24-32v d-c power to higher or lower voltages.

The unit is designed to meet military specifications and operate under airborne environmental conditions including an ambient temperature range of −65F to +165F.

The high voltage output can be shorted without damage to the unit.

Units rated up to 30w output can be provided in Mil-T-27-GB cases. Typical units have the following output ratings: 450v d-c at 17ma, 200v d-c at 70ma, 110v d-c at 100ma, 6.3v d-c at 6amps.

Ramo-Wooldrige Corp., Dept. ED, 5730 Arbor Vitae St., Los Angeles 45, Calif.
Wescon Show, Booth No. 1113.

CIRCLE 39 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Power Transistors

For Automobile Radios

The *2N155* is a power transistor designed especially for the audio output stage of automobile radio receivers. Designed to operate from a 12v battery, this p-n-p germanium-alloy junction transistor features high power gain, uniformity and exceptional reliability. It is plug-in for easy installation.

Highly efficient heat dissipation is characteristic of the unit. Its heavy copper flange mounting permits the flow of heat from the power transistor to the chassis, thus providing a large radiating area.

CBS-Hytron, Dept. ED, Lowell, Mass.
Wescon Show, Booth No. 210.

CIRCLE 40 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Variable Impedance Termination

For High Power Testing

This unit is a high power precision variable impedance termination which enables the microwave engineer to determine the high power performance of microwave generators and waveguide components under known conditions of mismatch.

The unit may also be used for impedance matching in low or high power waveguide systems. It is built within a 1 x 1/2" waveguide and will handle up to 300kw peak power with any VSWR setting up to 3.0.

Canoga Corp. Dept. ED, 5955 Sepulveda Blvd., Van Nuys, Calif.
Wescon Show, Booth No. 510.

CIRCLE 41 ON READER-SERVICE CARD FOR MORE INFORMATION

△ X-Band Wavemeter

Q of Approx 8000

This new direct reading X-Band wavemeter provides broad band coverage of the complete 8.2 to 12.4kMc frequency range. The instrument provides direct reading of any frequency in the entire X band with an accuracy of 0.08%. It is readable directly in megacycles and is resettable within 0.01%.

The wavemeter is a transmission type, having a Q of approx 8000 and a dip at the resonant frequency of approx 1.5db.

Hewlett-Packard Co., Dept. ED, 275 Page Mill Rd., Palo Alto, Calif.
Wescon Show, Booth No. 1050.

CIRCLE 42 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Resin-Potted Transformers

Ruggedized and Miniaturized

This new resin-potted transformer will withstand temperatures up to 170°C. The units are hermetically sealed and designed for airborne use. They are impervious to humidity and altitude, and will withstand abuse without electrical or mechanical damage.

The potting material also welds core, coil, case, and terminals into an integral unit. The absolute lack of shrinkage in epoxy resin potting, due to a special formula, eliminates separation from the case as in normal resin potted units.

The transformers may be qualified under MIL-T-27A, Grades 1, 2, 4, or 5 as required. In addition, commercial types may be supplied with most of the benefits required by military specifications.

Electro Engineering Works, Inc., Dept. ED, 401 Preda St., San Leandro, Calif.

Wescon Show, Booth No. 922.

CIRCLE 43 ON READER-SERVICE CARD

Beam Power Tube

Horizontal-Deflection Amplifier

The *6CB2-A*, a high-perveance beam power tube of the glass-octal type, is designed especially for use as a horizontal-deflection amplifier tube in color TV receivers. Utilizing a button-stem construction in a T-12 envelope, this tube is smaller and more compact than the *6CB5* with which it is unilaterally interchangeable.

The *6CB5-A* has a max plate dissipation of 23w and a max grid-No. 2 input of 3.6w. These ratings in addition to a peak positive-pulse plate voltage rating of 6800v (absolute), enable a single *6CB5-A* in suitable circuits to provide full deflection for the RCA-*21AXP22-A* color picture tube.

Other electrical features are low mu-factor, high plate current at low plate voltage, and a high operating ratio of plate current to grid-No. 2 current.

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

CIRCLE 44 ON READER-SERVICE CARD

CIRCLE 45 ON READER-SERVICE CARD ➤

△ Wideband Flutter Meter

14.5Kc Carrier Frequency

The Model FL-4 wideband flutter meter is designed to permit a close and detailed study of the flutter and wow content of tape transport mechanisms. The unit operates at a carrier frequency of 14.5kc, obtainable from an internal crystal controlled oscillator. A zero-center 4" square meter indicates ±2% deviations and wow from a d-c to 4cps rate from center frequency.

A second meter measures percent rms flutter with full scale sensitivities of 2.0, 0.6 and 0.2%. A 3" flat face oscilloscope displays the flutter and wow signals with the same peak sensitivities. Selectable filters with 24db/octave slopes provide for flutter waveform analysis from d-c to 30cps, 30-300cps, 300-5000cps, and d-c to 5000cps.

D-c response of the instrument provides for a self-calibrating procedure with the aid of a frequency counter and an audio oscillator. The extended bandwidth of the unit makes possible the examination and study of high flutter frequency phenomenon associated with head scrape, tape motion, and modulation noise. The flutter signal is available for galvanometer or direct writing recorders.

D&R Ltd., Dept. ED, 402 E. Gutierre St., P. O. Box 1500, Santa Barbara, Calif.
Wescon Show, Booth No. 344.

CIRCLE 48 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Disc Dial & Vernier Set

In 4 Ranges of Diameter

These precision engraved disc dial and vernier sets are available in 4 ranges of diameter 1-1/2", 2", 3", and 4". A complete set consists of disc dial and vernier which will allow readings within 6 minutes of accuracy. Standard stock units are engraved in 1° steps reading 0 to 360°.

PIC Design Corp., Dept. ED, 160 Atlantic Ave., Lynbrook, L. I., N. Y.
Wescon Show, Booth No. 1329.

CIRCLE 49 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Miniature Telemetering Filters

For Every Channel and Bandwidth

This is a complete line of miniature telemetering filters for every channel and bandwith. A typical miniature bandpass filter (illustrated) in the MIL style GB case has 15% bandwidth at ±1.0db and phase shift linearity within ±5%. Attenuation at ±15% from center frequency is 30 db. Voltage gain is 0db.

Hycor, Div. of International Resistance Co., Dept. ED, 12970 Bradley Ave., Sylmar, Calif.

Wescon Show, Booth No. 912.

CIRCLE 50 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Tape Translator

Accepts Any 1-2-4-8 Binary Code

The Model 50 tape translator permits the automatic plotting of digital information from perforated paper tape when used in conjunction with a standard tape reader and an Autograf Model 2 X-Y recorder.

The Model 50 tape translator is adaptable for use with computers and a variety of perforated tape prepared on a Flexowriter, IBM tape punch, or other similar equipment. The standard machine will accept any 1-2-4-8 binary code and (on special order) any other code.

Special features of the translator include: plotting of any number of values of the dependent variable versus one value of the independent variable; two methods of indicating positive and negative values; automatic by-pass of all finish codes punched into computer prepared tape; provision for introduction of error signals to correct incorrect points punched in the tape.

Specifications include: plotting speed: 60 points per minute, max; accuracy: 0.10% for digital to analog conversion; plotting scales: 10, 20, 50, 100, and 200 points per inch; zero offset: 100 to 900 points in steps of 100 by calibrated front panel switch.

F. L. Moseley Co., Dept. ED, 409 N. Fair Oaks Ave., Pasadena, Calif.

Wescon Show, Booth No. 1148.

CIRCLE 51 ON READER-SERVICE CARD FOR MORE INFORMATION

CIRCLE 52 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Subminiature Voltage Regulator

Has Good Long Time Stability

The REL-11 is designed for airborne electronic instrumentation and guidance systems where precise and dependable voltages are required. It is packaged in two separate aluminum cases. One case contains the control unit—the other contains the series regulator. By the addition of another series regulator case the current capacity can be increased to 200ma. The unit utilizes subminiature tubes, printed circuitry and efficient heat transfer construction.

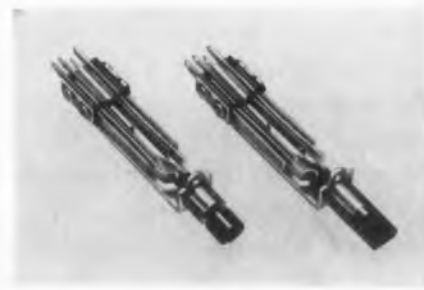
The REL-11 is designed for high performance operation under adverse conditions and has good long time stability and allows calibration of the output voltage independent of line and load variations. Interaction of a-c signals in circuits under operation or test is kept at a minimum by the low a-c output impedance. High gain amplifiers assure constant output for changes in line voltage and load current.

Rheem Mfg. Co., Dept. ED, 9136 E. Hall Rd., Downey, Calif.
Wescon Show, Booth No. 135.

CIRCLE 54 ON READER-SERVICE CARD FOR MORE INFORMATION

△ "T-Switch"

Has Long Frame



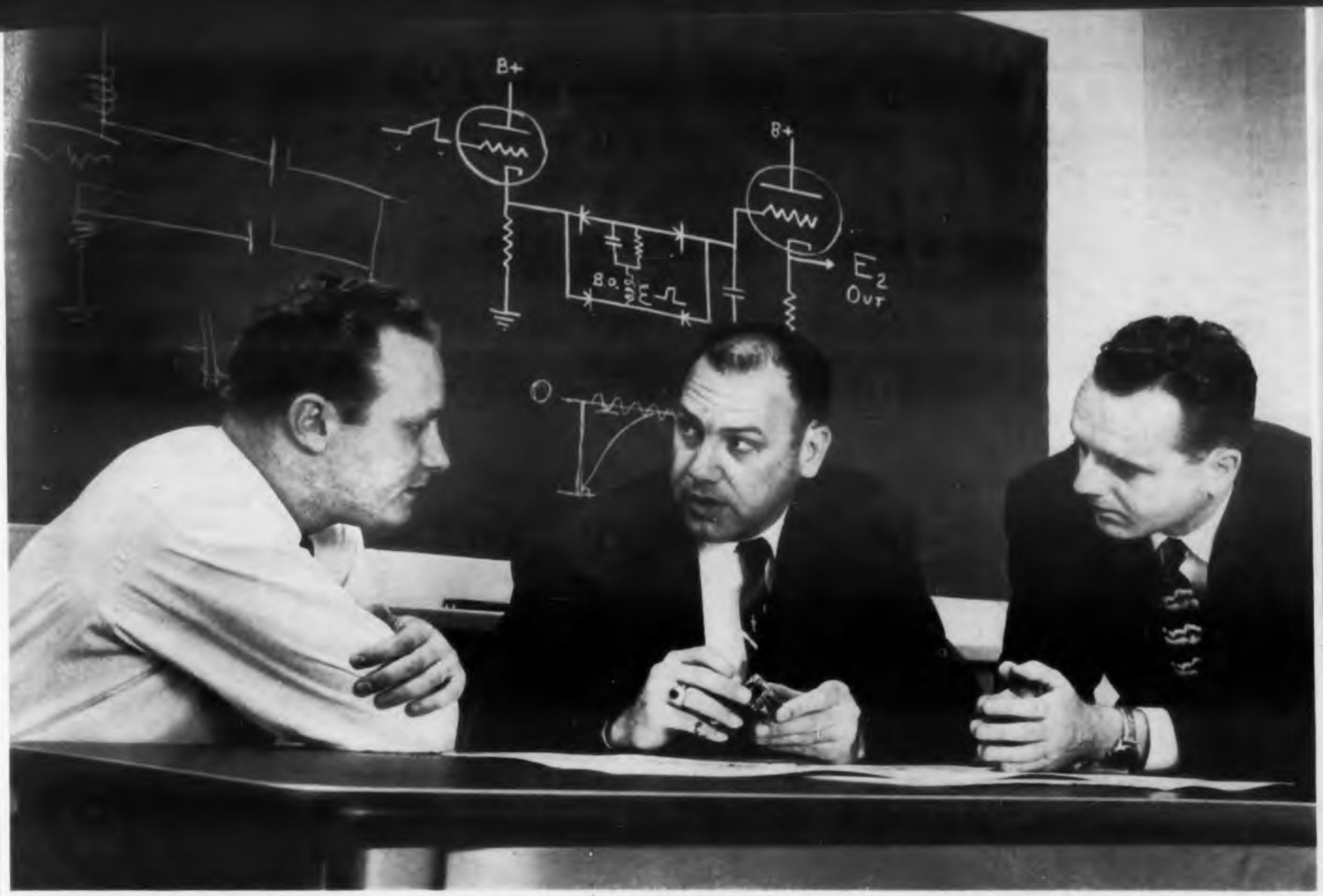
This is a long frame switch in 2 frame designs, designed especially for high quality communication equipment and to meet the exacting requirements of the Armed Services.

Available in 2 series: Series 11000—Push button switch for momentary action and in push-to-lock, pull to release action or locking type. Series 11200—2 position turn button switch for non-locking and locking action; button faced with a wide white line making it easy to see the position of the knob.

The new design features relatively long springs without any "forms" at point of flexing for longer spring life.

Switchcraft, Inc., Dept. ED., 1328 N. Halsted St., Chicago 22, Ill.
Wescon Show, Booth No. 805.

CIRCLE 55 ON READER-SERVICE CARD FOR MORE INFORMATION



A. A. Daush (center), head of the Electronic Components Design and Packaging Section. discusses the use of transistors and other new components in packaging techniques involving modular construction and etched boards with N. J. Schuster (left), Electronic Research Design Engineer, and P. A. Alpine, Missile Guidance Group Leader.

ELECTRONIC PACKAGING

▲ ▲ ▲

a critical missile problem

Advance missile performance reflects the ability of engineers and designers to solve packaging problems of great complexity. To meet the demands of space, weight and reliability, creative effort of a high order is required.

New developments at Lockheed Missile Systems Division call for important progress in the art of packaging. In Missile Laboratories engineers and designers are applying new approaches to modern techniques such as modular construction, printed circuitry, sub-miniaturization and potting. Moreover, the effect of new materials and components on packaging problems is under intensive study.

The ability to exercise and have responsibility is an important attribute of those participating in this program. Inquiries are invited from engineers and designers possessing keen interest in this field.

Lockheed **MISSILE SYSTEMS DIVISION**

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Phone DUnkirk 5-3286.

Significant developments at Lockheed Missile Systems Division have created new openings on our staff in the following fields:

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L. A. G. ter Veen, R. B. Morgan and senior members of the technical staff will be available for consultation at the convention hotel.
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Lockheed

MISSILE SYSTEMS DIVISION

△ Wide-Band Preamplifier

Usable With Any Oscillograph

This new self-contained, wide-band differential preamplifier is usable with any cathode-ray oscillograph. The high sensitivity of the instrument permits investigation of low level signals with any oscillograph, including wide band types.

Designated the Type 342 wide-band preamplifier and differential input adapter, it increases the sensitivity of existing wide-band oscillographs by a factor of 20 across a frequency band of 5cps to 15Mc. An important feature of the instrument is its application for single--ended amplification as well as for differential input measurements.

The differential input feature allows wide band measurements in high impedance or push-pull circuits, and across elements where both sides are at off-ground potentials.

A front-panel balance control can adjust the common mode signal reflection ratio to 200:1 across the instrument's frequency band. For signals between 60cps and 1Mc, the common mode rejection ratio can be adjusted to better than 1000:1

Overall dimensions of the instrument are 9-1/2″ high by 7″ wide, by 14-1/2″ deep. It weighs 22 lb.

Allen B. Du Mont Laboratories, Inc., Dept. ED, 760 Bloomfield Ave., Clifton, N. J.

Wescon Show, Booth No. 929.

CIRCLE 57 ON READER-SERVICE CARD

Microwave Ferrite Isolators

In Standard and Custom Designs

Ferrite isolators for microwave applications are now available in standard designs covering the X, K, and C bands, as well as in custom designs.

Ferrite devices are more compact, rugged, and efficient than conventional microwave components. Ferrite switches, for example, are superseding TR tubes, which require glass and vacuum. Ferrite isolators, inserted in the transmission line between r-f source and antenna, isolate the transmitter from its load, minimizing frequency "pulling" and long-lines effect.

Raytheon Manufacturing Co., Dept. ED, Waltham 54, Mass.

CIRCLE 58 ON READER-SERVICE CARD

◄ CIRCLE 59 ON READER-SERVICE CARD

△ Bonding Agent

In Heavy Paste Form

Bonding Agent R-385 is a new one component epoxy metal adhesive, which develops high heat resistance and a strong bond between metal parts. It is furnished in a heavy paste form and is applied as received with no addition of catalyst or hardener. It has a shelf and pot life of at least a year.

Exposure to the air does not affect this compound, consequently parts to be bonded together can be coated and left exposed to the air as long as necessary before baking and securing the bond.

The compound does not have the tendency to appreciably thin out at the baking temperature, consequently will not run out or creep from between the bonded parts.

It is inert to acids, alkalies, corrosive salt solutions, petroleum solvents, lubricating oils, alcohol and the acetones.

Although it will adhere well to practically all metals, ceramics, plastics, glass, etc., it cannot be used on materials that are harmed by the bake temperature of 325°F.

Carl H. Biggs Co., Inc., Dept. ED, 2255 Barry Ave., Los Angeles 64, Calif. *Wescon Show, Booth No. 415.*

CIRCLE 61 ON READER-SERVICE CARD

Converter

Output 0-6000v

The 7MVT voltage converter connects to a 1-1/2 or 3v battery to obtain its high voltage output. Output voltage is adjustable from zero to 6000v a-c (or d-c when rectified). Hookup circuits are supplied with each unit. Both the miniaturized transformer and chopper are built into one compact efficient package.

Since the transformer is directly activated by the chopping switch, the maximum possible output is obtained. Temperature drift effects are eliminated. Typical output is 1 ma at 130v d-c; 200μamp at 500v; or 100μamp at 1000v, when powered by two ordinary flashlight batteries.

Barry Electronics Corp., Dept. ED, 512 Broadway, New York 12, N. Y.

CIRCLE 62 ON READER-SERVICE CARD

CIRCLE 63 ON READER-SERVICE CARD ➤

△ Pushbutton Switch

Lights In 3 Different Colors

This is a new, indicating pushbutton switch which lights in three different colors and plugs in like a radio tube. Designated 62PB1 this assembly is intended for use in computer consoles for guided missile control systems. Three separate lamps, energized by separate circuits, are alternately visible through the plastic button.

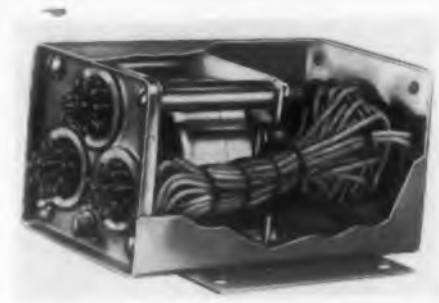
A special feature is the incorporation of a "radio tube" type connector, or plug-in base, which carries all the connections to the basic switches and lamp terminals. The whole assembly can be quickly and easily pulled out for lamp replacement. Lamp connectors are a flexible pivoted type. The connector plug also eliminates the need for complicated wiring and connections after the switch has been mounted.

Micro Switch, Dept. ED, Freeport, Ill.
Wescon Show, Booth No. 213.

CIRCLE 66 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Rotary Switches, Relays

Moisture and Dust Proof



These hermetically sealed moisture and dust proof rotary selector switches and stepping relays are applicable to the aircraft automation and electronics fields. Both are hermetically sealed in an inert atmosphere of dry nitrogen with a slight addition of helium tracer. Sealing is to test No. 1 of MIL-R-25018.

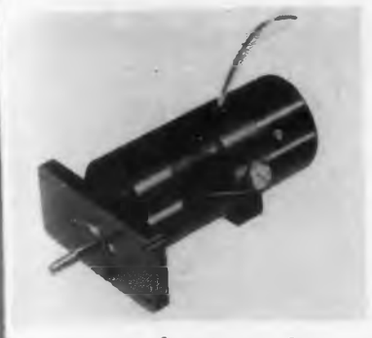
The illustration shows an example of a hermetically sealed Ledex relay which qualifies for the requirements of shock, vibration, high and low temperatures, salt spray and acceleration outlined in MIL-E-5272A. Standard hermetically sealed switches are available with a maximum of 4 wafers and 105 pins in the header.

G. H. Leland, Inc., Dept. ED, 123 Webster St., Dayton, Ohio.
Wescon Show, Booth No. 1215.

CIRCLE 67 ON READER-SERVICE CARD FOR MORE INFORMATION

△ D-C Drive Motor

±0.3% Speed Variation



This new rugged governor-controlled continuous duty d-c drive motor has only ±0.3% speed variation and is designed for high shock and vibration applications. Type QHGR-750 Model 1 has a cast aluminum housing and is tropicalized against humidity and fungus. A gear train reduces shaft speed from 7344 to 1836rpm.

Output speed is constant within ±0.3% with loads varying from 1/12 to 1/30th hg, input voltage varying from 22 to 28v and ambient temperatures varying from −65°F to +140°F. Average efficiency of the unit is 48% with a maximum current of 6.3amp. The unit weighs 2-1/2 lb, diameter is 2-3/8″ and over-all length with gear train and governor 5-13/16″.

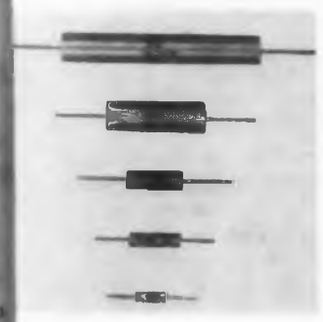
John Oster Mfg. Co., Avionic Div., Dept. ED, Racine, Wisc.

Wescon Show, Booth No. 247.

CIRCLE 68 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Molded Film Resistors

Deposited Carbon and Boron



Identified as Types MD and MB, both series are now available in ratings of 1/8, 1/4, 1/2, 1, and 2w. Double protection is provided by the addition of a molded plastic housing which protects the unit against mechanical damage and the effects of environmental and atmospheric conditions. Uniformity, reliability and freedom from manufacturing defects are maintained to the highest possible degree.

Molded deposited carbon and molded boron carbon resistors are particularly suited for applications where unmolded units cannot be used due to the risk of mechanical damage to their coating, insulation breakdown or moisture change. They are recommended for computer and amplifier circuits requiring superior resistance-temperature characteristics and stability.

International Resistance Co., Dept. ED, 401 N. Broad St., Philadelphia 8, Pa.

Wescon Show, Booth No. 1023.

CIRCLE 69 ON READER-SERVICE CARD FOR MORE INFORMATION

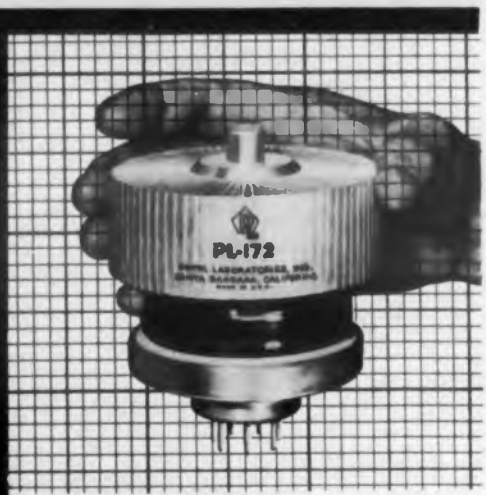
versatile new

PENTA PL-172

external anode

1-KW BEAM POWER PENTODE

new design principle
gives extra-high power
at low plate voltages



This new pace setter delivers high power at low plate voltage for a variety of r-f and a-f applications. The exceptional performance of the PL-172 is due to the exclusive new suppressor grid vanes which direct electrons to the plate in beams, giving true beam tube characteristics. For critical Class AB_1 linear amplifier applications, for high power audio service, or for high-efficiency, low-drive Class-C use, the PL-172 is a logical choice.

USE IT AS A CLASS-AB_1 LINEAR R-F AMPLIFIER—

Delivers over 1000 watts useful output at only 2000 plate volts, over 1500 watts at maximum ratings.

AS A CLASS-C AMPLIFIER—

Over 2000 watts useful output at high efficiency. Driving power less than 5 watts.

OR AS A CLASS AB_1 AUDIO AMPLIFIER—

Over 1200 watts per pair at 1500 volts. Up to 3000 watts at maximum ratings. Low output impedance simplifies output transformer problems.

RATINGS

Heater Voltage	6.0 volts	Plate current, max.	1.0 amperes
Heater Current	7.5 amperes	Plate dissipation, max.	1000 watts
Plate voltage, max.	3000 volts	Transconductance	21,000 μmhos

A COMPLETE LINE OF HIGH-EFFICIENCY POWER TUBES

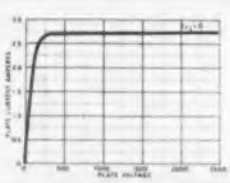


Plate current curve at zero grid voltage shows why the PL-172 gives high power gain and operates efficiently at low voltages.

Write for complete technical data and suggested operating conditions.

Representatives in principal cities.

PENTA *laboratories, inc.*

316 N. Nopal St., Santa Barbara, Calif.

Visit our booth #1145 **WESCON SHOW**

CIRCLE 71 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Oscillograph Record Camera

For Single Frame Recordings

This is an oscillograph record camera for single frame recordings which automatically advances film frames in rapid sequence, at random, or at synchronized intervals.

One full winding of a self-contained spring motor advances automatically 1 to 24 film frames. The rate at which the photographs can be taken is determined by the shutter setting. With the shutter set at 1/500, the camera is capable of taking 6 photographs in 1 second. A booster spring is available to permit an uninterrupted sequence of 54 photographs to be taken. Also available is a 24v motor which permits use of a 400-exposure auxiliary magazine.

Incorporating a "Robot" camera back with a 7-element Wollensak f/1.5-50 mm. lens, the Type 352 is capable of recording exceedingly high writing rates (writing rates as high at 2000″/sec have been recorded from a Type P11 screen with 30kv acceleration, using Tri-X film).

The use of a beam-splitting mirror provides for simultaneous binocular viewing and recording. Also, an illuminated data card is built into the camera's housing to permit pertinent information to be printed directly on the film record.

Allen B. Du Mont Laboratories, Inc., Dept. ED, 760 Bloomfield Ave., Clifton, N. J.
Wescon Show, Booth No. 929.

CIRCLE 72 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Transistor Transformers

Very Small Size

This new line of transistor transformers is designed for transistor circuit applications. They feature very small size, high efficiency nickel alloy cores, bobbin wound windings and flexible coded leads. The units have open type mountings.

Merit Coil & Transformer Corp., Dept. ED, 4427 N. Clark St., Chicago 40, Ill.
Wescon Show, Booth No. 829.

CIRCLE 73 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Digital Voltmeters

Use Mercury Wetted Contacts

Digital voltmeters, Models 1300, 1400, and 1500, all incorporate a new advance in design: use of mercury wetted contact relays. These relays assure a life expectance of more than one billion readings.

Model 1500 (5 digits) has manually selected ranges of ±00.000 to ±99.999v d-c with resolution of 0.001v, and ±100.00 to ±999.99v d-c with resolution of 0.01v.

It has automatic polarity indication; gives three complete readings per second. Absolution accuracy: ±.01% of value read or ± one digit. Size of this model is 10-1/2″ high, 15-1/4″ deep for mounting in a standard 19″ wide rack.

Non-Linear Systems Inc., Dept. ED, Del Mar Airport, Del Mar, Calif.
Wescon Show, Booth No. 941.

CIRCLE 75 ON READER-SERVICE CARD

Ceramic Resistor Cores

Have Smooth Surfaces

These ceramic resistor cores are available in a wide range of sizes and designs. They have outstanding advantages for resistors of many kinds—including ink, metal film, and deposited carbon types. Very close dimensional tolerances can be maintained. Uniformity is dependable from part to part and from lot to lot.

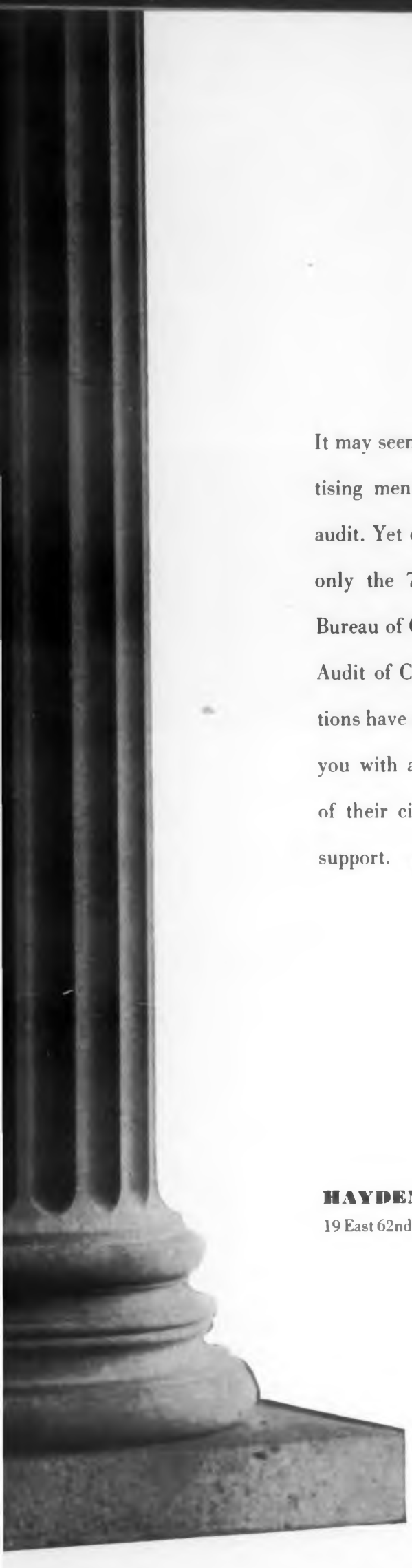
Exceptionally smooth surfaces make these cores ideal for use in ink and metal film resistors—a great advantage for even and uniform application of such finishes.

Of primary importance to manufacturers of deposited carbon resistors is the fact that the surface finish of these cores is untouched by human hands. This prevents unnecessary waste caused by processing parts with contaminated surfaces. In the final production stage, after careful inspection, they are put through a cleansing acid bath, then rinsed in de-ionized water.

American Lava Corp., Dept. ED, Cherokee Blvd. & Mfgrs. Rd., Chattanooga 5, Tenn.

CIRCLE 76 ON READER-SERVICE CARD

CIRCLE 77 ON READER-SERVICE CARD ➤



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American Milk Review
American Motel Magazine
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Building Specialties
Building Supply News
Burroughs Clearing House
Business Education World
Business Publication Rates and Data
Bus Transportation
Butane-Propane News
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California Stylist
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Concrete Products
Confectioners Journal
Connecticut Beverage Journal
Conover-Mast Purchasing Directory
Construction
Construction Bulletin
Construction Digest
Construction Equipment
Construction Methods and Equipment
Construction News Monthly
Constructioneer
Consulting Engineer
Consumer Magazine Rates and Data
Contractor (The)
Contractors & Engineers
Contractors' Electrical Equipment
Control Engineering
Cooperative Merchandising
Corsets & Brassieres
Corset and Underwear Review
Cotton Trade Journal
County Agent & Vo-Ag Teacher
Credit & Financial Management
Crockery and Glass Journal
Croplife—Weekly
Croplife—Northeast Dealer Issue
Croplife—South Dealer Issue
Croplife—Midwest Dealer Issue
Croplife—West Dealer Issue
Current Medical Digest
Curtain & Drapery Dept. Magazine

D

Daily News Record
Dairy Record
Dental Laboratory Review
Dental Survey
Department Store Economist
Design News
Diesel Power
Diesel Progress
Diner-Drive-In
Distribution Age
Display World
Dixie Contractor (The)
Domestic Engineering
Drilling
Drug & Allied Industries
Drug and Cosmetic Industry
Drug Topics
Drug Trade News
Dun's Review and Modern Industry

E

Earnshaw's Infants', Boys' and Girls' Wear
Editor & Publisher
Efectos De Escritorio
El Automovil Americano
Electrical Construction and Maintenance
Electric Light & Power
Electrical Dealer
Electrical Equipment
Electrical Manufacturing
Electrical South
Electrical West
Electrical Wholesaling
Electrical World
Electrified Industry
Electronic Design
Electronic Equipment
Electronics
El Mundo Azucarero
Engineering and Mining Journal
Engineering News Record
Equipment & Materials Reporter
Esquire's Apparel Arts
Excavating Engineer
Explosives Engineer
Export Buyer (The)
Export Trade and Shipper

F

Factory Equipment & Production
Factory Management and Maintenance
Farm Chemicals
Farm Equipment Retailing
Farm Implement News
Farm Power
Feed Age
Feeds Illustrated
Fibre Containers and Paperboard Mills
Finish
Fire Engineering
Fleet Owner
Floor Covering Profits
Flooring
Florists' Telegraph Delivery News
Flow
Flow's Material Handling Illustrated
Food Business
Food Engineering
Food Field Reporter
Food Packer
Food Processing
Food Topics
Food Trade News
Footwear News
Forecast for Home Economists
Foundry
Fountain & Fast Food
Frosted Food Field
Frozen Food Age
Frozen Food Center
Fueloil & Oil Heat
Fuel Oil News
Furniture Age
Furniture Manufacturer
Furniture News
Furniture Production
Furniture Retailer

G

Garden Supply Merchandiser
Gas
Gas Age
Gas Heat
Gasoline Retailer (The)
Geyer's Dealer Topics
Gift and Art Buyer
Giftwares
Glass Digest
Glass Industry
Glass Packer (The)
Go Magazine
Golfdom
GP
Grain & Feed Review (The)
Graphic Arts Monthly
Grocer-Graphic

H

Handbags & Accessories
Hardware Age
Hardware & Housewares
Hardware Retailer
Hardware World
Hatchery and Feed
Hearing Dealer (The)
Heating & Air Conditioning Contractor
Heating & Plumbing Equipment News
Heating & Plumbing Merchandiser
Heating, Piping and Air Conditioning
Hobby Merchandiser (The)
Home Comforts Wholesale
Hosiery and Underwear Review
Hosiery Industry Weekly
Hospital Management
Hospitals
Hospital Topics
Hotel Bulletin
Hotel Greeter
Hotel Index
Hotel Management
Hotel Monthly (The)
Hotel World-Review
House & Home
Housewares Review

I

Ice Cream Field
Ice Cream Review (The)
Ice Cream Trade Journal (The)
Illinois Beverage Journal
Implement & Tractor
Implementos Y Tractores
Indiana Beverage Life
Industrial and Engineering Chemistry
Industrial Arts and Vocational Education
Industrial Design
Industrial Development
Industrial Distribution
Industrial Equipment News
Industrial Finishing
Industrial Heating
Industrial Laboratories
Industrial Maintenance & Plant Operation
Industrial Marketing
Industrial Medicine and Surgery
Industrial Packaging
Industrial Woodworking
Industry & Power
Industry & Welding
Infants' and Children's Review
Ingenieria Internacional Construccion
Ingenieria Internacional Industria
Inland Printer
Inplant Food Management
Institutional Feeding and Housing
Institutions Magazine
Instrument & Apparatus News
Instruments and Automation
Insulation
Insurance Field
Insurance Record (The)
Insurance Salesman
Interior Decorators' Hand Book
Interior Design
Interiors
Iron Age (The)
Irrigation Engineering and Maintenance
I S A Journal

J

Jewelers' Circular
Jobber News
Jobber Product News
Jobber Topics
Journal of Accountancy
Journal of American Oil Chemists' Society
Journal of Commerce-International Edition
Journal of Osteopathy
Journal of Plumbing, Heating & Air Conditioning (The)

K

Frank Kane's Licensed Beverage Review
Kansas Beverage Journal
Kansas Business
Kansas Construction Magazine
Kentucky Beverage Journal
Knitter (The)

L

Lamp Journal
Law and Order
Leather & Shoes
Leonard's Guide
Life Insurance Selling
Light Metal Age
Linens and Domestics
Lingerie Merchandising
Liquor Store
Local Agent
Log (The)
Los Angeles Industrial News
LP-Gas
Luggage and Leather Goods
Lumberland
Lumberman (The)

M

Machine and Tool Blue Book
Machine Design
Machinery
Macrae's Blue Book
Maine Coast Fisherman
Maintenance
Management Methods
Manufacturers Record
Manufacturing Confectioner
Marine Engineering
Marine News
Mariner (The)
Maritime Reporter
Market Growers Journal
Mart
Maryland-Washington-Delaware Beverage Journal
Masonry Building
Mass Transportation
Materials & Methods
Meat
Meat and Food Merchandising
Mechanical Engineering
Mechanization
Medical Economics
Medical Times
Men's Wear
Merchants Trade Journal
Metal Finishing
Metal Progress
Metal-Working
Michigan Beverage News
Michigan Contractor & Builder
Michigan Food News
Michigan Roads & Construction
Mid-Continent Banker
Mid-West Contractor
Milk Dealer
Milk Plant Monthly
Milk Products Journal
Mill & Factory
Mining and Quarrying
Mining Congress Journal
Mining Engineering
Mining World
Mississippi Valley Contractor
Missouri Beverage Journal
Modern Beauty Shop
Modern Brewery Age
Modern Castings and American Foundryman
Modern Grocer (The)
Modern Hardwaring
Modern Hospital
Modern Lithography
Modern Machine Shop
Modern Materials Handling
Modern Medicine
Modern Miss
Modern Packaging
Modern Plastics
Modern Railroads
Modern Sanitation
Modern Textiles Magazine
Modern Windows
Monopoly State Review (The)
Motion Picture Exhibitor
Motion Picture Herald
Motor
Motor Age
Motor Service Magazine
Motor Transportation in the West
Motor West
Motorship
Municipal South (The)
Music Trades (The)

N

N.A.R.D. Journal
Nargus Bulletin
National Bottlers' Gazette
National Cleaner & Dyer
National Engineer
National Fisherman
National Fur News
National Furniture Review
National Hearing Aid Journal
National Jeweler
National Lithographer
National Petroleum News
National Photographer (The)
National Provisioner
National Real Estate and Building Journal
National Roofer
National Safety News
National Underwriter
Nation's Schools
New England Appliance & Television News
New England Construction
New England Electrical News
New England Hardware
New Equipment Digest
New Jersey Beverage Journal
New Mexico Beverage Journal
Newspaper Rates and Data
Northwest Beverage Journal
Notion & Novelty Review
Nucleonics
Nursing Outlook

O

Observer
Occupational Hazards
Office (The)
Office Appliances
Office Executive
Office Management
Official Steamship and Airways Guide
Offshore Drilling
Ohio Tavern News
Oil and Gas Equipment
Oil and Gas Journal
Oil, Paint & Drug Reporter
Optical Journal & Review of Optometry
Optometric Weekly (The)
Oral Hygiene
Oregon Licensee Magazine
Organic Finishing

P

Pacific Air & Truck Traffic
Pacific Architect and Builder
Pacific Builder and Engineer
Pacific Coast Record
Pacific Drug Review
Pacific Factory
Pacific Fisherman
Pacific Laundry and Cleaning Journal
Pacific Mountain States Industrial News
Pacific Road Builder & Engineering Review
Pacific Work Boat
Package Store Management
Packaging Parade
Packer (The)
Paint and Varnish Production
Paint, Oil and Chemical Review
Paper & Paper Products
Paper& Twine Journal
Paper, Film and Foil Converter
Paper Industry (The)
Paper Mill News-Feature Numbers
Paper Mill News-News Issues
Paper Sales
Paper Trade Journal
Park Maintenance
Parts Jobber Magazine (The)
Patterson's Calif. Beverage Gazetteer
Petroleum Engineer
Petroleum Equipment
Petroleum Marketer
Petroleum Processing
Petroleum Refiner
Petroleum Transporter (The)
Petroleum Week
Petroleum World and Oil
PF—The Magazine of Prefabrication
Photo Dealer
Photographic Trade News
Pipe Line Industry
Pipe Line News
Pipeliner (The)
Pit and Quarry
Pit and Quarry Handbook
Plant (The)
Plant Engineering
Plastics World
Playthings
Plumbing & Heating Business
Plumbing-Heating-Air Conditioning Wholesaler
Pocket List of Railroad Officials
Postgraduate Medicine
Post's Paper Mill Directory
Poultry & Eggs Weekly (The)
Poultry Processing & Marketing
Power
Power Engineering
Power Equipment
Practical Builder
Practical Home Economics
Practical Lawyer (The)
Precision Metal Molding
Premium Practice
Printers' Ink
Printing Equipment Engineer
Printing Magazine including "The Offset Printer"
Proceedings of the I. R. E.
Produce News & Produce Barometer
Product Design & Development
Product Engineering
Production
Production Equipment
Products Finishing
Progressive Architecture
Progressive Grocer
Public Power
Public Works Magazine
Publishers' Auxiliary
Pulp & Paper
Purchasing
Purchasing News

Q

Qualified Contractor
Quick Frozen Foods

R

Radio & Television Journal
Radio Television Service Dealer
Railway Age
Railway Locomotives and Cars
Railway Purchases and Stores
Railway Signaling and Communications
Railway Track and Structures
Recreation
Refrigerating Engineering
Resort Management
Restaurant Equipment Dealer
Restaurant Management
Retailing Daily
Revista Aerea Latinoamericana
Roads & Streets
Rock Products
Rocky Mountain Construction
R.N.—A Journal for Nurses
Rough Notes
Roofing, Siding and Insulation
Room Service Magazine
Rubber Age
Rubber World
Rural Electrification
Rural Roads

S

Sales Management
Savings and Loan News
Savings Bank Journal
Scholastic Coach
School Arts
School Equipment News
School Executive
School Shop
Seaboard Beverage Journal
Seedmen's Digest
Seed World
Server (The)
Service (Radio-Television-Electronic)
Service Management
Shipping Digest
Shoe and Leather Reporter
Showmen's Trade Review
Signal
Signs of the Times
Skyways
Small World
Snips Magazine
Soap and Chemical Specialties
Southern Appliances
Southern Automotive Journal
Southern Beverage Journal
Southern Building Supplies
Southern Fisherman
Southern Florist and Nurseryman
Southern Hardware
Southern Hospitals
Southern Motor Cargo
Southern Power & Industry
Southern Seedsman
Southwest Bldr. & Contr.—Arch. & Bldg. Edition
Southwest Bldr. & Contr.—Eng. & Public Works Edition
Southwestern Advertising & Marketing
Spectator (The)
Spirits
Sporting Goods Dealer
Sporting Goods Products
Sports Age
Spot
Spot Radio Rates and Data
Standard (The)
Starchroom Laundry Journal
Steel
Steel Processing
Sugar
Sugar Journal (The)
Super Market Manager
Super Market Merchandising
Super Market News
Super Service Station
Surgical Business

T

Tap & Tavern
Taxicab Industry—Auto Rental News (The)
Technician & Circuit Digests
Tele-Tech & Electronic Industries
Television Age
Texas Contractor
Textile Age
Textile Bulletin
Textile Industries
Textile World
Thomas' Register of American Manufacturers
Tide
Timberman
Tire, Battery & Accessory News
Tire Review
Tires TBA Merchandising
Tobacco Jobber (The)
Tool Engineer (The)
Tooling & Production
Tourist Court Journal
Toys & Novelties
Traffic World
Transportation Supply News
Transport Topics
Travel Items
Trusts and Estates

U

Underwriters' Report
Underwriters Review
Upholstering
Utilization

V

Variety Store Merchandiser
Vend
Veneers & Plywood
Voluntary & Cooperative Groups Magazine

W

Wastes Engineering
Water and Sewage Works
Waterways Journal (The)
Water Works Engineering
Welding Engineer
Welding Illustrated
Western Advertising
Western Appliances & Television
Western Automotive Journal
Western Aviation
Western Baker
Western Bottler
Western Builder
Western Building
Western Canner & Packer
Western City
Western Confectioner with Western Candy Review
Western Construction
Western Dairy Foods Review
Western Electronic News
Western Fabrics
Western Farm Equipment
Western Feed & Seed
Western Fruit Grower
Western Hotel & Restaurant Reporter
Western Industry
Western Machinery & Steel World
Western Metals
Western Paint Review
Western Underwriter
What's New In Home Economics
Wines and Vines
Wisconsin Beverage Journal
Women's Wear Daily
Wood and Wood Products
Wood Construction & Bldg. Materialist
Wood-Worker
Wood Working Digest
Work Boat (The)
World Construction
World Oil
World Petroleum
World's Business & Guia

Y

Yankee Grocer

△ Trimmer Potentiometer

Temperature Coefficient of Wire 0.00002/°C

The A10-W has a precision built wire wound resistor element with 25 turns of wire. Usable winding length is 98%. Temperature coefficient of wire is 0.00002°C. Outside dimensions are 0.220" x 0.312" x 1.250". The trimmer weighs 2.25 grams.

This potentiometer holds set resistance values after trimmer adjustment under extreme ranges of temperatures, as all internal parts have nearly the same coefficient of expansion. Operating temperatures range from —55°C to 200°C.

Powered at 0.8w derated to 0 at 175°C, the completely sealed trimmer has all plastic and bonding agents able to withstand over 200°C temperatures, continuous. The internal cavity is air evacuated by injecting silicone grease. Finest adjustment is provided by an extended winding surface, assuring high precision resolution without sacrificing subminiature design.

Standard resistance values range from 10 ohms to 50K ohms with 16 various values. Other values will be made on special order. Standard resistance tolerance is ±5%, lower tolerances to ±1% available. Insulation resistance is 500v d-c at room temperature, 1000 megohm min.

Dale Products, Inc., Dept. ED, P. O. Box 136, Columbus, Neb.

Wescon Show, Booth No. 1114.

CIRCLE 81 ON READER-SERVICE CARD FOR MORE INFORMATION

△ "One Piece" Core Design

Benefits Transformer Makers

A newly-invented "one-piece" wound core that has but one slit for coil insertion has shown a number of advantages over conventional C-type cores with two air gaps.

The advantages of this core over "C" type cores are: one air gap instead of the usual two; the cores are varnished on the sides only; the two halves of the "C" cores must be kept and used together so that their ground pole pieces will fit flush.

The Indiana Steel Products Co., Dept. ED, Valparaiso, Ind.

Wescon Show, Booth No. 339.

CIRCLE 82 ON READER-SERVICE CARD FOR MORE INFORMATION

Sylvania develops a

power

NEW

POWER TRANSISTOR—

provides 2½ watts
Class A output with
*5% total harmonic distortion

FEATURES—

- 10 watts maximum collector dissipation
- 2 amps max. collector current
- 40 volts max. collector voltage
- New heliarc-weld hermetic seal
- 30 db minimum power gain (typically 35 db)
- 85° C storage temperature
- 100° C operating temperature
- derating—3° C per watt (typically 2° C per watt)

DETECTOR-DRIVER

Type 12J8—delivers 20 mw signal
power output with
*5% total harmonic distortion

CHARACTERISTICS—

- zero signal plate current —14 ma
- zero signal screen current—3 ma
- plate resistance —2000 ohms
- transconductance —540 μmhos
- plate voltage —12.6 volts
- heater voltage —12.6 volts

CIRCLE 83 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Tiny Rectifier

For TV Applications

A new twin diode, miniature Vac-u-Sel rectifier has been developed for use as a horizontal phase detector in place of 6AL5 tubes in TV. The tiny rectifier is built to last many times longer than the tube. In addition, the selenium unit is far more rugged and resistant to breakage.

It is built to withstand prolonged exposure at 90% humidity and is capable of operation at high ambient temperatures. Typical electrical characteristics are a min forward current of 0.5ma d-c at 2v and a max reverse current of 25μamp at –20v. The characteristic capacitance per section is approx 50μμf.

General Electric Co., Dept. ED, Schenectady 5, N. Y.

Wescon Show, Booth No. 1218.

CIRCLE 84 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Dial Drives

Include a Potentiometer

The higher-speed models operate with a self - reversing synchronous motor in the same way as the Type 908-P synchronous dial drives. The lower-speed models drive the dial drives. The lower-speed models drive the dial in a counter-clockwise (increasing frequency on GR oscillators) direction only. A friction clutch is supplied to prevent damage if the motor is permitted to run after the dial has reached its stop.

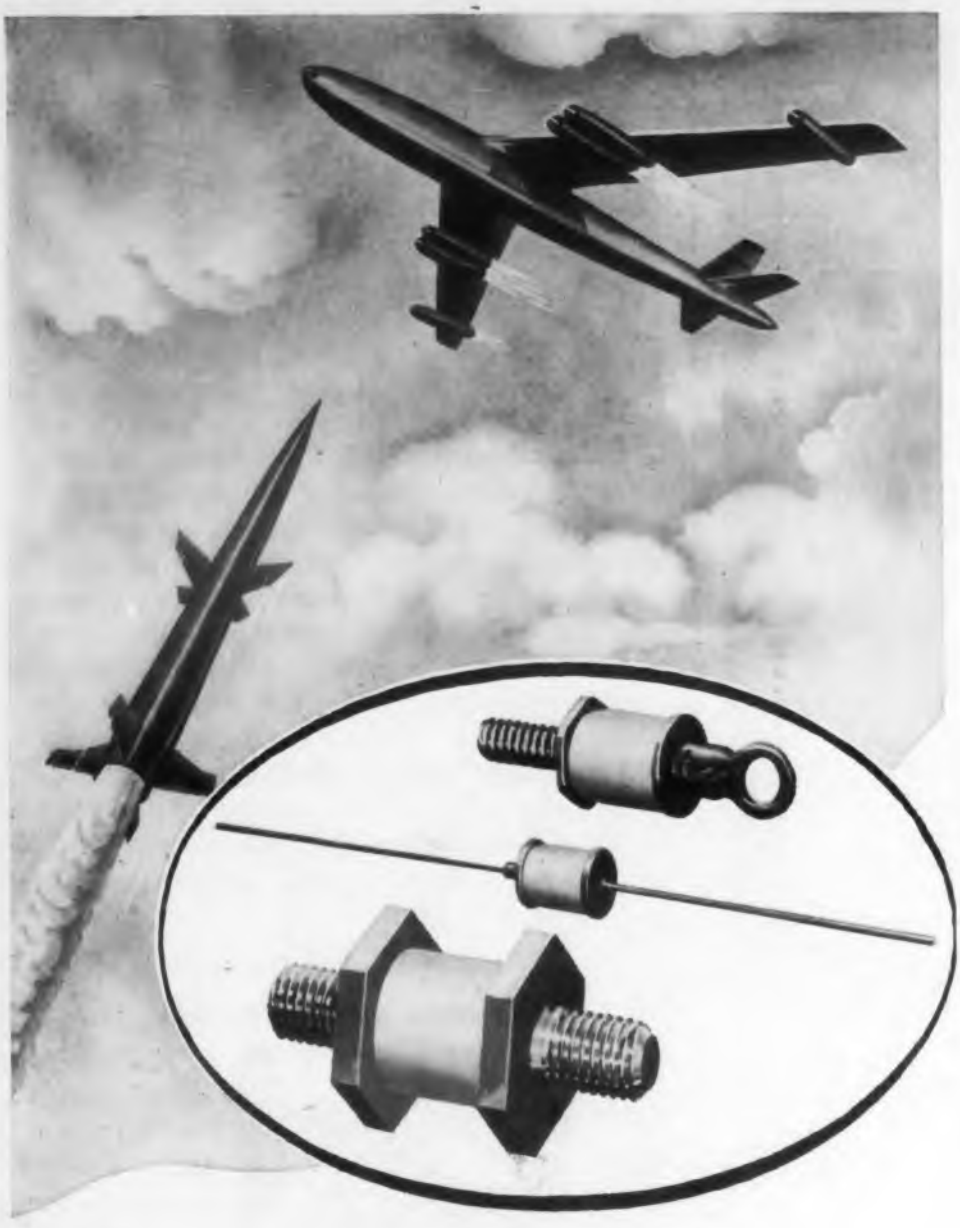
When mounted, the drive motor may be disengaged from the dial for manual operation of the instrument with a direct-coupled knob on the dial drive. This knob is also used to rotate a friction coupling to center the potentiometer about any dial setting.

For use with a wide range of d-c output levels, and, therefore, with a wide variety of recorders, binding posts are provided for the insertion of a selected d-c supply voltage to the drive potentiometer. Binding posts are also available for the position signal output. A power switch and cord are included.

General Radio Co., Dept. ED, 275 Massachusetts Ave., Cambridge, Mass.

Wescon Show, Booth No. 918.

CIRCLE 85 ON READER-SERVICE CARD FOR MORE INFORMATION



"We use them—

in our electronic controls because of light weight and dependability. They are also used in commercial applications.

Why don't you write regarding your application?"

Sarkes Tarzian

SILICON POWER RECTIFIERS

Sarkes Tarzian, Inc., RECTIFIER DIVISION

DEPT. C-4 415 N. COLLEGE AVENUE, BLOOMINGTON, INDIANA

IN CANADA: 700 WESTON RD., TORONTO 9, TEL. MURRAY 7535

EXPORT: AD AURIEMA, INC., NEW YORK CITY

Look us up at the Wescon Show for further information.

CIRCLE 87 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Low Frequency Oscillator

1 CPS to 100Kc In 5 Ranges

Model 202C is a new, multi-purpose l-f oscillator providing pure waveforms for subsonic, audio, and supersonic measurements in the laboratory, field or factory. It offers a high output power of 160mw delivered from a transformer-coupled balanced matched source.

The instrument covers frequencies from 1cps to 100kc in five ranges. Accuracy is ±2% under normal conditions including warm-up and tube aging. Frequency response is ±1db full range, output is either 160mw or 10v into 600 ohms or 20v open circuit. Output balance is better than 0.1% at lower frequencies and approx 1% at 100kc. Distortion is less than 0.5% above 5cps and is independent of load impedance. Hum voltage is less than 0.1% of rated output. Recovery time is less than 5sec at 1cps.

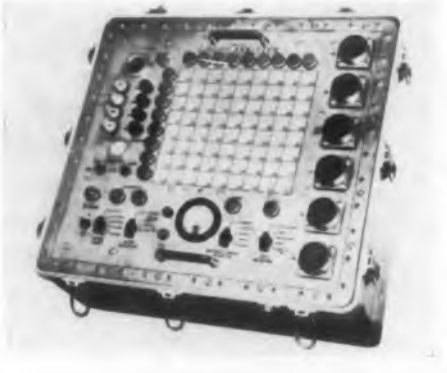
Hewlett-Packard Co., Dept. ED, 275 Page Mill Rd., Palo Alto, Calif.

Wescon Show, Booth No. 1050-1051.

CIRCLE 88 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Circuit Analyzer

For Military Use



The Model 144NX is an adaptation of Model 200 circuit analyzer designed to withstand the rugged conditions of military use. The unit is completely waterproof, shockproof and vibration resistant.

The instrument automatically tests up to 144 circuits in seconds. Electrically complex, interconnected, multiple circuits are tested for continuity or shorts with absolute accuracy at extremely close predetermined values.

The analyzer tests complex electrical systems in aircraft, guided missile, radar, computers, relay and telephone systems, servomechanisms, and fire control systems.

DIT-MCO, Inc., Dept. ED, 911 Broadway, Kansas City, Mo.

Wescon Show, Booth No. 502.

CIRCLE 89 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Silicon Mixer Diodes

For L, S, C, and X Band

Four new high sensitivity point contact microwave silicon mixer diodes have been developed for low noise mixer performance in L, S, C, and X band radar receiver circuitry. The new 1N23E fixed forward polarity and 1N415E reversible polarity diodes achieve minimum performance of 7.5db overall noise figure at their X band design center frequency when used with a 1.5db i-f strip.

In S band equipments, use of the 1N21E or 1N416E reversible mixer diode will result in a maximum overall system noise figure of 7.0db given a 1.5db i-f noise level.

Microwave Associates, Dept. ED, 22 Cummington St., Boston 15, Mass.

Wescon Show, Booth No. 248.

CIRCLE 93 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Coaxial Slotted Line

Includes a Broadband Probe

The precision coaxial slotted line, Model SL-42, is used in the design and testing of coaxial line components to provide a means of making accurate VSWR and impedance measurements in the S, C, and X band regions (3950Mc to 10,000Mc).

The completely tunable Model PR-25 broadband probe greatly facilitates precision measurements over a broad frequency span. With its normal range, including L, S, C and X bands (from 900Mc to 12,400Mc), this probe can be used for the majority of slotted line and wave guide measurements required in the microwave laboratory. It has a 0.750" diam mounting barrel and is suitable for use with most types of slotted lines.

Vectron, Inc., Dept. ED, 1583 Trapelo Rd., Waltham 54, Mass.

Wescon Show, Booth No. 942.

CIRCLE 94 ON READER-SERVICE CARD FOR MORE INFORMATION

relay rack mounting

model 4
MOSELEY AUTOGRAF
trade mark
X-Y recorder

MODEL 1

MODEL 2

MODEL 3

FEATURES

- Independent servo-drives, each axis.
- Better than 0.25% accuracy.
- High input resistance.
- 5 mv to 150 volts stepped range controls with stepless control within each range.
- Full range zero set and zero offset.
- Illuminated translucent recording table.
- Self-contained vacuum paper hold-down system.
- Accommodates either 11"x16½" or 8½"x11" standard graph paper.
- Available as curve follower without external attachments.

Choose an AUTOGRAF from four versatile models:

MODEL 1
Drum Type
8½"x11" paper
X-Y Recorder-
Curve Follower

MODEL 2
Flat-bed
11"x16½" paper
X-Y Recorder-
Curve Follower-
Point Plotter

MODEL 3
Desk Type
8½"x11" paper
X-Y Recorder-
Curve Follower

MODEL 4
Rack type
11"x16½" paper
X-Y Recorder-
Curve Follower-
Point Plotter

A complete line of accessories is available for any data translation application.

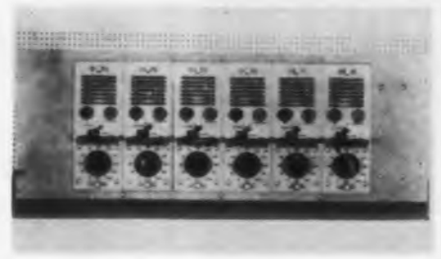
We'll be glad to send you additional information or consider your special problem.

F. L. MOSELEY CO.
409 N. Fair Oaks Ave., Pasadena, California

CIRCLE 95 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Decade Amplifier

Gain Accuracy ±1% D-C



The Model 111 d-c decade amplifier is a high gain, wide band, d-c amplifier specifically designed to accept a small d-c voltage from a strain gage or other electro-mechanical device and amplify this signal. It provides a voltage output which can be used to drive conventional recording potentiometers or voltmeters. A large amount of feedback provides a very precise and stable gain.

This instrument uses a chopper amplifier for very low frequency amplification. Higher frequencies bypass the chopper amplifier and are amplified by an a-c amplifier. The output of both the high and low frequency amplifiers is combined in a summing junction. From the summing junction, the combined output is applied to a bridge type output amplifier which supplies the requisite power.

Specifications are: gain—adjustable by switch on front of instrument to steps of: 0, 20, 30, 50, 70, 100, 200, 300, 500, 700 and 1000; gain accuracy—±1% d-c; input impedance—100,000 ohms; capability at d-c —0 to ±25v with load impedance greater than 1000 ohms; output impedance—less than 1 ohm in series with 25 μh; linearity—better than 0.1% to 2kc.

Kay Lab, Dept. ED, 5725 Kearney Villa Rd., San Diego 12, Calif.

Wescon Show, Booth No. 1013.

CIRCLE 98 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Silicon Junction Diodes

Have High Conductance

High voltage and current ratings, along with operation in ambient temperatures up to 200°C, have been combined to produce a rugged silicon diode suitable for printed-board power service. Together with forward current ratings up to 200ma, these units have inverse current of less than 0.25μamp at voltages up to 225v. Two type 1N486A diodes can deliver up to 400ma at 65v in a full-wave center tapped circuit.

Transitron Electronic Corp., Dept. ED, Melrose 76, Mass.

Wescon Show, Booth No. 903.

CIRCLE 99 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Recording System

Analog-to-Digital-to-Analog

The ADAR (Analog-to-Digital-to-Analog) recording system is designed to accept inputs of analog voltages to provide instantaneous permanent records in quantized analog form to a precision of 1 part in 256.

The system can record an analog voltage phenomenon which increases from 0 to full scale in one sampling period (1/24,000sec) without overshoot, undershoot, or oscillatory disturbances.

Radiation, Inc., Dept. ED, Melbourne, Fla.
Wescon Show, Booth No. 1146.

CIRCLE 101 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Frequency Meter

Offers High Q Performance

This highly accurate and legible frequency meter, Model 802, covers the range of the most used microwave frequencies, 2400 to 10,000Mc. Over the entire band covered by this instrument, the loaded Q is in excess of 750 from 2400 to 6500Mc and in excess of 1500 from 6500 to 10,200Mc.

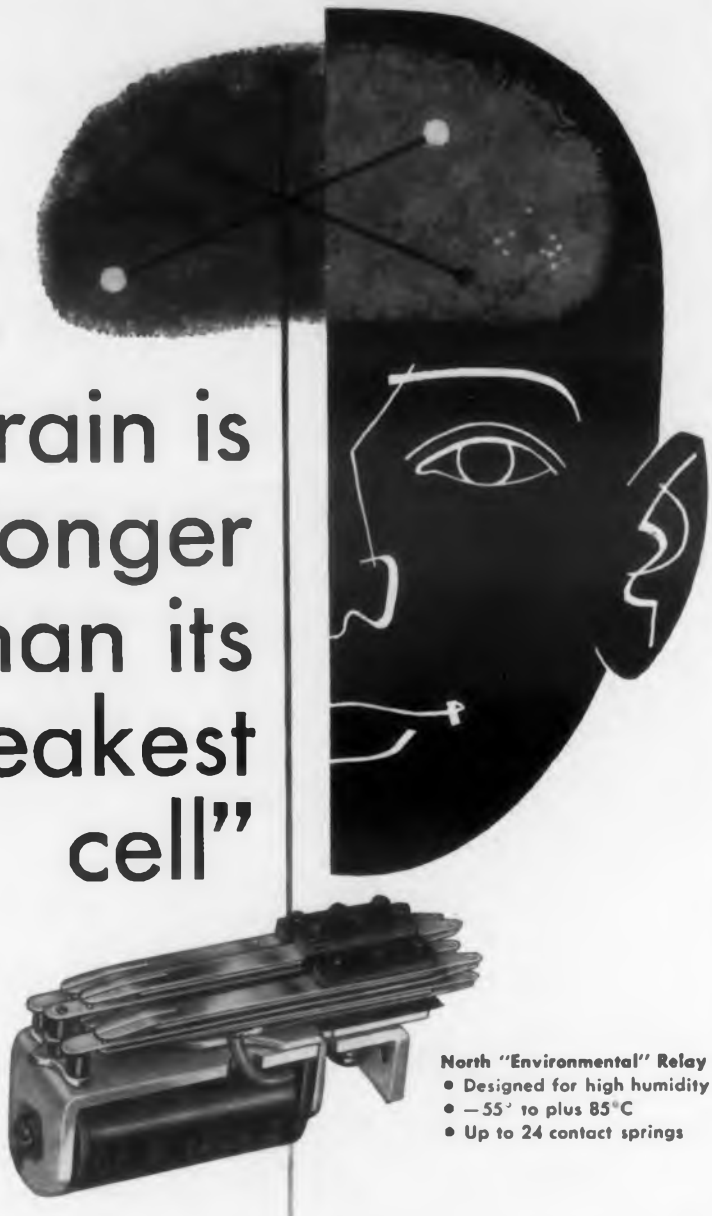
In addition to greater overall utility, the Model 802 offers exceptional micrometer readability even under poor lighting conditions, as a result of a new reading line with an expansive viewing area, optimum color finish and marking contrast on the tuning micrometers.

Higher loaded Q has also resulted in increased sensitivity and resolution when using the built-in indicator. A universal nomograph type calibration chart provides frequency data without calculations or written interpolation at any point in the entire frequency range to the rated accuracy of 0.2%.

The Narda Corp. Dept. ED, Mineola, L.I., N.Y.
Wescon Show, Booth No. 1036.

CIRCLE 102 ON READER-SERVICE CARD FOR MORE INFORMATION

"... a brain is no stronger than its weakest cell"



North "Environmental" Relay
- Designed for high humidity
- —55° to plus 85°C
- Up to 24 contact springs

The necessity for automatic controls to release man-brains from the details of repetitive operations in industry is obvious. The reasons for some systems being more dependable than others is less apparent, but equally important.

The most responsible "automatic brains" are those in which the cells directing control sequences are North Relays. First because relays properly employed are the best components for such controls . . . second because North know-how **and** know-**where** in this field are unsurpassed.

Whether **your** system is for simple machine control or for programing computers, remember that one inadequate "brain cell" might cancel it all out when the chips are down. Insure its life with an all-relay control.

To be **doubly** sure

SPECIFY NORTH RELAYS

"Building Brain-Cells is Our Business"

INDUSTRIAL DIVISION

NORTH ELECTRIC COMPANY

489 S Market — Galion, Ohio

CIRCLE 104 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Torque-Measuring Gage

Reads Low Torque in Both Directions

Measurements of low torque for both clockwise and counterclockwise rotation can be made with this single, direct-reading instrument. The Model 6500 "Torque-Watch" gage reads torque on two linear scales, each spread over 300 on a 1" diam watch face. The scales are of different colors for easy identification. Ranges of 0.1 to 1.2 and 1.0 to 20 oz in are standard; special ranges are available. Accuracy is ±5% of full scale.

This gage is contained in an anodized aluminum case 1-1/8" diam and 3-7/16" long; the unit weighs 7 oz. Jacobs chuck fits all shafts up to 1/4" diam; 1/4" or 1/2" key chucks are available on special order.

Waters Manufacturing, Inc., Dept. ED, P. O. Box 368, So. Sudbury, Mass.

Wescon Show, Booth No. 937.

CIRCLE 105 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Propeller Fans

Venturi-Type Mounting Ring

Model DFE 4" diam propeller fans are of a novel integrated design combining a diecast venturi-type mounting ring, a streamlined 4-legged motor mounting spider and a separable ring-mounted screen or finger guard.

The venturi ring makes an airtight seal with the mounting surface and is aerodynamically profiled for two alternative directions of air flow. The 4-legged motor mounting spider grips the motor at center of gravity and draws heat effectively from two flats on the finned diecast motor case.

These fans are available with a choice of 22 different driving motors covering 50 to 1000cps line frequency, 1 and 3-phase operation and many voltages.

Rotron Mfg. Co., Dept. ED, Schoonmaker Lane, Woodstock, N.Y.

Wescon Show, Booth No. 965.

CIRCLE 106 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Acoustic Calibrator

Pressure Calibrates Microphones

The 12185 acoustic calibrator is designed to pressure calibrate 21-BR type microphones used for measuring high intensity sounds in the jet engine and missile fields. It consists of the L1 pressure unit mounted so as to provide a cavity of 1 CC. A sound pressure level of 140db can be obtained with 1v input. Impedance is 30 ohms. Maximum safe input is 5v and maximum sound pressure level 155db.

The calibrator provides rapid check on overall sensitivity of systems using all 21BR microphones so that the microphone can be standardized on the recording apparatus before and after each measurement in field or laboratory. Accuracy of measurement obtained is less than 1db. Temperature coefficient is 0.02db/° F.

Altec Lansing Corp., Dept. ED, 9356 Santa Monica Blvd., Beverly Hills, Calif.
Wescon Show, Booth No. 916.

CIRCLE 110 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Variable Capacitor

Provides Extra Low Capacity

This new miniaturized variable capacitor of butterfly design provides extremely low capacity in the v-h-f range. Designated as Type MACBF, it has rotor and stator assemblies made of brass, precision jig soldered, and nickel-plated. Base construction consists of bearing and eyelets spun securely into silicone-treated steatite. Terminals are hot-tinned dipped.

The MACBF may be either panel, or chassis-mounted by means of a threaded bushing with flatted sides. The rotor shaft is slotted for adjustment of screwdriver. Air gap is 0.017" nominal. The units are tested at 750v, rms, 60cps. Standard models are available in 7, 9, 15, and 21 plates per section, with nominal values per section from 1.3 to 10.8μμfd.

Hammarlund Mfg. Co., Inc., Dept. ED, 460 W. 34th St., New York 1, N.Y.
Wescon Show, Booth No. 708.

CIRCLE 111 ON READER-SERVICE CARD FOR MORE INFORMATION

AT WESCON SEE

Radio Noise Eliminated with METEX RF SHIELDING

Don't miss seeing this actual demonstration of radio noise suppression using METEX knitted wire Electronic Weatherstrip and RF Gaskets. Being metallic, METEX RF Shielding materials are highly conductive; being knitted, they are both flexible and resilient.

This unique combination of electrical and mechanical properties not only re-establishes electrical conductivity across joints, but conforms to wide irregularities in mating surfaces with minimum closing pressure, thus making efficient and economical RF-tight joints.

On display, too-

METEX RESILIENT COOLING SLEEVES FOR INCREASED TUBE RELIABILITY

Cool tubes last longer! NEW METEX Resilient Cooling Sleeves, die-formed from continuous sleeves of knitted wire, provide fast, efficient conduction of heat from the tube envelope to a heat sink. Resilient construction provides maximum contact with tube envelope and heat sink despite wide variations in envelope size.

See the METEX Display at Booths 1007-1008

Represented by
Harry Appleton Co., Inc.
Los Angeles, Cal.

METEX
ELECTRONICS DIVISION
METAL TEXTILE CORP.
ROSELLE • NEW JERSEY

6-200

CIRCLE 112 ON READER-SERVICE CARD FOR MORE INFORMATION

TEXAS INSTRUMENTS

HERMETICALLY SEALED RESISTORS

PRECISION DEPOSITED CARBON TYPE

Built for hard service far exceeding MIL-R-10509A specifications . . . with ±1% resistance tolerance . . . high stability over temperature range and under overload, these ruggedized resistors give top performance in extreme environmental conditions. Texas Instruments hermetically sealed resistors are leakproof, trouble-free, and fully insulated.

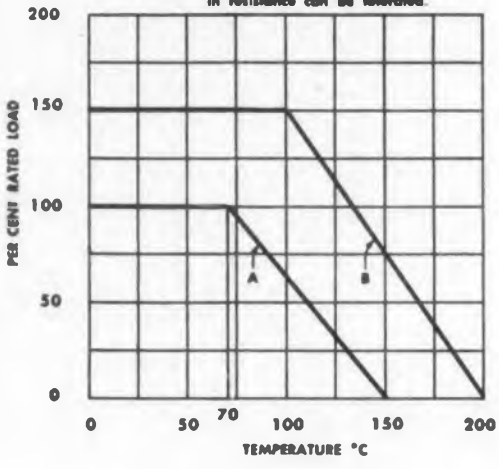
Featuring low negative temperature coefficients, TI hermetically sealed resistors are precision manufactured, ideally suited for automatic assembly applications. Under operating conditions, these superior units show negligible voltage coefficient and noise level.

Mass-produced to the same exacting tolerance and quality standards, Texas Instruments Industrial Line and MIL-Line deposited carbon resistors provide exceptional accuracy and reliability throughout a wide range of applications. For *increased* reliability – at economical prices – design with TI precision resistors. All three types are available in five sizes from ½ watt to 2 watts . . . with resistance values from 25 ohms to 30 megohms.

RECOMMENDED DERATING CURVES OF TI HERMETICALLY SEALED LINE DEPOSITED CARBON RESISTORS

Curve A — Conservative rating equivalent to MIL-R-10509A.

Curve B — High rating can be applied where a 3% permanent change in resistance can be tolerated.



FOR COMPLETE DATA, WRITE FOR BULLETIN DL-C 539

TEXAS INSTRUMENTS
INCORPORATED
6000 LEMMON AVENUE DALLAS 9, TEXAS

CIRCLE 114 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Power Supplies

Feature Germanium Rectifiers

Germanium rectifiers, making for higher efficiency, compact design, and longer life are featured in 4 new space-saving rack model regulated d-c power supplies. Models 481, 481M, and 482M have a panel height of only 5-1/4″ and thus allow added rack space for other components.

The models, rated at 400ma, have a range of 125-325v d-c for Models 481 and 481M, and 325-524v d-c for Models 482 and 482M. They have fuse failure indicators, oil-filled hermetically-sealed transformers and chokes protected from moisture for trouble-free service. Internal impedance is less than 3 ohms, a-c output, 615v a-c (unregulated) is 15amp.

Other features include: Regulations: (line) better than 0.15% or 0.3v (whichever is greater); (load) better than 0.25% or 0.5v (whichever is greater). Transient response: (line) output voltage is constant within regulation specifications for step-function line voltage change of +10v or −10v rms within the limits of 105-125v a-c; (load) output voltage is constant within regulation specifications for step-function load change between 0 to full load or full load to 0 ma.

Lambda Electronics Corp., Dept. ED, 11-11 131 St., College Point 56, N.Y.
Wescon Show, Booth No. 508.

CIRCLE 115 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Miniature Relay

Contact Rating 5Amp

The R-100 has a contact rating of 5amp with a maximum weight of 2-1/2 oz and a displacement of 1.03 cu in volume. It is qualified to 20g, 2000cps vibration and 50g shock in accordance with MIL-R-25018.

The relay can be supplied in sensitivities of 85mw for aircraft and missile settings, and is available with coil resistance to 40,000 ohms for operation on currents to 150v d-c.

Electronic Specialty Co., Dept. ED, 5121 San Fernando Rd., Los Angeles, Calif.
Wescon Show, Booth No. 103.

CIRCLE 116 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Servo Amplifiers

Have High Sensitivity

Transistor - magnetic amplifiers have high sensitivity and high input impedance. Available for practically all standard 60 and 400cps servo motors, these amplifiers, named TRANSI-MAG, have been added to the company's line of standard products.

The units are small and light weight, have high sensitivity and high input impedance. The TRANSI-MAGS are designed for ambient temperatures of −50°C to +71°C.

Magnetic Amplifiers, Inc., Dept. ED, 632 Tinton Ave., New York 55, N. Y.
Wescon Show, Booth No. 1604.

CIRCLE 120 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Counter-Timer

Has Improved Readability

Model 225A universal counter-timer offers improved direct digital readout combined with compactness and portability. It has been designed for the precise measurement of frequency, frequency ratios, period, average period and time interval. With appropriate transducers it may be utilized for determination of pressure, velocity, acceleration, displacement, flow, rps, rpm, etc. The instrument also serves as a secondary frequency standard.

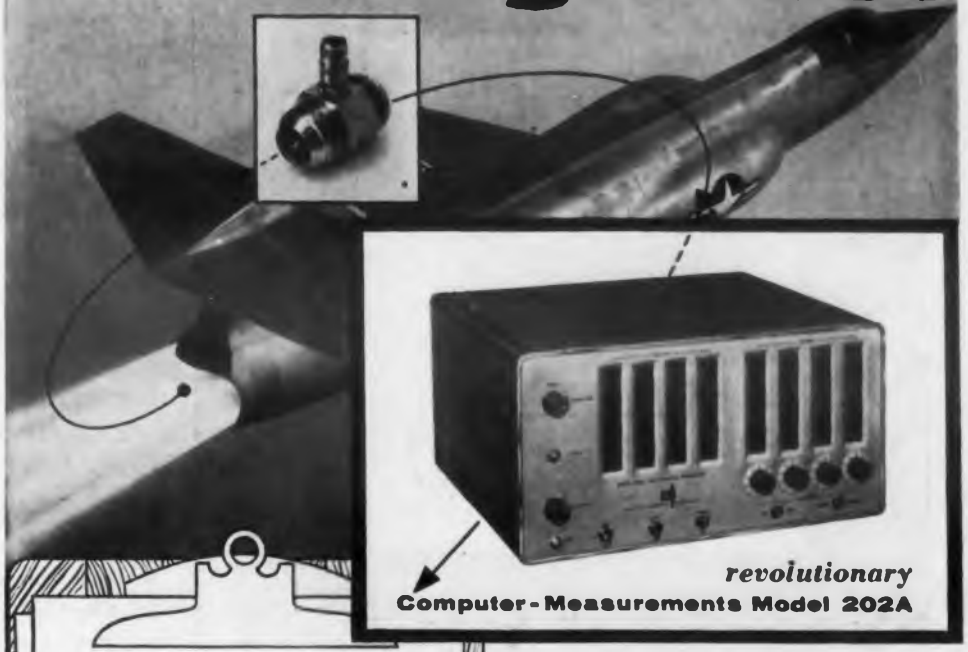
Important features include: three direct-coupled inputs, quick time base alignment, 70mv sensitivity, and provision for oscilloscope marker signals for trigger level adjustment on complex wave forms.

Among the specifications are: 3 independent threshhold controls permitting adjustment of trigger levels at any voltage from −50 to +50v with the resolution of 70mv; frequency range from 0 to 100,000cps; period measurement range from 10μsec to 100,000sec; time interval range from 10μsec to 100,000sec. Power requirements are: 117v, 10% 50-60cps, 280w.

Computer-Measurements Corp., Dept. ED, 5528 Vineland Ave., N. Hollywood, Calif.
Wescon Show, Booth No. 1047.

CIRCLE 121 ON READER-SERVICE CARD FOR MORE INFORMATION

translate flow ... into pounds per hour **at a glance!**



revolutionary
Computer-Measurements Model 202A

TIME-FUNCTION TRANSLATOR

Applications:

- ✓ **Gallons per minute ... into Gallons per hour**
- ✓ **Gallons per minute ... into Pounds per hour**
- ✓ **Pulses per second ... into Gallons per minute**
- ✓ **Total Count of Gallons or Pounds**
- ✓ **Tachometer Applications**
- ✓ **Direct Frequency Measurement**
- ✓ **Many Others**

Translating flow into weight as required for jet engine analysis is just *one* of the *many* uses for the *all-new* Model 202A TIME-FUNCTION TRANSLATOR. The 202A permits *instant* direct read-out of unknown quantities by translating one function of time into another function of time. It eliminates the need for conversion tables, graphs, charts, etc. The variable time base display may be illuminated or blanked at operator option. The versatile 202A fills a long recognized need in electronic measurement.

Write for complete information and detailed specifications on the Model 202A Time-Function Translator TODAY...

SPECIFICATIONS:	
Frequency Range:	1-100,000 cycles per second 0-100,000 positive pulses per second
Input Sensitivity:	0.05 volt rms: 10-100,000 cps (5 millivolts optional) 0.07 volt rms: 1-10 cps Positive pulse rise time: ½ volt or more per sec.
Input Impedance:	0.5 megohm and 50 mmf.
Accuracy:	± 1 count ± stability
Stability:	Short Term: 1 part in 1,000,000 Long Term: 5 parts per million per week
Time Bases:	0.001 to 10 seconds in 1 millisecond steps 0.0001 to 1 second in 0.1 millisecond steps (0.0001 to 10 sec. in 0.1 millisec. steps, 0.001 to 100 sec. in 1 millisec. steps optional)
Read-Out:	Direct. Four digits. (Five digits optional)
Display Time:	Automatic: Continuously variable, 0.1 to 10 sec. Manual: Until reset
Power Requirements:	117 volts ± 10%. 50-60 cycles, 250 watts (50-400 cycles optional)
Dimensions:	17" W x 8¾" H x 13½" D
Weight:	35 lbs. net.
Finish:	Panel: Light grey baked enamel Case: Dark grey baked enamel
	Data Subject to Change Without Notice

*Model FL Flow Pickup: Courtesy—Waugh Engineering Co., Van Nuys, Calif.

Computer-Measurements Corporation
5528 Vineland Avenue, North Hollywood, Calif. Dept. 76-H

CC-18

CIRCLE 122 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Time Interval Meter

Ranges From 1-9999 Millisec

The Model 7440A time interval meter, using cold cathode glow transfer tubes, provides a reliable, compact, and economical instrument for the measurement of time intervals, periods, and velocity. The instrument utilizes electrical impulses defining the interval to be measured to start and stop a gate. It then counts the number of cycles of an internally generated, crystal controlled frequency occurring during this gate.

Indication is directly in milliseconds, ranging from 1-9999millisec. Automatic recycling is provided, or the measurement may be held and indicated until a manual reset is operated. Model 7440A provides a time base of 1kc or 10kc or may be operated with an external time base. Accuracy is crystal stability ±1 count.

Electro-Pulse, Inc., Dept. ED, 11861 Teale St., Culver City, Calif.

Wescon Show, Booth No. 1313.

CIRCLE 125 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Magnetic Recording Heads

Multiple Channel Units

This improved line of multiple channel magnetic recording and playback heads is designed for a wide variety of uses, such as computer input-output equipment, memory drums, discs, and telemetering recording.

The precision machining removes adjustment problems by assuring complete interchangeability of heads, the elimination of any potting compound at the head surface prevents oxide build up, and the use of a laminated core consisting of strips of a special alloy 0.002" in thickness results in greater efficiency.

J. B. Rea Co., Dept. ED, 1723 Cloverfield Blvd., Santa Monica, Calif.

Wescon Show, Booth No. 131.

CIRCLE 126 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Socket Extenders

Useful In Tube Testers

These socket extenders provide replaceable units useful in tube testers and similar equipment. Wear is thereby shifted from the socket built into the tester to one in the extender. When the extender is worn out, a new one can be easily inserted. Thus, it is possible to lengthen the life of expensive test equipment.

The sockets have highest grade beryllium copper contacts. If it is desired to lock the extender in place, a nut can be screwed on a long screw projecting through the plug and then through the test equipment socket. Socket-to-plug leads are soldered, 1 to 1, 2 to 2, etc. and an outer shell is bonded in place.

They are available in 7 or 9-pin miniature and in 8-pin octal types.

Vector Electronic Co., Dept. ED, 3352 San Fernando Rd., Los Angeles 65, Calif.

Wescon Show, Booth No. 1028

CIRCLE 129 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Wire Wound Potentiometer

Operates From —55 To 150°C

The X-500 is a subminiature precision wire wound potentiometer which operates from —55°C to 150°C.

Available in the resistance range from 200 ohms to 250,000 ohms, the X-500 is only 1/2" diam and weighs 1/4 oz. The unit was designed to meet the requirements of subminiaturization, yet still offer the features, characteristics, and dependability of regular size potentiometers. One-piece anodized case gives maximum heat dissipation.

Specifications are: linearity ±0.3% highest resolution; ambient temperature range —55°C to 150°C; available in threaded bushing, servo, flush tapped hole, or flange mountings and gaged units; meets applicable portions of JAN specs and MIL-E-5272A standards.

Ace Electronics Associates, Dept. ED, 103 Dover St., Somerville, Mass.

Wescon Show, Booth No. 1364.

CIRCLE 130 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Slotted Lines

Characteristic Impedance 50 Ohms

The impedance meter, Model 230, is used to measure VSWRs and impedances in the frequency range of 500 to 4000Mc. It is specifically intended for measuring the VSWR of coaxial components equipped with type "N" connectors (male or female). The model 230B is equipped for measuring 7/8" coaxial components.

The instrument consists of a section of coaxial transmission line of the parallel plane type, a pick-up probe, and an r-f detector which uses IN21B and IN23 crystals.

End connectors are male and female type "N". The type "N" connectors are designed to mate with standard type "N" fittings, male on one end to mate with standard UG-23B/U, and female on the other end to mate with standard UG-21B/U. The type "N" connectors on both ends of the instrument are matched or compensated for use with either end of the instrument connected to load or signal source.

The characteristic impedance is 50 ohms for the model 230 and 46 ohms for the 230B. The slotted line is calibrated in centimeters and millimeters, with vernier reading accurately to 0.1mm. Residual VSWR is under 1.04 from 500 to 4000Mc.

The Narda Corp., Dept. ED, Mineola, N.Y.
Wescon Show, Booth No. 1036.

CIRCLE 135 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Transistor Transformers

Ultra-Miniature, Push-Pull

This is a stock line of ultra-miniature push-pull transistor transformers. Their size is only 3/8" x 3/8" x 11/32". Weight is 0.005 lb. They are supplied with 4" color coded leads suitable for use in dip soldered printed circuits.

Molded nylon bobbins, high-nickel laminations, and Mylar insulation are used to permit maximum size reduction. They are primarily designed for transistor circuitry in guided missile and airborne equipment.

Microtran Co., Inc., Dept. ED, 145 E. Mineola Ave., Valley Stream, N. Y.
Wescon Show, Booth No. 812.

CIRCLE 136 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Digital Recorder

Counts 11 Digits Per Line

Model 560A digital recorder operated from electronic counters provide a printed record of the total count accumulated by each counting period.

This instrument will mount 11 decimal digits per line at a printing rate which is controlled by the counter with which it operates up to a maximum of 5 complete lines per second.

An optional feature is provision for an analog output from the 560A. Any three consecutive digits may be graphically plotted with a potential resolution of 0.1%.

Hewlett-Packard Co., Dept. ED, 275 Page Mill Rd., Palo Alto, Calif.

Wescon Show, Booth No. 1050.

CIRCLE 138 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Preset Counter

Preset by 4 Decade Switches

Featuring compactness, long life, and versatility, the Model 7240A preset counter is usable in applications such as time interval generation and the control of sorting equipment, winding machines, counting and packaging, engine rpm, shearing and punching, automatic feeds, etc.

The instrument utilizes cold cathode glow transfer tubes which accomplish both counting and indication.

The unit counts and indicates the number of input events up to a number (from 1 to 9999) preset by four decade switches, at which time an input pulse is provided, a relay operates, and the count is held. Rapid recycling or manual resetting to repeat the operation is provided. The unit may be used as a time interval generator by counting the line voltage frequency, presenting the interval as a relay open or closed time.

Electro-Pulse, Inc., Dept. ED, 11861 Teale St., Culver City, Calif.

Wescon Show, Booth No. 1313.

CIRCLE 139 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Transistorized Servo Amplifier

Is Smaller, More Powerful

This is a new, smaller transistorized servo amplifier assembly measuring only 1-1/2" x 1-1/2" x 1" and with exceptional power output in relation to its size. The high power gain of 10^5:1 is achieved by a "heat-sink" design which rapidly dissipates heat. No output transformer is necessary because the amplifier works directly into a size 10 servo motor which has center tap control winding.

Control phase impedance of the servo is 250 ohms effective resistance when tuned with a 2μfd capacitor. Amplifier rating is 1w at 71°C, ambient operating temperature range −55°C to 71°C and voltage gain approx 300:1.

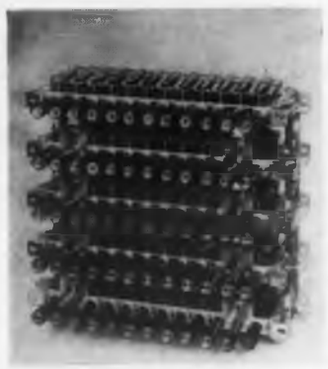
Output stage of the amplifier consists of two *H-3* germanium transistors operating in class B push-pull. The amplifier assembly is encapsulated in an epoxy resin. Applications include computers, guided missiles and others where exceptionally accurate servo-mechanisms are required.

John Oster Mfg. Co., Avionic Div., Dept. ED, Racine, Wisc.
Wescon Show, Booth No. 247.

CIRCLE 142 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Multiple Push-Button Switch

In Ganged Assemblies



The "Multi-Switch" is a multiple push-button switch available in illuminated or non-illuminated push buttons, featuring a choice of switching functions. Flexible tooling makes it practical to make it in any multiple from 2 to 12 stations. Choice of mounting centers. By mounting stack switches on a separate plate, up to 4 stacks can be operated by each button, providing innumerable circuit possibilities. Can be furnished with the function desired as interlock, non-locking, or combination of interlock and non-lock, etc. Inter-lock action can be achieved between all the buttons of two or more rows.

Switchcraft, Inc., Dept. ED, 1328 N. Halsted St., Chicago 22, Ill.
Wescon Show, Booth No. 805.

CIRCLE 143 ON READER-SERVICE CARD FOR MORE INFORMATION

PHOTO SHOWING SECTION OF CIRCUIT enlarged 10 times was made directly from panel and is **UNRETOUCHED.**

ABOVE PANEL IS ACTUAL PHOTO OF LAMINATE BY TAYLOR FIBRE CO., Norristown, Pa. and La Verne, Calif., using Revere Rolled Printed Circuit Copper.

CIRCLE 144 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Voltage Sensors

Actuates Voltages Between 90 and 130v

The RY-426 series of voltage sensors provides reliable, exact sensing of 400cps systems. Output contacts are provided to light warning indicators disconnect gyros, remove non-essential loads or whatever remedial action is designed for the system.

This series can be supplied to actuate at any voltage between 90 and 130v. Another series can be set in the 180 to 250v range.

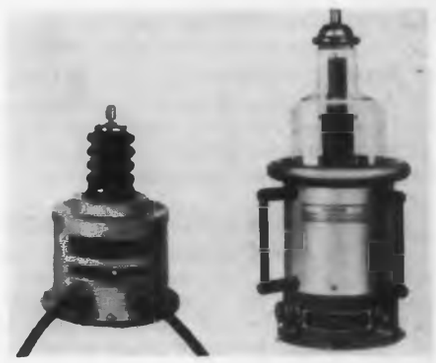
Specifications are: pull in and drop out in the range of 80-150v (±1-1/2v); temperature, —65°F to +250°F; frequency, 320cps to 480cps; contact rating, 5amp d-c @ 29v d-c, spdt.

Electronic Specialty Co., Dept. ED, 5121 San Fernando Rd., Los Angeles, Calif.
Wescon Show, Booth No. 103.

CIRCLE 147 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Capacitance Voltage Dividers

Accuracy of ±5%



Two new capacitance voltage dividers have been developed for accurate measurement of peak voltage; for critical viewing of pulse shape from magnetrons, pulse forming networks, driver amplifiers and radar modulators; and for measuring pulse signals of 1/4 to 10 μsec duration or continuous wave frequencies from 500cps to 10Mc/sec.

These voltage dividers can be used with any synchroscope or cathode-ray oscillograph with trigger delay circuit and an input resistance of 300,000 ohms or more with a shunt capacity of approx 30 μμfd. Both units are low dissipation capacitance type dividers with an accuracy of ±5%.

Model VD-35 has a 35,000v peak and division ratios of 200 to 1 and 50 to 1. Model VD-100 incorporates a vacuum capacitor and is highly stable with an extremely wide voltage range, from 250 to 100,000 peak volts, and division ratios of 500 to 1, 100 to 1, and 10 to 1.

Vectron, Inc., Dept, ED, 1583 Trapelo Rd., Waltham, Mass.
Wescon Show, Booth No. 942.

CIRCLE 148 ON READER-SERVICE CARD FOR MORE INFORMATION

MAGNETIC AMPLIFIERS & TRANSFORMERS

Precision...

Delivery...

Quality...

MAGNETIC AMPLIFIERS. Custom computer amplifiers with high stability and linearity can be designed having single or multiple inputs to your specific needs. Servo drives and relay actuators are also available. Frequency selective networks can be integrally designed to provide additional useful control functions. Proven packaging techniques insure minimum size — proven toroidal construction assures highest performance.

Typical Temperatures . . . . . —60° C. to +150° C.
Typical Line Frequencies . . . . . 60cps to 6000cps

MISSILE POWER TRANSFORMERS. Recommended for supply frequencies above 400 cps and where size performance and reliability are factors. Thin nickel alloy toroidal cores reduce core losses. Toroid structure cures stray field problems.

SEALED MISSILE POWER SUPPLIES combining toroidal power transformers, toroidal filter chokes, hi temp capacitors and silicon rectifiers. These units offer multiple outputs and low ripple. Low stray field of toroidal elements obviate usual internal shielding. Mag regulation where required.

LAMINATED TRANSFORMERS AND INDUCTORS. A complete line of laminated constructed units are now available through CAC. Our highly qualified engineering staff, a well complemented laboratory, humidity controlled production facility with modern manufacturing equipment guarantees conformance with any specifications. Both power and audio transformers employing advanced techniques can be supplied either hermetically sealed or encapsulated to 150° C. ambients. Catalogs, supplied upon request, cover a wide range of standardized designs including omnirange and ILS Filters.

PRECISION RATIO COMPUTER TRANSFORMERS. Toroidal form of construction is ideal for designing precision ratio transformers since the turns of wire are applied to and adjusted *on* the core. Normal production procedure of zero turn accuracy, high permeability cores, low phase shift, and near unity coupling will yield laboratory quality on any production run. Advanced design and newest packaging methods provide optimum performance with mini mum size and rugged construction.

Catalogs on Individual Components are Available on Request

COMMUNICATION ACCESSORIES CO.
World's Largest Exclusive Producer of Toroidal Windings
HICKMAN MILLS, MISSOURI • PHONE KANSAS CITY, SOUTH 1-6111

A Subsidiary of Collins Radio Company

CIRCLE 150 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Industrial X-Ray Tubes

For Use In 120 to 260 PKV Range

Five new industrial x-ray tubes, the PR series, are designed for use in the 120pkv to 260pkv range. Designed especially for light weight, self contained, portable x-ray tube heads (either oil or pressurized gas insulated), these tubes provide compactness, strength and high energy ratings, combined with the extremely useful small focal spot.

For replacement or for new equipments, these tubes make it possible to select the optimum combination of tube voltage and focal spot size to achieve maximum radiographic quality with minimum exposure time for any of a wide range of field requirements.

Machlett Laboratories, Inc., Dept. ED, 1063 Hope St., Springdale, Conn.
Wescon Show, Booth No. 801.

CIRCLE 151 ON READER-SERVICE CARD FOR MORE INFORMATION

△ X-Band Calibrated Load

Accuracy ±1% Calibrated Value

Offered as a convenient reference for equipment calibration, the new X-band calibrated load provides an adjustable mismatch using a micrometer probe calibrated at 8600, 9000, and 9500Mc for VSWR's of 1.10, 1.16, 1.4, and 1.8 at each of these frequencies. Identified as Model 128A, the unit has accuracy of ±1.0% of calibrated value.

Special units can be provided with calibrations to other frequencies and VSWR's as required. Fitting UG-39/U waveguide, the load is accurately aligned by means of two locating guide pins in the flange which mates with UG-39/U cover flange or equivalent. Overall length is 8-3/4".

Color Television Inc., Dept. ED, 932 E. San Carlos Ave., San Carlos, Calif.
Wescon Show, Booth No. 1065.

CIRCLE 152 ON READER-SERVICE CARD FOR MORE INFORMATION

***to a Lead Holder you can rely on in the "clutch"**

You can rely on CASTELL LOCKTITE Lead Holder in the *clutch*—and no pun intended. Because the gun-rifled clutch of LOCKTITE is the very heart of the mechanism which holds the lead like the jaws of a bull dog—prevents slipping, twisting and turning. Why risk your professional output? Lay it on the line with LOCKTITE—and imported CASTELL #9030 Lead. Call your dealer now.

A.W. FABER - CASTELL
PENCIL COMPANY INC. NEWARK 3, N. J.

CIRCLE 153 ON READER-SERVICE CARD FOR MORE INFORMATION

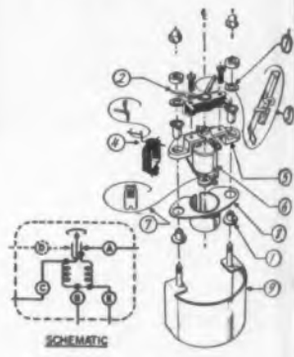
VHS* RELAY

(*Very High Sensitivity)

● The VHS is a balanced armature, Alnico magnet type relay. It is internally shock-mounted and resistant to vibration. The screw-on cover is gasket sealed. It can be opened and resealed.
Connections: 9 pin octal style. Dimensions: 1¾ diameter x 2¼ long. Weight: 4 ounces.
Sensitivity: Infinite variations from 0.2 Ua. to 10 Amp. or 0.1 Mv. to 500 volts, self contained. Higher volts or amps with external multipliers. A.C. rectifier types. Trip point accuracies to 1%. Differential 1%. The degree of resistance to shock and vibration primarily depends upon sensitivity and type of action wanted. In general, the relays will not be permanently damaged by shocks of 100 G's and vibrations up to 2,000 cps at 3-4 G's. The most sensitive relays may close their contacts under these conditions.
Contacts: SPST or SPDT, 5-25 Ma. D.C. Other ratings to ½ Amp. A.C. A locking coil gives high pressure and chatter free contact even under shock and vibration.
Prices on the order of $20-$80. Delivery 4 to 6 weeks. Assembly Products, Inc., Chesterland 17, Ohio (West Coast: Desert Hot Springs 17, Calif.

Model 266

Sample specs. are 0.2 micro-amperes, (12,000 ohms coil) or 0.1 millivolt (5 ohms)



1. Shock mount
2. Contact assemby
3. Contact detail
4. Armature with contact detail
5. Cast bracket
6. Alnico magnet
7. Bearing detail
8. Yoke (steel)
9. Mounting frame

See us at Wescon Show, August 21-24, Los Angeles

CIRCLE 154 ON READER-SERVICE CARD FOR MORE INFORMATION

New Aircraft Controls Catalog Just Off Press

New Fenwal Publication Gives Data on Accessory Controls for Aircraft, Guided Missiles and Ground Control Apparatus

LATEST AUTHORITATIVE DATA on accessory controls comes from Fenwal, originators of famous THERMOSWITCH® unit and pioneers in many advanced ideas in aircraft, guided missiles and ground apparatus. Copies without charge.

Here is new reference data everyone interested in aviation accessory equipment will want to have within reach.

It describes Fenwal Midget and Miniature THERMOSWITCH® units — logical answers to "tight-spot" temperature control problems. Gives general and specific data for standard and special applications according to government and/or customer specifications.

If your problems include temperature control of liquids, solids or gases in any area, the information in this catalog should be valuable to you. Write for FREE catalog, "Accessory Controls", Aviation Products Division, Fenwal Incorporated, 98 Pleasant Street, Ashland, Massachusetts.

CIRCLE 156 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Motor Gear Head

For Use With Size 8 Motors

This is a new, ultra-miniature precision motor gear head weighing only 1-1/8 oz. The gear head, Model 750-GH, is designed for adaptation to Size 8 motors. The unit measures 0.750" diam and, in its "solid type" model, is 1" long.

Four through-bolts make it adaptable to specially tapped Size 8 motors without the use of adapter plates or other accessories. A.B.E.C. Class 5 ball bearings throughout contribute to the 750-GH's low starting torque of 0.004 oz in. Ratios up to 650:1 are available without increase in length; but ratios up to 20,000:1 can be produced in longer units. The 750-GH is designed to operate synchro and potentiometer type loads.

Principal applications include missile control systems; servomechanisms; aircraft control equipment; indicating devices; computers and other precision electromechanical instrument applications.

Bowmar Instrument Corp., Dept. ED, 2415 Pennsylvania St., Fort Wayne, Ind.
Wescon Show, Booth No. 824.

CIRCLE 158 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Camera

Special Acoustic Housing

This ruggedized camera is designed for use in high noise environments. It has been tested observing rocket and jet engines with noise levels in excess of 150db. Special construction has been employed to eliminate and minimize the picture deterioration that normally takes place when ordinary cameras are operated in high sound levels.

A special acoustic housing has been designed with ruggedized camera assembly. This housing provides for frequencies which tend to cause most picture deterioration. In those applications where noise in the medium frequency spectrum is present the use of the housing with the camera is ideal.

Kay Lab, Dept. ED, 5725 Kearney Villa Rd., San Diego 12, Calif.
Wescon Show, Booth No. 1013.

CIRCLE 159 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Coaxial Termination

For 900 to 10,000Mc Range

This high power coaxial termination for the 900 to 10,000Mc frequency range, Model 369, has a power rating of 200w average and 50,000w peak. Model 369 is provided with efficiency heat-dissipating cooling fins to minimize temperature rise.

Capable of withstanding temperatures in excess of 500°F, the terminating element is a long tapered molding of "Narda-Iron" which results in very low VSWR (1.10) over the entire frequency range.

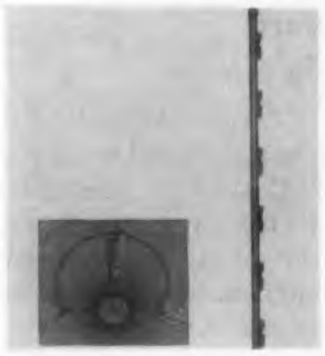
The unit is useful for terminating directional couplers and other devices in high power systems in actual operation or for test purposes. The low VSWR of the terminating element increases the effective directivity of directional couplers and facilitates more accurate VSWR measurement of all types of coaxial components. The termination is 11" long and is available with a type N female connector.

The Narda Corp. Dept. ED, Minneola, L.I., N.Y.
Wescon Show, Booth No. 1036.

CIRCLE 163 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Antenna System

10.8 db Gain Over 1/2-Wave Dipole



The basic part of this new system is the Type 201 base station antenna which provides a measured gain of 10.8db over a half-wave dipole in the direction of maximum radiation, while still providing gain considerably higher than unity in all directions. The transmitter station may now be located in an off-center position in relation to the general service area, yet provide concentrated high gain into the selected area where communications need is the greatest.

The base station antenna is fed by a flexible air dielectric cable, HELIAX, which can save as much as 2db over less efficient cable. Complementing the Type 201 base station installation is the new Type 233 mobile gain antenna, which will add 1.8db gain to the system, when compared to conventional quarter-wave roof-top antennas fed with RG-58/U cable.

Andrew Corp., Dept. ED, 363 E. 75th St., Chicago 19, Ill.
Wescon Show, Booth No. 848.

CIRCLE 164 ON READER-SERVICE CARD FOR MORE INFORMATION

△ FM Deviation Meter

Has Wide Range

Extended range and high stability are features of a new FM deviation Meter developed for telemetering and other wide deviation systems. Carrier frequency is 20 to 500Mc, deviation is measured to an accuracy of 3% in the range ± 2 to ± 400kc and crystal standardization is built in. The instrument accepts modulation frequencies from 50cps to 120kc.

A counter type discriminator is used since this has the advantage of linearity and freedom from drift; there is provision for aural or visual monitoring of the carrier modulation.

Since the instrument may have to be used in exposed locations, the steel case is waterproof and the chassis is shock mounted.

Marconi Instruments, Dept. ED, 44 New Street, New York, N. Y.

Wescon Show, Booth No. 1247-48.

CIRCLE 170 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Rate Gyro

Linearity ±1.5%

This new oil-filled rate gyro incorporates a non-heated temperature sensitive mechanism to maintain a linear damping over the ambient temperature range of −54°C to +71°C. Exceptionally accurate and rugged, the Model 36129 has a precision potentiometer pickoff which provides rate signals up to 70v with a linearity of ±1.5% or better and repeatability of ±0.4%.

No amplification of the high level output is necessary in d-c telemetering or instrumentation applications and no demodulation is required for most a-c control systems.

Hermetically sealed in an oil-filled, 2" case, the mechanism is semi-floated for protection during severe vibration (and shock up to 100g). The unit is available in standard rate ranges from ±15°/sec to ±200°/sec with motor excitation by 115v or 200v 3-phase, 400cps power.

G. M. Giannini & Co., Inc., Dept. ED, 918 E. Green St., Pasedena, Calif.

Wescon Show, Booth No. 904.

CIRCLE 171 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Accelerometer Amplifier

High Input, Low Output Impedance

The REL-104 voltage amplifier is designed for amplifying piezo-electric accelerometer signals and other similar low level signals to sufficient amplitude to modulate a sub-carrier oscillator in a telemetering system. It features high input impedance and low output impedance with a gain setting of 10 adjustable 10%.

Rheem Mfg. Co., Dept. ED, 9136 E. Hall Rd., Downey, Calif.

Wescon Show, Booth No. 135.

CIRCLE 175 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Nylon Screws and Nuts

12 New Sizes Added

In addition to their fractional inch lengths of 6-32, 8-32 and 10-32 molded black Nylon screws, the company now offers 1" lengths, in both flat and round head, in 6-32, 8-32, 10-32 and 1/4-20 sizes. Also added, in round head types are 1/2" lengths in both 1/4-20 and 4-40, 1-1/2" lengths in both 8-32 and 10-32 sizes.

Weckesser Co., Dept. ED, 5261 N. Avondale Ave., Chicago 30, Ill.

Wescon Show, Booth No. 129.

CIRCLE 176 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Nameplate Activating Machine

Activates A Special Adhesive

The new dial and name plate triactivator is a mechanical nameplate activating machine that activates a special type of adhesive used on metal nameplates in a split second. Only 1/10th of a second is required to activate the adhesive on a name plate and prepare it for installation on a product.

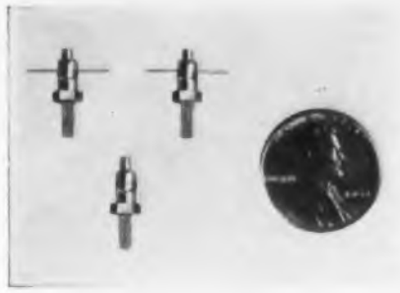
Miller Dial and Name Plate Co., Dept. ED, 4400 N. Temple City Blvd., El Monte, Calif.

Wescon Show, Booth No. 232.

CIRCLE 177 ON READER-SERVICE CARD FOR MORE INFORMATION

ADVERTISEMENT

New Spring Loaded Diode Clip holds fragile leads securely



Among the most recent of new products from Cambridge Thermionic Corporation, is a spring loaded diode clip designed primarily to hold securely fragile diode pigtail leads from .005 to .035" in diameter.

The clip is made of brass and is finished in .0002" bright alloy plate. When mounted it is 11/32" in over-all height. The mounting stud is 7/32" long, hexagonal with a 2-56 threaded stud.

Up to this time there has been no diode clip offering the same advantages. Its unique sturdiness derives both from its design and the precision care with which CTC manufactures it, typical of the company's standards throughout.

Write for complete data, including prices. Cambridge Thermionic Corporation, 457 Concord Ave., Cambridge 38, Mass.

CIRCLE 178 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Multiplier Phototube

3/4", 10-Stages

The 3/4", 10-stage multiplier phototube will make available subterranean areas never before reached in geophysical exploratory work.

Designated Type K1382, it has a rate average gain of 300,000 at 105v/stage. At the same potential, maximum dark current measures 0.1μamp, photo-cathode sensitivity is 40 μamp/lumen.

Allen B. Du Mont Laboratories, Inc., Dept. ED, 760 Bloomfield Ave., Clifton, N. J.
Wescon Show, Booth No. 939.

CIRCLE 182 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Silicon Power Rectifiers

Peak Inverse Ratings To 570v

Types 1N253, 1N254, 1N255, and 1N256 miniature silicon rectifiers have peak inverse voltage ratings up to 570v, and will handle average currents up to 1 amp at 135°C. No voltage or current derating is necessary throughout their operating temperature range of −65°C to +135°C.

Transitron Electronic Corp., Dept. ED, Melrose 76, Mass.
Wescon Show, Booth No. 903.

CIRCLE 183 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Custom Cabinets

Solid or Perforated Hinge Cover

These new cabinets are soundly engineered, versatile in usage, and of advanced design suitable for housing the highest quality instruments and equipment.

Bud Radio Inc., Dept. ED, 2118 E. 55th St., Cleveland 13, Ohio.
Wescon Show, Booth No. 1418.

CIRCLE 184 ON READER-SERVICE CARD FOR MORE INFORMATION

Official U. S. Air Force Photograph

Where a miss is worse than a mile

Today's new airborne weapons demand new standards of reliability.

Failure of even one part, for example, in the complex fire control computer of a modern interceptor like the F-102A *(above)* could nullify all the engineering skill that went into its design and construction. Even worse, such failure could cause a collision with target debris or allow the escape of a target bearing nuclear or thermonuclear weapons.

Reliability is one good reason engineers picked Bristol's® Syncroverter® high-speed polar relays for the fire control equipment.

These high-speed relays have a normal life of billions of operations in dry circuit applications. They are available in SPDT and DPDT models. They're reliable in such equipment as air-to-ground telemetering, analog and digital computers, aircraft or missile control, carrier-current switching, as well as others.

Your application may require different specs from those listed below. But chances are you'll find what you need in Bristol's broad Syncroverter line. Write for complete data. The Bristol Company, 151 Bristol Road, Waterbury 20, Conn. 6.43

Bristol Syncroverter high-speed relay. Covered by patents.

TYPICAL CHARACTERISTICS

Temperature range: —55°C to 100°C
Operating shock: 30G; 11 milliseconds duration
Vibration (10-55 cps, see below, mounting): 10G
Contact ratings: up to 35v, 45 microamperes
Stray contact capacitance: less than 15 mmfd
Pull-in time (including bounce): as low as 200 microseconds
Drop-out time: 300 microseconds
Life: Billions of operations
Mounting: Octal tube socket; others available, including types for vibration to 2000 cps.

BRISTOL FINE PRECISION INSTRUMENTS FOR OVER 67 YEARS

CIRCLE 186 ON READER-SERVICE CARD FOR MORE INFORMATION

△ 400cps Frequency Meter

Overall Accuracy 0.1% or Better

The new 400-cps frequency meter known as Model 6505A is designed for laboratory and control applications. Overall accuracy is 0.1% or better at all frequencies in its range. Frequency range is 370 to 430 cps. The meter scale may be expanded to increase reading accuracy in its center portion.

The instrument is calibrated at 370, 400, and 430cps by three built-in precision tuning fork oscillators having an accuracy of better than 0.2%. An exceptionally linear recorder output circuit (linearity better than 0.1%) may be adjusted to 1v output for 30cps frequency deviation.

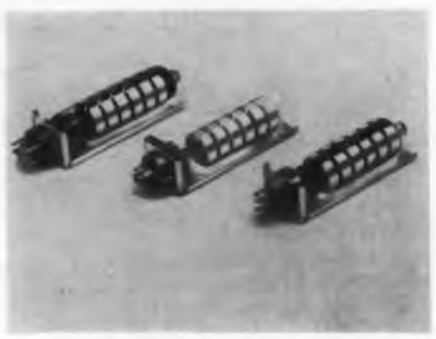
The Model 6505A requires no adjustment for operation from any signal input from 6v to 20v. Waveform distortion does not effect accuracy, provided the signal has continuous waveform with symmetrical half-periods.

Varo Mfg. Co., Dept. ED, 2201 Walnut St., Garland, Tex.
Wescon Show, Booth No. 225.

CIRCLE 187 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Tube Socket Clamps

For Severe Vibration Conditions



The new modification of "Kool Klamps," for use with button base or flat press T-3 tubes using sockets, has a special ridged base and socket mount to give maximum support and cooling under the severest vibration and shock conditions.

Designated 4A-539, 4A-527, and 4B-530, they are available both with and without sockets. All, except the 4B-530 which is made in beryllium copper only, can be ordered in 99-1/2% pure silver or beryllium copper. Clamps feature multiple finger sleeve construction, which compensates for tube irregularities and eliminates air spaces and destructive pressure points between tube and shield.

The Birtcher Corp., Industrial Div., Dept. ED, 4371 Valley Blvd., Los Angeles 32, Calif.
Wescon Show, Booth No. 1109.

CIRCLE 188 ON READER-SERVICE CARD FOR MORE INFORMATION

Time delays in automation circuits

AGASTAT

Time / Delay / Relay

When automatic machinery and circuits must be timed with repetitive accuracy (from 0.1 second to ten minutes or more) you'll find a sure, reliable answer in AGASTAT electrically-actuated pneumatically-timed time delay relays.

The AGASTAT is
- light, versatile, dependable.
- unaffected by voltage variations.
- instantaneous recycling.
- available in models which offer delays on energizing and de-energizing, two-step delays, manually-actuated time delay switch, remote push button control.

WRITE **our application engineers for help with your timing problem. Address Dept. A23-824**

AGA DIVISION

Elastic Stop Nut Corporation of America

1027 Newark Avenue, Elizabeth, New Jersey
Pioneers in pneumatic timing.

CIRCLE 189 ON READER-SERVICE CARD FOR MORE INFORMATION

COMPUTER POCKETSCOPE S-14-C

BY Waterman

16 POUNDS
7" x 6" x 12"

The Waterman Computer POCKETSCOPE Model S-14-C combines sound electrical performance, portability and operational simplicity. Designed primarily for computer field service in conjunction with a leading computer manufacturer, its applications to allied electronic fields are manifold. Operational simplicity with a minimum of inputs and controls greatly increases operational efficiency. Many improved electrical characteristics include high light output for viewing fast phenomena at low repetition rates; high trace stability for pulse position identification; and distortion-free trace expansion equivalent to 15" of sweep length with improved "parading" control. The oscilloscope incorporates practical frequency response (dc to beyond 700 kc) with a 70 millivolt per inch deflection sensitivity. Available accessory pre-amplifier probe increases signal sensitivity to 7 millivolts per inch. Fixed calibration voltage available. Amplifier design prevents visible image distortion eliminating all too common field error of misinterpreting distortion due to overload. Unique system of fixed calibrated, and variable uncalibrated, sweeps cover range from 20 microseconds to 2 seconds. Sweeps operative in trigger mode to meet requirements of typical computer and other electronic services. Synchronization from internal or external sources. Sync. lock out and clamping circuits maintain stable trace position for variations in sync. repetition rates. All 4 deflection plates and intensity grid are cathode ray tube accessible. All this high performance packaged in traditional POCKETSCOPE styling having case dimensions of 7" x 6" x 12" and weighing only 16 lbs. Consumes 85 watts at 117 volts. 60 cycles

WESCON SHOW BOOTH NO. 1003

WATERMAN PRODUCTS CO., INC.
PHILADELPHIA 25, PA.
CABLE ADDRESS: POKETSCOPE
MANUFACTURERS OF

PANELSCOPE®
S-4-C SAR PULSESCOPE®
S-5-C LAB PULSESCOPE®
S-11-A INDUSTRIAL POCKETSCOPE®
S-12-B JANized RAKSCOPE®
S-12-C SYSTEMS RAKSCOPE®
S-14-A HIGH GAIN POCKETSCOPE®
S-14-B WIDE BAND POCKETSCOPE®
S-14-C COMPUTER POCKETSCOPE®
S-15-A TWIN TUBE POCKETSCOPE®
RAYONIC® Cathode Ray Tubes and Other Associated Equipment

WATERMAN PRODUCTS
®T. M. REG.

CIRCLE 190 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Molded Transformers

Flexible at Low Temperatures

This new development is a cast or molded transformer whose ability to withstand moisture penetration is higher than that previously available. The transformers are cast in a material that maintains its flexibility at low temperatures. For example, they will pass the Type C thermal shock test of MIL-C-16923. This test is performed on cast samples which are poured around 1" long, 3/4" diameter hexagon steel bars. The castings are heated to 130°C and then plunged directly into —55°C alcohol-dry ice bath. The specification requires that ten of these thermal cycles be passed without cracking.

Westmold transformers have excellent heat stability and the material used for casting them has less weight loss on heat aging than any other transformer materials tested.

Westinghouse Electric Corp., Transformer Div., Dept. ED, P. O. Box 231, Greenville, Pa.
Wescon Show, Booth No. 947.

CIRCLE 194 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Mounting Systems

Withstand Severe Shock and Vibration

The new mounting systems provide isolation through sustained acceleration during the take-off and climbs and dives through high frequency vibration, and through all flight altitudes of the plane or missile.

The integral design represents a radical departure from standard bases in that unit isolators are replaced by independently controlled spring and damping elements built into the mounting system.

A wide line of mounting bases using standard All-Angl mounts are also designed to meet tougher conditions of sustained acceleration and shock through all altitudes and maneuvers of jets and missiles. In this, the isolators exceed performance required by standard MIL specifications which call out operation only at inclinations up to 10°.

Barry Controls Inc., Dept. ED, 700 Pleasant St., Watertown, Mass.
Wescon Show, Booth No. 737.

CIRCLE 195 ON READER-SERVICE CARD FOR MORE INFORMATION

UNION

"Selenium Slim" Rectifiers
Quality First....TO LAST

5200 UNION Selenium Rectifiers
used without a single failure!

Here is what Mr. P. W. Aitkenhead,
General Manager, Electro-Air Cleaner Company,
Pittsburgh, Pa., says
about UNION Selenium Rectifiers:

"We decided to use selenium rectifiers in our electronic air cleaners because, in the interest of building service-free equipment, we definitely did not want to use delicate high vacuum rectifier tubes.

Our experience in the use of selenium rectifiers has been one hundred per cent satisfactory. At the present time, we have some four thousand 3/16" rectifier pencils in service and about twelve hundred 3/8" rectifiers. Some of these selenium rectifiers are in the third year of operation and I am certain that continued satisfactory operation is assured. *We have not had a single rectifier failure to date.*"

Standard UNION selenium rectifier cells, pencil type, range in size from 1/8" to 1/2" diameter, rated from 2.5 to 40.0 milliamperes per cell; and stack-type, 1" x 1" to 5" x 6", rated from .180 to 10.0 amperes per cell in a single-phase full-wave bridge basis. Special combinations can be made to fit practically any current and voltage conversion requirements in various housings and special shapes. Write for complete information.

UNION Selenium Rectifiers in place in the power pack of the "Electro-Air" electronic air cleaner assure long, trouble-free operation.

75 Years 1881 1956

OF EQUIPMENT AND SYSTEMS ENGINEERING . . . . .

UNION SWITCH & SIGNAL
DIVISION OF WESTINGHOUSE AIR BRAKE COMPANY
PITTSBURGH 18, PENNSYLVANIA

CIRCLE 196 ON READER-SERVICE CARD FOR MORE INFORMATION

△ 1000-w Beam Pentode

Plate Voltage of 3000v

The new PL-172 external-anode beam pentode transmitting tube is 4″ diam and 5″ high. It has a max plate dissipation rating of 1000w, a max allowable plate voltage of 3000v and a max current rating of 1 amp.

In addition to serving in ordinary Class B and C applications, the PL-172 is designed to meet the critical requirements of linear amplifier operation, and will deliver a useful power output of over 1.5kw as a low-distortion Class AB-1 linear amplifier. The suppressor and screen grid terminals of the PL-172 are ring contact surfaces, which provide isolation between circuits and contribute to the high overall stability of r-f amplifier stages using the new tube.

Penta Laboratories, Inc., Dept. ED, 312 N. Nopal, Santa Barbara, Calif.

Wescon Show, Booth No. 1145.

CIRCLE 199 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Quartz Trimmer Capacitor

Has Ultra Low Loss

Model VC11A fused quartz piston capacitor is designed for use in capacitor networks requiring low-loss and high leakage resistance for 400cps operation. It is also for ultra stable oscillator circuits and as a tuning element in high frequency, low power tank circuits.

The coaxial construction utilizes an invar tuning slug and adjustment screw that is individually fitted to the precision bore cylinder. A silver clad invar band serves as the fixed electrode. Special quality control procedures give the VC-11A a dissipation factor of less than 0.0002 at 400cps to +125°C.

Other characteristics include: 1μμfd max at minimum setting at 1kc, 10μμfd min at maximum setting at 1kc; dielectric strength that withstands 2000v d-c between leads for 5 seconds within full range capacity; approx zero temperature coefficient at 0.1Mc; Q factor of 2000 min at 50Mc; insulation resistance better than 1,000,000 megohms after 30 days exposure to MIL-STD 170 moisture test.

JFD Mfg. Co., Inc., Dept. ED, 6101 16th Ave., Brooklyn, N.Y.

Wescon Show, Booth No. 130.

CIRCLE 200 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Power Resistors

3w, Axial Lead Types

Three watt AXIOHM resistors are designed specifically for printed circuits and advanced miniaturized designs where the stability and overload capacity of wire wound resistors are essential.

The resistors are made with special alloy resistance wire of low temperature coefficient of resistivity wound on tough miniature ceramic cores. Resistance wire and axial leads are spot welded to the end caps insuring strong, permanent, low resistance bond.

Stock Type 3X AXIOHMS are conservatively rated at 3w (based on 300°C rise, 40°C ambient). Resistance values to 6500 ohms, ±5% tolerance.

Ward Leonard Electric Co., Dept. ED, Mount Vernon, N. Y.
Wescon Show, Booth No. 727.

CIRCLE 202 ON READER-SERVICE CARD

Lightweight Triodes

For 50-60kw Equipments

The ML-6696 and ML-6697 coaxial terminal triodes, employing thoriated-tungsten filaments, are intended for industrial r-f heating and for broadcast equipments of 50-60 kw power output.

ML-6696 and ML6697 have maximum ratings for 16kv d-c plate voltage and 120kw plate input. A wide latitude in choice of load impedance is available; as examples, full input can be utilized at 10.9kv and 11 amp, or at 16.0kv and 7.5 amp.

ML-6696 is particularly suitable for water-cooled industrial heating equipments, either dielectric or induction. It has a plate dissipation rating, with 18 gallons of water flow per minute, of 60kw.

ML-6697, forced-air cooled, is ideal for high power dielectric heaters and for a-m broadcasting. It weighs only 29 lb, in contrast to older tubes of same power level weighing 120 to 230 lb. It has a plate dissipation rating of 35kw with 1700cfm air flow at 7.8" static pressure.

Machlett Laboratories, Inc., Dept. ED, Springdale, Conn.

CIRCLE 203 ON READER-SERVICE CARD

CIRCLE 204 ON READER-SERVICE CARD ➤

△ Hermetic Variductors

Feature High Q

These hermetic variductors are extremely miniaturized (base dimensions 25/32 x 1-1/8) variable inductors designed to meet MIL-T-27 specifications. They provide high Q, exceptional voltage and temperature stability, and excellent shock and vibration characteristics. Adjustment of the set screw on the top of the case permits varying inductance from +200% to −70% of the mean value.

United Transformer Co., Dept. ED, 150 Varick St., New York 13, N.Y.
Wescon Show, Booth No. 1155.

CIRCLE 208 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Telemetering Power Supply

For Airborne Applications

The REL-251 is a rugged miniature instrument designed to meet the requirements of all applicable military specifications. The versatility of this unit affords instrumentation and operational application in the fields of missile, aircraft, laboratory, and ground support equipment.

Physical specifications are: size—6.5″ wide x 6.15″ high x 6.625″ deep; weight—11.5 lb, approx.

Rheem Mfg. Co., Dept. ED, 9136 E. Hall Rd., Downey, Calif.
Wescon Show, Booth No. 135.

CIRCLE 209 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Guided Missile Beacons

Vibration 500cps at 10g's;

These "S" & "L" band guided missile beacons meet all requirements of the latest missile reliability program. Specifications include: temperature range—65°F to 160°F; relative humidity—95%; altitude—70,000 ft; vibration—500cps @ 10g's; shock—15g's.

Telerad Mfg. Corp., Dept. ED, Flemington, N. J.
Wescon Show, Booth No. 1204.

CIRCLE 210 ON READER-SERVICE CARD FOR MORE INFORMATION

Time / Frequency Calibrator

a compact, inexpensive and accurate secondary frequency standard

★ Crystal-controlled fundamental frequencies at 10 kc, 100 kc, 1 Mc and 10 Mc; usable harmonics to 1,000 Mc

★ High stability of 1 ppm/°C after one hour's warmup, when used with Type 1201-A Power Supply

★ New type crystal-mixer circuit produces and detects beats over entire 1,000 Mc range; with self-contained audio amplifier, locates calibration points for r-f oscillators without additional equipment

★ Internal video amplifier makes available accurately-known multivibrator square waves, supplying timing pulses at intervals of 0.1, 1.0, 10 and 100 μsec for triggering oscilloscope sweeps and pulse-generating equipment

Type 1213-C Unit Time/Frequency Calibrator: $195.00
Type 1203-A Unit Power Supply $40.00

Write for Complete Information

GENERAL RADIO Company

275 Massachusetts Avenue, Cambridge 39, Massachusetts

90 West Street **NEW YORK 6** • 8055 13th St., Silver Spring, Md. **WASHINGTON, D. C.**
1150 York Road, Abington, Pa. **PHILADELPHIA**
920 S. Michigan Ave. **CHICAGO 5** • 1000 N. Seward St. **LOS ANGELES 38**

CIRCLE 212 ON READER-SERVICE CARD FOR MORE INFORMATION

for hundreds of electronics applications use...

AVERY PRESSURE-SENSITIVE LABELS

Your product tells its own story with Avery pressure-sensitive labels. *Identification, trademarks, "use" information, wiring diagrams, warnings, service instructions and inspection markings* are but a few of the many ways you can use Avery self-adhesive labels efficiently and economically.

With Avery electric dispensers labeling is as much as 5 times faster than with ordinary methods!

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COMPANY_____
ADDRESS_____
CITY_____ ZONE____ STATE_____
OUR BUSINESS IS:_____

CIRCLE 213 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Electrometer and D-C Amplifier

Has High Sensitivity

Basically a high-resistance millivoltmeter, the new Type 1230-A d-c amplifier and electrometer indicates voltage, current, and resistance on a panel meter.

Excellent stability and high sensitivity make this instrument useful for the measurement of: ionization currents, photo currents, electron tube grid currents, time-current curves of capacitors, piezo-electric, etc.

General Radio Co., Dept. ED, 275 Massachusetts Ave., Cambridge 39, Mass.
Wescon Show, Booth No. 918.

CIRCLE 214 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Interval Timers

Feature High-Torque Motor

Available in full-scale ranges from 15 seconds to 24 hours, the new Type 241 interval timers feature a completely new drive and automatic reset mechanism actuated by a precision-built, high-torque synchronous motor. The permanent-magnet-type synchronous motor develops a minimum torque of 30 oz in at 1 rpm.

Cramer Controls Corp., Dept. ED, Centerbrook, Conn.
Wescon Show, Booth No. 1108

CIRCLE 215 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Military Type Transistor

For Operation Up To 75°C

The *2N200* military type transistor is a germanium p-n-p junction transistor designed for electronic equipment requiring extreme reliability at high temperatures and under severe environmental conditions. Rated and tested for operations up to 75°C, the *2N200* will provide excellent performance in a wide variety of applications.

The *2N200* has a typical common emitter current gain of 45, and can dissipate up to 350mw.

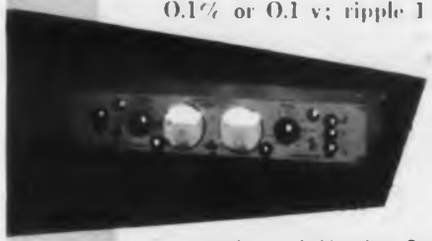
Transitron Electronic Corp., Dept. ED, Melrose 76, Mass.
Wescon Show, Booth No. 903.

CIRCLE 216 ON READER-SERVICE CARD FOR MORE INFORMATION

General Type

New PROGRAMMABLE (Remote Control) regatron® power pack

Unique circuit design of these newly developed power supply units is intended for applications requiring remote control and/or programming according to commands from an operator or control system —such as in tube-test programming, automatic production testing, and other automated processes. Also useful for general applications, all models feature main and vernier controls. Regulation applies over full range and for all load conditions: 0.1% or 0.1 v; ripple 1 M. V.



TRANSISTOR POWER PACK

- Main and Vernier Controls
- Auxiliary Bias and Filament outputs (General Type)
- Designed for Automation. Transistors, Test Consoles, Computers
- Ideal for Laboratory and Production Purposes
- Unusually low-priced, High-Quality Units

General Types:	Volts	Current
Model 231 A	0-300	0-100 MA
Model 232 A	0-300	0-200 MA
Model 233 A	0-300	0-300 MA
Transistor Types:		
Model 212 A	0-100	0-100 MA
Model 213 A	0-50	0-1000 MA
Model 214 A	0-100	0-1000 MA

Write today for Additional Information to Dept. D1

Electronic MEASUREMENTS COMPANY INC.
EATONTOWN, NEW JERSEY
Eatontown 3-0300

CIRCLE 217 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Metal-Ceramic Seals

For High Temperature Fields

Among the many advantages of these custom made A1SiMag metal-ceramic seals are: close dimensional tolerances; ceramics with extremely low dielectric loss, excellent insulation resistance and high softening temperature; improved glaze with superior surface resistivity; permanent bonding between ceramic and metal; outstanding mechanical and electrical characteristics at every point in the wider operating temperature range; high tensile and impact strengths; superior resistance to spalling and chipping.

Suitable metal-ceramic seals can be supplied for silver solder brazing, hard or soft soldering. (Attaching with hard solder greatly extends the operating temperature range.) Silver solder joints on high temperature designs have a minimum melting point of 1400°F.

American Lava Corp., Dept. ED, Cherokee Blvd. & Mfgrs. Rd., Chattanooga 5, Tenn.
Wescon Show, Booth No. 926.

CIRCLE 220 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Toroidal Transformers

All With 1:1 Turn Ratios

Three wide-band toroidal transformers have been developed for application in video-frequency circuitry as found in digital computers, forward scatter transmission, and color TV. They are designed for low power operation, all with 1:1 turn ratios, and are available with pig-tail leads or solder lug terminals. The outer protective cover can be furnished as a varnish-covered tape wrapping, resin-dipped coating or casting.

The frequency bands covered by these video transformers are 1kc to 1Mc, 375cps to 2.8Mc; and 120cps to 800kc. Physical dimensions for two are approx 1-5/8" OD by 1/2" high. The third toroid is approx 1-3/4" OD by 5/8" high.

Allen B. Du Mont Laboratories, Inc., Dept. ED, 750 Bloomfield Ave., Clifton, N. J.
Wescon Show, Booth No. 929.

CIRCLE 221 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Color Oscilloscope

100% Response At 3.58Mc

Model 485 is an advanced, 7″ high-gain, wide-band scope especially designed for color-TV service. (Ideal for black and white, too.) A feature of the Model 485 is its flat frequency response—within 1db to 4.5Mc.

Additional features include: dual bandwidth which provides extra testing versatility; properly compensated wide band vertical amplifier stages; high sensitivity and very good transient response; compensated step attenuator vernier vertical attenuator for continuous control of the signal voltage; CRT balanced deflection; excellent square wave response; very small loading of circuit being checked.

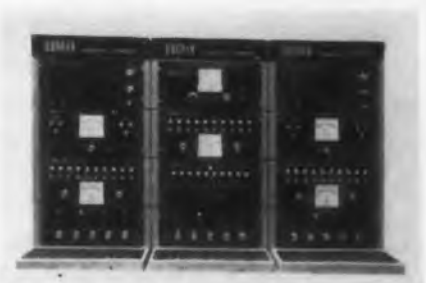
Simpson Electric Co., Dept. ED, 5200 W. Kinzie St., Chicago 44, Ill.

Wescon Show, Booth No. 943.

CIRCLE 225 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Analog Computer

Has 30 Operational Amplifiers



The new modular analog computer incorporates 30 operational amplifiers 10 of which are individually chopper stabilized. Included also are two dual channel electronic function multipliers, two variable base function generators and a special comparator bridge for setting true coefficient values.

This is a complete analog computing facility. The problem is carried on three quick detachable problem boards which utilize plug-in computing components. These problem boards can be interchanged vary rapidly and easily so that an entirely new problem may be placed on the computer in the very minimum time.

One of the outstanding features of this analog computing facility and others like it is its ability to be changed or expanded at will. The modular construction permits additional units or accessories to be added with great ease.

Donner Scientific Co., Dept. ED, 2829 Seventh St., Berkeley 10, Calif.

Wescon Show, Booth No. 855.

CIRCLE 226 ON READER-SERVICE CARD FOR MORE INFORMATION

MS-25089

PUSH-BUTTON SWITCHES

. . . designed to MIL-S-6743 specifications for aviation's toughest jobs.

- **Fully moistureproof**
- **Positive snap-action cannot be teased off contact**
- **Withstands 20G vibration up to 2,000 cps.**
- **Made in six single-pole circuit arrangements**
- **Choice of 7 mounting adapters (illustrated)**
- **Rated for 25,000 operations at 10 amps, 28 volts dc.**

Detailed specifications on the complete line of Hetherington precision push-button switches designed to MIL-S-6743, drawing MS-25089 will gladly be sent on request.

HETHERINGTON, Inc.
1200 ELMWOOD AVENUE • SHARON HILL, PA.

West Coast Division:
139 Illinois St.
El Segundo, Calif.

HETHERINGTON
Snap-Action Switches

SNAP-ACTION SWITCHES FOR ALL AIRCRAFT AND PRECISION INDUSTRIAL APPLICATIONS • INDICATOR LIGHTS • SWITCHES WITH BUILT-IN LIGHTS • HIGH-IMPACT RELAYS • COILS • SOLENOIDS.

CIRCLE 227 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Frequency Sensors

Control Points Frequency 365 ±5cps

These units are available for over and under frequency signals and as band-pass units. Actuating frequencies can be adjusted to any point between 350 and 450 cps to meet specific requirements.

Operating characteristics of the RY-430 model are: control point frequency, 365 ±5cps; line frequency, 250 to 1000cps; operating voltage, 102 to 124v a-c; contact rating, 3amp resistive 3pdt; temperature, −65 to +250°F; altitude, 85,000 ft.

Electronic Specialty Co., Dept. ED, 5121 San Fernando Rd., Los Angeles, Calif.

Wescon Show, Booth No. 103.

CIRCLE 231 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Sloping Panel Support

For Easier Instrument Viewing

This new sloping panel support for rack mounted instrument panels permits the electronics engineer to more easily view test instruments. The support holds a standard 19" panel at approx 45° from the rack.

The use of the sloping panel support speeds up test operations and makes the construction of test equipment more economical.

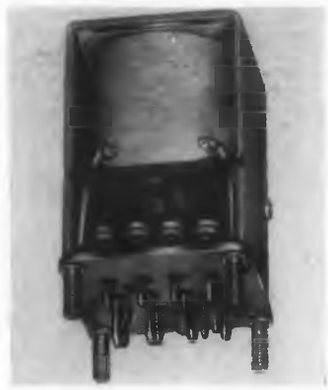
Wyco Metal Products, Dept. ED, N. Hollywood, Calif.

Wescon Show, Booth No. 701.

CIRCLE 232 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Relay

10Amp Rating



Relay 7011 is a balanced armature design. It is a 4 pole double throw unit rated at 10amp. The unit is vibration resistant and hermetically sealed. It exceeds the requirements of Mil-R-6106A, Mil-R-5757B, Mil-R-25018. The relay has screw controlled spring adjustment for pull-in reliability. It measures 1-7/16 x 1-7/16 x 2-3/16".

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

Wescon Show, Booth No. 1201.

CIRCLE 233 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Toggle Switch Boots

Have Rigid Hexnut

No. N-1030B toggle switch boots are a new, improved version of the company's standard HEXSEAL design. Constructed with an integral hexnut, they can be tightened with an ordinary pliers eliminating the need for special tools. They retain the one piece construction of the standard HEXSEALS, and also the qualities of silicone rubber. The boots will withstand temperature variations from 125°F to 500°F and remain unaffected by salt water, acids or ozone.

Design of the N-1030B permits the toggle switch bat to be exposed while the high pressure seal is maintained. Sealing takes place at three places: a double "O-ring" construction formed in the neck of the boot provides firm sealing against the bat handle of the switch (two distinct seals) and effective panel sealing is obtained by a gasket rib formed in the base of the holding hexnut.

Automatic & Precision Mfg. Co., Dept. ED, 252 Hawthorne St., Yonkers, N.Y.
Wescon Show, Booth No. 966.

CIRCLE 234 ON READER-SERVICE CARD FOR MORE INFORMATION

△ D-C Microvolt-Ammeter

15 Ranges Provided

This unit measures voltages at low as 10μv and currents as low as 10μμamp. Fifteen ranges are provided. An uncluttered zero centered mirrored scale meter instantly indicates polarity. Input impedance is 10 megohms on low voltage range and 100 megohms above 100mv.

A feature of the instrument is that it can also be used as an extremely stable d-c amplifier providing a gain of 80db with equivalent input drift under 10μv.

Kay Lab, Dept. ED, 5725 Kearney Villa Rd., San Diego 12, Calif.
Wescon Show, Booth No. 1013.

CIRCLE 235 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Automatic Switching Discriminators

Plays Back Signals From Tape

This new discriminator, when coupled to Type 103 tape transport, or another similar switching device, permits completely automatic speed and frequency switching over wide ranges. The automatic switching discriminators will automatically follow switched speed changes on the tape transport.

Type 5202 f-m signal discriminator can be automatically switched to any of four operating frequencies corresponding to any of four different tape speeds; no changing of plug-in units is necessary in this switching operation. Control is effected by the speed selector switch on the tape transport.

A companion Type 5252 f-m compensation discriminator provides for wow and flutter compensation in the f-m system and includes four automatically switched crystal oscillators for discriminator adjustment.

The Davies Laboratories, Inc., Dept. ED, 4705 Queensbury Rd., Riverdale, Md.
Wescon Show, Booth No. 1045.

CIRCLE 240 ON READER-SERVICE CARD FOR MORE INFORMATION

△ D-C Amplifier

Chopper Stabilized

This compact d-c chopper stabilized amplifier has very low drift and noise level. Amplifiers are complete with integral power supply for operation on 115v 60cps with only 50w power consumption.

Features provided are a 10 step attenuator, current overload indicator and zero adjustment. Amplification of 1000 with feedback, a frequency response from d-c to 30,000cps, and output of ± 50v open circuit or ± 45ma into 20ohms provides ideal combination of characteristics.

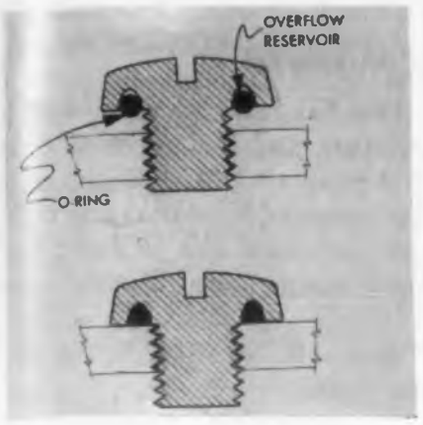
Known as Model DC-6, the amplifiers are available in single channel, four, five and six channel groupings.

William Miller Instruments, Inc., Dept. ED, 325 N. Halstead Avenue, Pasadena, Calif.
Wescon Show, Booth No. 1412.

CIRCLE 241 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Shake Proof Screws

Are Self-Sealing



This new line of machine screws has been designed for use on hermetically sealed cabinetry and under conditions of severe vibration. Designated Seelscrews, they employ an "0-rib" made of silicone rubber, neoprene or plastic, depending on the end of the screw.

The rib is held in a circular groove under the screw head. When the screw is tightened, the material is compressed under the head to form a positive hermetic seal. Wherever a "locking" or "shake proof" screw is required, a plastic is used in place of the rubber. To all outward appearances these screw heads are identical with all standard screws. Seelscrews are made of brass or steel, plain or nickel-plated, in three sizes, 6-32, 8-32, and 10-32.

Automatic & Precision Mfg. Co., Dept. ED, 252 Hawthorne Ave., Yonkers 5, N.Y.
Wescon Show, Booth No. 966.

CIRCLE 245 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Electrical Connector

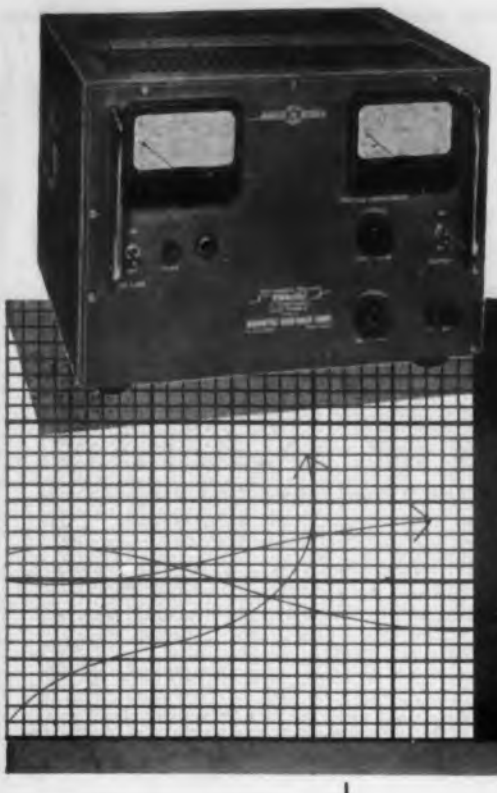
For Miniaturized Equipment

A new miniature electrical connector known as the "Pygmy" has been developed especially for application to miniaturized electronic equipment. The "Pygmy" is available in both the "A" and "E" styles; in a series for potting; with jam nut receptacles; and with hermetically sealed receptacles. Both a double stub quick action thread and a three-point bayonet lock are offered for the convenience of users.

Either cadmium plate or alumilite finishes are available for these connectors. Resilient Scinflex inserts are used to resist vibration effects. The standard size 20 gold plated contacts are the closed entry type and will not accept oversize probes or pins.

Scintilla Div., Bendix Aviation Corp., Dept. ED, Sidney, N.Y.
Wescon Show, Booth No. 1153-1154.

CIRCLE 246 ON READER-SERVICE CARD FOR MORE INFORMATION



±¼% REGULATION
3-36 VOLTS, 15-AMPERE
D.C. POWER SUPPLY

short circuit-proof dual magnetic regulation gives you line transient-free wide-range d.c. power

SHORT CIRCUIT-PROOF

EXCELLENT STATIC and DYNAMIC REGULATION

VERY LOW RIPPLE

NO TUBES, NO MOVING PARTS

ULTRA-FAST RESPONSE

LOW INTERNAL IMPEDANCE

Write for complete technical data

Stablvolt© MR 532-15 D.C. POWER SUPPLY

Exclusive MRC **dual** magnetic, tubeless circuitry efficiently isolates line voltage transients from the d.c. output, giving you precision regulation unobtainable with conventional magnetic amplifier-type voltage regulator systems. Circuit uses high-performance flux oscillators in connection with high-gain magnetic amplifiers, eliminating vacuum tubes, mechanical references and other delicate elements, and providing excellent dynamic and static regulation.

The MR 532-15 is short circuit-proof. When short circuited, line current is automatically limited, protecting power supply from internal damage. Normal operation is resumed automatically—no re-setting of switches, no fuses, no downtime. **Extremely wide voltage range** is accomplished by means of static magnetic circuitry. No transistors—no variable transformers. A superior performer for industrial, laboratory and original equipment applications. Competitively priced.

Model MR 532-15/SPECIFICATIONS

Type: Dual magnetic regulated

Input: Voltage Range 80-150V
Frequency Range 57-63 cps

Output: Voltage Range 5-32V DC
Extended Range 3-36V DC
Current Range 0-15A DC
Short Circuit Current 30A DC

Voltage Adjustment: Continuous with vernier.

Ripple: less than 50 millivolts entire voltage range

Response time: less than 25 milliseconds for line transients
max. 150 milliseconds for load transients

Size: 17.5" w x 12.5" h x 15.5" d (also avail. for 19" st'd rack mt.)

Weight: 150 #

REGULATION

Static:	Dynamic:
±¼% for 80-150V line change	less than 1% for 10% line transient
±½% for 0-15A load, 5-32V range	less than 1.5V for 10% load transient
±1% for extended voltage range	

magnetic research corp.

200 CENTER STREET, EL SEGUNDO, CALIFORNIA,

Phone: ORegon 8-8921

Visit our booth #211 Wescon Show

CIRCLE 250 ON READER-SERVICE CARD FOR MORE INFORMATION

New Literature

Audio Testing 251

Bulletin No. A-137 has been offered describing Model No. 201 Acousti-Room, an audiometric testing environment. Accurate audiograms can be obtained with this unit. Included are a description of the Acousti-Room, illustrations, applications and graphs.

Burgess-Manning Co., 5970 Northwest Highway, Chicago, Ill.

Connectors 252

A 2-color, 2-page bulletin, No. 26A, has been issued describing series 18 miniature precision Continental Connectors. Included are code number designations, actual size photographs, aluminum hoods, and illustrations of other interesting special design Continental Connectors.

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

Potting Compound 253

A data sheet has been issued on a new high temperature and fuel resistant electrical potting compound, 3C-155. The compound is characterized by outstanding resistance to oils, gasolines, and jet fuels, and to prolonged temperature exposures of 300°F.

Churchill Chemical Corp., 3137 E. 26th St., Los Angeles, Calif.

Flexible Couplings 254

A new 4-page bulletin has been issued describing standard and special miniature couplings for power transmission. The bulletin, MC-100, illustrates, describes, and shows dimensional drawings of miniaturized couplings which can be used on servo mechanisms, computers, and other small devices.

Thomas Flexible Coupling Co., Warren, Pa.

Receiving Tubes 260

A selection chart has been published listing the company's 5-star high-reliability tubes for critical applications. The chart classifies the 34 tubes, applicable military specifications, heater voltages and currents, and gives average characteristics.
General Electric Tube Dept., 1 River Rd., Schenectady, N.Y.

Mica Capacitors 261

A technical article has been released describing how new "K" gaged mica permits the manufacture of capacitors having the same capacity but only 1/2 to 1/4 the size previously used in transistorized and other printed circuits.
Perfection Mica Co., 20 No. Wacker Dr., Chicago, Ill.

Air Switches 262

Type RC double break air switches are described in a new 2-page bulletin, GEA-6483. Featuring a rotating center insulator-switch, the apparatus is designed for applications where space limitations make impossible the use of a vertical break switch.
General Electric Co., Schenectady 5, N. Y.

Telemetry Equipment 263

Several bulletins have been made available describing various special purpose receivers operating in the frequency range of 55 to 260Mc. Each bulletin provides a description of the unit, specifications, applications and outstanding features, including an illustration of the equipment.
Nems-Clarke, Inc., 919 Jesup-Blair Dr., Silver Spring, Md.

Small Tubing 264

Bulletin No. 3 is available describing small tubing for all industry from 7/8" OD to 0.010" OD. The bulletin includes alloys, tolerances, temper requirements, and finish of the precision tubing.
Precision Tube Co., Inc., North Wales, Pa.

Welding Data 265

Welding Data Book TIS 2575 has been issued containing a wealth of information on welding and welding techniques. The book will be of considerable value to engineers in all phases of industry.
Eutectic Welding Alloys Corp., 40-40 172nd St., Flushing 58, N.Y.

Solution:

. . . **DAYSTROM POTENTIOMETER'S MODEL 300-00,** the tiniest, wire-wound precision "pot" on the market.

The less than dime-sized model, recently improved even over the well performing original, is a fly-weight unit (2 grams) designed for exacting jobs in minute spaces and through extreme temperature ranges.

For your applications demanding higher resistance ranges, plus compactness, the slightly larger Model 303-00 is the answer. Both models are designed for universal adaptability and unlimited stacking (21 per cubic inch for the Model 300-00). Both are immediately available in standard models.

Some outstanding characteristics:

	Model 300-00	Model 303-00
Size	0.5" square by 0.187" thick	0.75" square by 0.28" thick
Weight	2 grams	7 grams
Resistance Ranges	10 ohms to 50K	5K to 125K

Write today for literature on these or any of the many other production or custom-made precision potentiometers available. Names of local representatives on request.

Openings exist for highly qualified engineers.

POTENTIOMETER DIVISION

Daystrom PACIFIC CORPORATION

11150 La Grange Ave. West Los Angeles 25, Calif.

A subsidiary of Daystrom, Inc.

CIRCLE 267 ON READER-SERVICE CARD FOR MORE INFORMATION

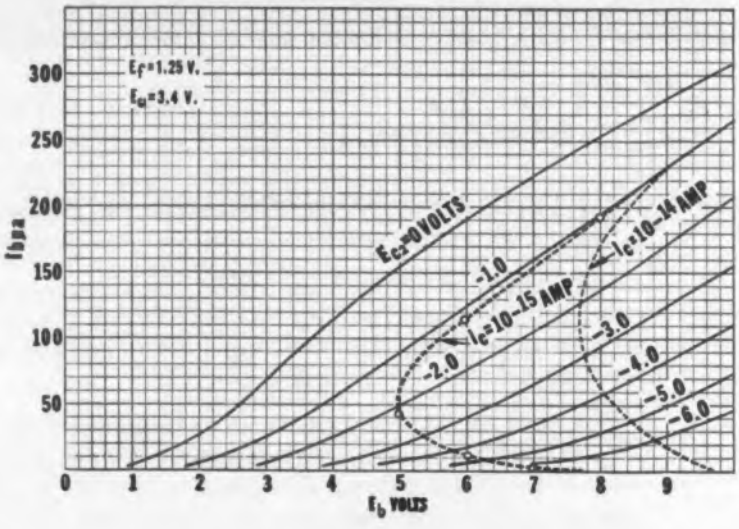
VICTOREEN
ELECTROMETER TUBES

PROVIDE EXTREME SENSITIVITY IN MEASURING MINUTE CURRENTS

Low grid current and consequently high input impedance are important features of Victoreen electrometer tubes. This is achieved by developing an optimum vacuum in the glass envelope, maintaining a low electrode potential to minimize gas ionization, low filament (10ma) current and proper grid potentials.

As an example of the performance achieved, the grid current for the type 5800 tube, centers at approximately 3×10^{-15} amperes.

TYPICAL OPERATION 5800 ELECTROMETER TUBE CHART



VICTOREEN HI-MEG RESISTORS
FOR ELECTROMETER CIRCUITS

To obtain the maximum performance from an electrometer circuit, Victoreen Hi-Meg resistors provide the necessary stability, accuracy and ability to withstand high humidity operation. The resistor element is vacuum sealed in glass and is subjected to a laboratory controlled, accelerated aging process to insure long-life and reliability. Glass surface is treated with silicon varnish to provide maximum immunity to humidity effects.

Hi-Meg resistors are available in the following values; from 10^8 to 5×10^{12} ohms and up to 10^{15} on special order. Tolerances of 10, 5, 2 and 1%. Temperature -65 to $+100°$ C; up to 1000 volts and 98% relative humidity.

Catalogs describing Victoreen electrometer tubes and Hi-Meg resistors are available on request.

The Victoreen Instrument Co.

3811 PERKINS AVE. • CLEVELAND 14, OHIO

CIRCLE 270 ON READER-SERVICE CARD FOR MORE INFORMATION

Hook-Up Wires 271

Bulletin 1901 has been issued describing PERMACODE hook-up wires, rated at 600 and 1000 volt service for continuous operation over the temperature range from −90°C to +210°C, combine flexibility, chemical and solvent resistance, high volume and surface resistivity with extremely low electrical losses. Specifications, engineering data and part numbers are included in this bulletin.
Revere Corp. of America, Wallingford, Conn.

Power Supplies 272

Two catalogs have been offered, one describing dynamotor power supplies (No. 155), the other, describing a line of d-c to a-c converters and inductor alternators (No. 553). Both catalogs contain numerous illustrations, performance charts, dimensional drawings, various applications, and complete specifications.
Carter Motor Co., 2644 N. Maplewood Ave., Chicago, Ill.

Solenoid Valves 273

A new 32-page catalog, No. 201, has been made available describing a line of solenoid valves. The latest designs in the company's line of 2, 3, and 4-way solenoid valves are included in this easy to read condensed catalog. It contains engineering information, flow charts, operation and construction details, illustrations, prices, etc.
Automatic Switch Co., 391 Lakeside Ave., Orange, N.J.

Microphones 274

A new 20-page catalog has been released describing the company's wide line of microphones and phonograph cartridges. The catalog lists prices, specifications and characteristics of each item marketed by the division. Highlighting the catalog is a section devoted to the new ceramic turnover and single needle phonograph cartridges recently added to the company's products.
Elgin National Watch Co., Elgin, Ill.

Microwave Ferrites 280

Data sheets have been published describing ferrite shapes for every known microwave application in custom designs. Ferrite rods, strips, bars, and toroids are examples of shapes supplied. These technical sheets describe microwave ferrites applicable to microwave isolators, attentuators, and phase-shifters.
Raytheon Mfg. Co., Ceramic Sales, Waltham 54, Mass.

Thermistors 281

A 12-page, 2-color catalog has been made available describing a complete line of thermistor elements. The catalog gives dimensional drawings, physical descriptions, and complete specifications of various forms of precision thermistors, including beads, rods, discs, washers, and built-up assemblies. In addition, the catalog contains much useful information on thermistors.
Fenwal Electronics, Inc., Mellon St., Framingham, Mass.

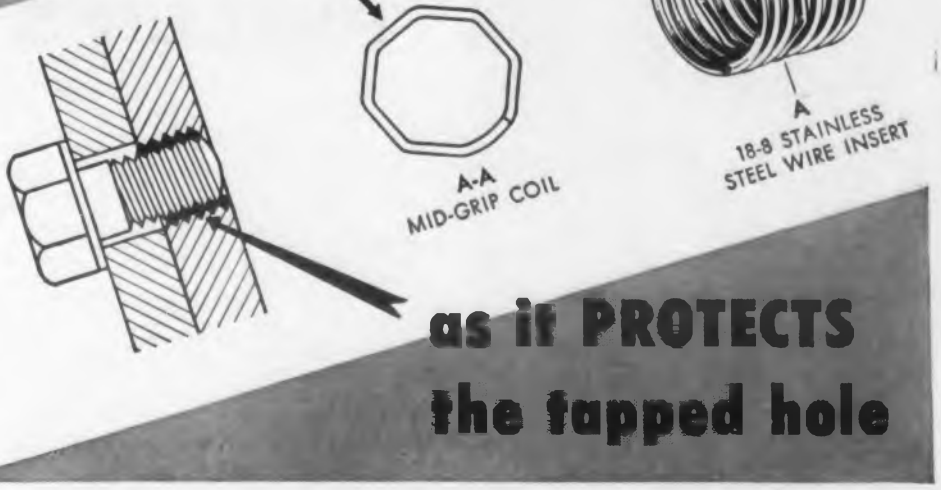
Magnetic Tape Recorders 282

A 4-page folder has been offered describing a series of variable and fixed-speed continuous loop magnetic tape recorders-reproducers incorporating an unusual tape drive. The brochure completely describes features of 21 models, which are available in single or dual speeds, as well as in single, dual and triple channels. Recording characteristics are tabulated for easy reference.
Amplifier Corp. of America, 398 Broadway, New York, N.Y.

Thermocouple Accessories 283

Bulletin No. 1610-A has been offered describing thermocouple accessories, including adapters, resistors, terminals, and firewall, bayonet and quick-disconnect connectors. The 4-page pamphlet includes illustrations, lists part numbers, and contains a cross-reference of products arranged by AN equivalents.
Revere Corp. of America, Wallingford, Conn.

New one-piece wire insert LOCKS the screw



as it PROTECTS the tapped hole

Withstands vibration, heat, corrosion — Meets AN-N-5b lock nut specifications

Here is a ONE-PIECE stainless steel thread insert that will *lock the screw against loosening* as it permanently protects the tapped hole. The secret is in the Mid-Grip coil. Shaped like a polygon, its chords exert a spring pressure on the screw thread and prevent rotation at less-than-rated torque. No loss of torque occurs at elevated temperatures or after repeated disassemblies.

NO EXTRAS—The *Heli-Coil** Screw-Lock (Mid-Grip) Insert employs no locking rings, pins, plugs, tabs or wiring. It can be installed from the front or top. Think of the money — and assembly time — you can save!

NO PROJECTIONS — Screw-Lock Inserts furnish AN-N-5b lock nut torque *right down inside the parent piece* . . . eliminate costly weight and space . . . improve design.

NO WEAR, NO CORROSION— Like regular *Heli-Coil* Inserts, new Screw-Lock Inserts are made from 18-8 stainless steel wire, and normally outlast the unit they protect. They permit smaller, fewer fastenings, and require minimum surrounding material. Screw-Lock Inserts are available in popular NC and NF sizes with choice of two lengths.

Mail coupon for complete data—or better still, see Yellow Pages of your phone directory — "Inserts — Screw Thread" for name of your local Heli-Coil Applications Engineer. Call him now!

Regular *Heli-Coil* Inserts (no locking action) put corrosion-proof, strip-proof stainless steel threads in soft materials . . . permit smaller, fewer fastenings, lighter weight, reduced cost.

HELI-COIL SCREW-LOCK INSERTS

Products of Heli-Coil Corporation, Danbury, Conn.

*Reg. U. S. Pat. Off.

HELI-COIL CORPORATION

248 Shelter Rock Lane, Danbury, Conn.

- ☐ Send complete design data on *Heli-Coil* Screw-Lock Inserts.
- ☐ Send design manual on standard *Heli-Coil* Screw Thread Inserts.
- ☐ Put me on a list to receive "*Heli-Coil*," case history periodical.

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____ 3534

IN CANADA: W. R. Watkins Co., Ltd., 41 Kipling Ave. S., Toronto 18, Ont.

CIRCLE 285 ON READER-SERVICE CARD FOR MORE INFORMATION

"....and pick up the man from PHILLIPS"

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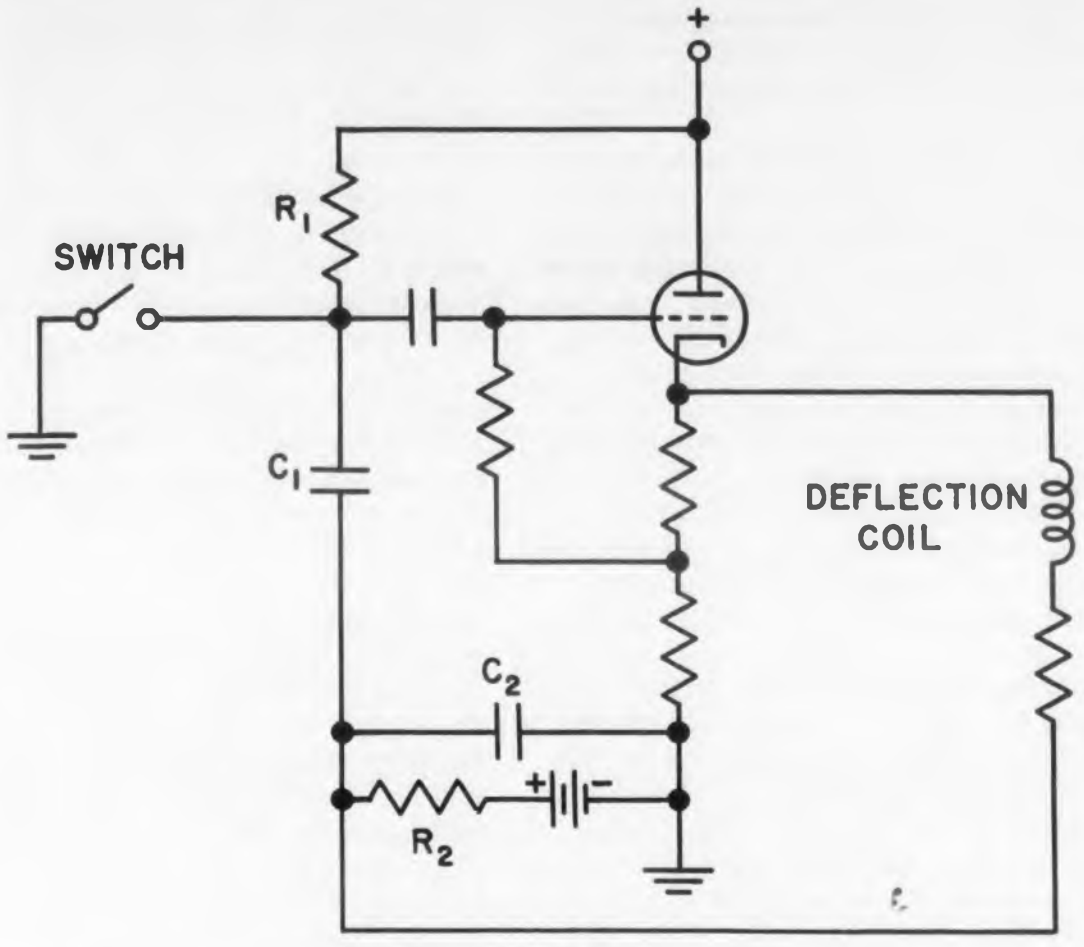
Patents

Cathode-Ray Tube Intensity Compensation . . . *Patent No. 2,739,264. Warren T. Shreve, Robert J. McCurdy. (Assigned to the United States of America as represented by the Secretary of the Navy.)*

A feedback amplifier circuit for maintaining a constant intensity image on a cathode-ray tube regardless of changes in deflection potential. The deflection voltage from the sweep generator is averaged and fed through an inverting amplifier to the control grid of the cathode ray tube. If the average sweep voltage should increase, the grid is biased more negatively, thus maintaining a constant intensity spot.

Electron Tube Amplifier Circuit . . . *Patent No. 2,735,957. Robert G. Neuhauser. (Assigned to Radio Corp. of America.)*

A feedback amplifier circuit for producing a linear sweep for a magnetic deflection cathode ray tube. A simplified schematic is shown in Figure 1 (the control tube has been replaced by a switch). When the switch is opened, the grid voltage of the sweep tube rises as capacitor C_1 is charged through resistor R_1. The feedback through capacitor C_2 and resistor R_2 is dependent upon the inductor current and tends to make the sweep current a linear function of time.



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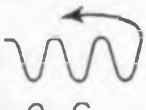
CIRCLE 293 ON READER-SERVICE CARD FOR MORE INFORMATION

Origin, Observation and Present-Day Control of "Boinng!"*

This phenomenon probably began long before recorded time and, at present, gives every indication that it is here to stay. First recognition is almost universally credited to the Cro-Magnon man who attempted to describe the combined sound and tingling sensation in his palms after he had laid asunder an enemy skull with his club. His chiseled inscription, handed down to us through the ages and still used today, tells us with eloquent simplicity what he heard and felt — "Boinng!"

Scholarly minds since then, at odd intervals, have added to the body of scientific knowledge concerning "Boinng!". A Mr. Newton, in fact, added a rather loud, squashy one just prior to the evolving of The L. of G. (An identical, and somewhat more familiar observation, was made by the operatic team of W. Tell & Son.) It is interesting to note that "Boinng!" has been nearly all things to all men; sometimes with overtones amorous; at others, with warnings of closeness-to-the-curberous. Without question, our children will enjoy a rich heritage of "Boinng!"someness.

And so, like the axe-wielder, like Sir Isaac, and like the fiend in olive drab, Sigma offers a small — but not unworthy — contribution to the cause of "Boinng!" vs. Relay Efficiency. We have watched it become a national worry, and have heard the voices crying out. Since our policy obviously could not be avoidal, we chose to make it sinusoidal, with 10 g's to 2,000 cycles our initial goal. The achievement is formally known as the Sigma Series 22 Relay, and basically offers the following: —



SERIES 22 ADJUSTMENTS

	G	HG	W
Vibration	10g to 300 cps 5g to 2,000 cps	15g to 500 cps	15g to 500 cps 10g to 2,000 cps
Contact Rating (28VDC. 115VAC resistive)	2 amp., 100,000 operations	1 amp., 100,000 operations (2 amp., 25,000 operations)	1 amp., 100,000 operations (2 amp., 25,000 operations)
Sensitivity			
SPDT ("C")	20 mw.	20 mw.	40 mw.
DPDT ("CC")	40 mw.	40 mw.	80 mw.

Those having applications in which "Boinng!" levels reach wrenching shudder proportions are welcome to printed data on the new 22's.

* Technical paper by Herr Doktor Ing. Helmut N. Greindloutten presented at the 1956 World Conference on the Forces of Ricoverbrigational Pingschafft in Hamburg.

22 KN

SIGMA

SIGMA INSTRUMENTS, INC.,
91 Pearl Street, So. Braintree, Boston 85, Massachusetts
CIRCLE 294 ON READER-SERVICE CARD FOR MORE INFORMATION

Musical Instrument Employing Tape Recording . . . *Patent No. 2,737,840. Joseph W. Gratian. (Assigned to General Dynamics Corp.)*

A magnetic tape system utilizing a number of parallel sound tracks, each track containing a recording of a single musical note. Under normal conditions the magnetic pickup heads are remote from the tape so that there is no pickup. Application of an input signal causes the appropriate pickup heads to move near the tape and produce an electrical output. The electrical signals are then amplified and used to produce an audible sound. By using different magnetic tapes it is possible to produce the sound of any desired musical instrument.

Transistor Amplifiers and Circuit Arrangements Therefor . . . *Patent No. 2,739,190. Robert L. Wallace, Jr. (Assigned to Bell Telephone Laboratories, Inc., New York, New York).*

A transistor amplifier circuit operating with zero bias. The input is applied directly to the base through a capacitor such that the input presents infinite impedance to direct currents.

Record Controlled Machine . . . *Patent No. 2,738,874. Lawrence A. Wilson, Benjamin M. Durfee. (Assigned to International Business Machines Corp., New York, N.Y.)*

A machine for sorting IBM cards, or other data storage records, acccording to the data stored on them. The machine analyzes the stored data on the card and sorts the card into a storage bin in accordance with prescribed instructions.

Pulse-Echo System for Providing Indications of Moving Objects in Response to the Reflection of a Single Transmitted Pulse . . . *Patent No. 2,739,307. David E. Sunstein. (Assigned to Philco Corp., Philadelphia, Pa.)*

A Doppler system for distinguishing between the echoes of fixed targets and moving targets. The received signal is heterodyned with a local oscillator and passed through a selective i-f amplifier. The i-f amplifier is supplied with a rejection filter which removes components of the received signal which are at the same frequency as the transmitted signal. Thus only frequencies which have been shifted by the Doppler effect of a moving object will produce an output.

Method and Apparatus for Duplicating Magnetic Recordings and Magnetic Tape Record Members . . . *Patent No. 2,738,383. Robert Herr and Reynolds Marchant. (Assigned to Minnesota Mining & Manufacturing Co.)*

A method of reproducing a magnetic recording from a master tape. A blank magnetic tape is placed in contact with the master tape and passed into a sufficiently strong external magnetic field. The magnetic pattern of the master is then transferred to the blank tape.

Cathode-Ray Tube for Color Television . . . *Patent No. 2,739,260. Ernest O. Lawrence. (Assigned to Chromatic Television Labs., Inc., New York, N.Y.)*

A cathode-ray tube for producing color television images. Two parallel conducting spirals are placed on the tube face with phosphors so adjusted that each of the three primary colors can be produced according to whether the electron stream strikes one of the two conducting strips or the tube face. By applying a defection potential to the two strips it is possible to control the place at which the electron beam strikes and hence control the color of the image formed.

Clipping Amplifiers . . . *Patent No. 2,739,-191. Thomas C. Wisenbaker, Martin R. Richmond, Benjamin R. Cole. (Assigned to Raytheon Manufacturing Co., Newton, Mass.)*

An amplifier circuit capable of increasing the degree of modulation of a carrier signal. The slightly modulated carrier is fed through a biased diode to a following stage of tuned amplification such that only the peaks of the carrier signal are amplified. The tuned circuit in the following stage of amplification filters out the unwanted frequencies with a net result that the sideband frequencies are amplified more than the carrier frequency and the percentage modulation is increased.

Electrical Elevation Angle Computer . . . *Patent No. 2,738,924. Frank S. Preston, Louis B. Wadel. (Assigned to Norden-Ketay Corp.)*

A device for computing an angle from its sine and cosine. The circuit utilizes a sine potentiometer, a cosine potentiometer and a linear resistor with a movable arm connected in a bridge circuit. When the bridge is balanced the position of the slider determines the tangent of the angle determined by the sine and cosine potentiometers.

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SPECIFICATIONS

- **Dynamic range: 40 lb**
- **Sweep rates: 30, 5, 1, and 0.1 cps**
- **Frequency range: 500 kc to 400 mc usable to 1000 mc**
- **Amplitude scale: linear or logarithmic**
- **Sweep width: 100 kc maximum, continuously reducible to 0 kc**
  Cathode ray tube flat face with edge lit screen and camera mount bezel

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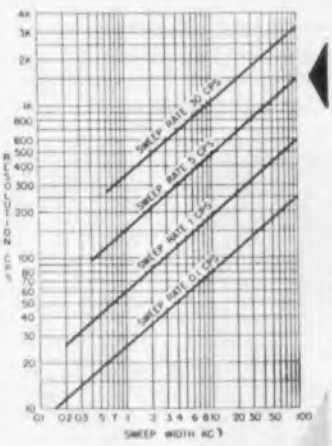
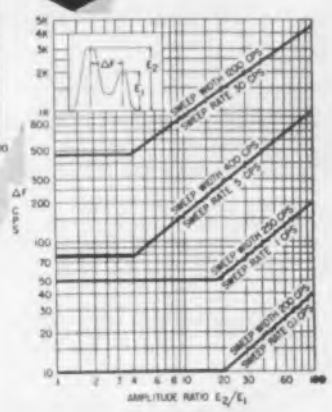


Resolution (in cps) vs sweep width (in kc)

Minimum frequency separation △F required to measure amplitude ratios E_2/E_1



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± .3% linearity
proved in use

ACEPOTS and ACETRIMS meet unusually rigid functional and physical requirements and are setting new standards for dependability in sub-miniaturization. The designs are the result of 4 years' development and over a year of *successful* use by leading electronic and aircraft equipment manufacturers.

Condensed Engineering Data

	ACEPOT (potentiometer)	ACETRIM (trimmer)
Resistance Range	200 ~ to 250K ± 2%	10 ~ to 150K ± 3%
Size	½ x ½"	½ x ½"
Linearity	±.3%	±3%
Resolution	extremely high	excellent
Ambient Temperature	—55° C to 150° C	—55° C to 125° C
Torque	low or high	low or high

The above specifications are standard — other values on special order.

All units sealed, moistureproofed, and anti-fungus treated. Meet applicable portions of JAN specs and MIL-E-5272A standards.

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Books

Principles and Techniques of Applied Mathematics . . . *Bernard Friedman. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y. 315 pages, price $8.00.*

One of the purposes of this book is to show that the seemingly widened gap between pure and applied mathematics is strictly an illusion. The book has two main themes. The first is the demonstration of how the abstract theory of linear operators can be used to unify and systematize the techniques of applied mathematics. The second is the development and explanation of specific techniques which can be used to obtain explicit solutions of partial differential equations. Previous works have been confined either to the abstract theory of operators or to the practical routines for solution. This book combines the abstract theory and its practical application.

Random Processes in Automatic Control . . . *J. Halcombe Laning, Jr., and Richard H. Battin. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N.Y. 434 pages, price $10.00.*

This book will provide the practical engineer and the theoretical research scientist with a basic background in the theory of

ndom signals and noise, together with practical techniques to be used in the analysis and synthesis of linear control systems which are subjected to random inputs.

The first half of this book treats the basic concepts of probability and random time functions. These fundamental ideas are then used to develop analysis and design techniques for linear control systems containing both constant and time-varying components. Special emphasis is given to the nonstationary problem and the use of modern automatic computing equipment to provide feasible solutions to such problems.

A wide variety of examples worked out in detail illustrate each new idea presented in the text. For most chapters, there are collections of problems of varying degrees of difficulty to test the reader's knowledge of the more important concepts developed.

Handbook of Industrial Engineering and Management . . . *W. Grant Ireson and Eugene L. Grant. Prentice-Hall Inc., 70 Fifth Ave., New York 11, N. Y. 1203 pages, price $16.00.*

This book is an integrated guide to the methods and procedures of today's scientific management. A reading of this text will help anyone to better understand those interrelationships of men, money, machines, materials and methods that are the concern of industrial engineers and management executives.

A guide is provided to both topics long established as important in the field, such as managerial economics, cost control, manpower, management, motion and time study, and production planning, and to topics that are drawing new attention in this area, such as industrial hygiene, statistical quality control, industrial statistics, and operations research.

Among the many notable sections is a discussion of the trade union outlook on industrial engineering, by William Gomberg, the well-known authority in this field. Also of unusual interest is treatment of industrial operations research, by A. W. Swan, who is associatetd with Courtaulds, Ltd., Coventry, Eng.

The techniques and procedures highlighted are those that can be applied in many situations. All the material has been chosen and presented so as to be of immediate practical value.

AMONG IMPORTANT ACTIVITIES AT HUGHES IS A PROGRAM INVOLVING COMPREHENSIVE TESTING AND EVALUATION IN CONNECTION WITH HUGHES-DEVELOPED RADAR FIRE CONTROL AND NAVIGATION SYSTEMS FOR LATEST TYPE MILITARY ALL-WEATHER INTERCEPTORS.

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What the Russians Are Writing

J. George Adashko

Avtomatika i Telemekhanika, 1956 No. 2

Filtering Non-Stationary Random Functions, Iu.P. Leonov, (10 pp; 3 figs). A mathematical treatise of second-order non-stationary functions, with the least-square error being replaced with another criterion, which permits extension of the problem to non-stationary random functions and leads to the design of an optimum filter (in a different sense of the word) having parameters that are stationary with time. Use of this new criterion for the optimum transfer function makes it possible to filter out noise with stationary linear fitter. In addition, the expression for the optimum transfer function can be determined without the need for calculating the correlation functions, which are replaced by suitable power spectra. This greatly simplifies the problem, for the determination of correlation functions for non-stationary cases is a labor-consuming task.

The new criterion reduces the determination of the optimum weighing function, needed to satisfy physical-realizability conditions, to the solution of the Wiener-Hopf equation. Reference is made to work by Wiener, Booton, and R. D. Davis.

Qualitative Regulation of a Neutral Object with an Astatic Regulator, V. A. Maslennikov, (10 pp; 7 figs). A "neutral object" is one that has neither natural damping nor self-equalization, and an "astatic" regulator is defined as one capable of maintaining a value of the regulated quantity for all operating conditions of a machine. The article concerns the analytic determination of the type of control required to regulate a neutral and undamped object in such a manner that the regulated system is stable as a whole, and the transient damps out on the first swing.

A theoretical proof is offered that a system can be generally stable even when the real parts of the roots of its piecewise-linear characteristic equation are not negative, being for example zero or even positive.

Use of Feedback to Improve the Dynamic Characteristics of Industrial Regulators, V. V. Karibskii, (12 pp; 12 figs). Discussion of a method for improving the dynamic characteristics of regulators used to control low-frequency thermal systems in chemical, petroleum, heat engineering and other branches of industry.

The theoretical analysis and the experimental results are devoted to the proof that is is possible to improve considerably the dynamic properties of industrial regulators by introducing velocity-lag feedback and to determination of the limitations imposed by stability considerations on the velocity lag feedback of the selected type.

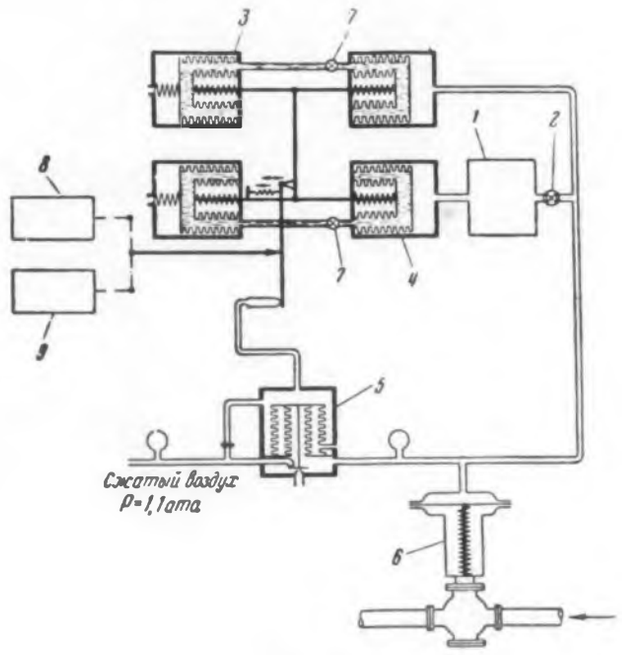


Fig. 1

Fig. 1—*1* Reservoir, *2* Throttle valve, *3* Ordinary feedback loop; *4* Velocity-lag feedback loop, *5* Secondary relay, *6* Membrane operating device, *7* Valve, *8* Sensitive element, *9* Setting device. The system employs compressed air at 1.1 atmospheres.

The theoretical deductions were verified experimentally. Fig. 2 shows the block diagram of the final version of a velocity lag regulator, and Fig. 1 shows the principal diagram of a pneumatic regulator embodying these principles.

Solid lines in graph show the theoretical values of the amplitude-frequency and phase-frequency characteristics of a regulator with velocity lag feedback; the dotted line shows the experimental results.

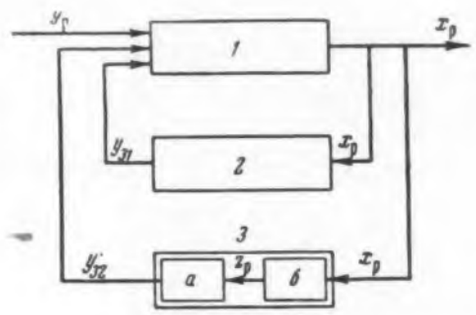


Fig. 2

Fig. 2—*1* Principal regulator element, *2* Conventional "rigid" feedback, *3* Velocity-lag "rigid" feedback; *a* Standard element of conventional feedback (amplifier), *b* Velocity lag feedback element.

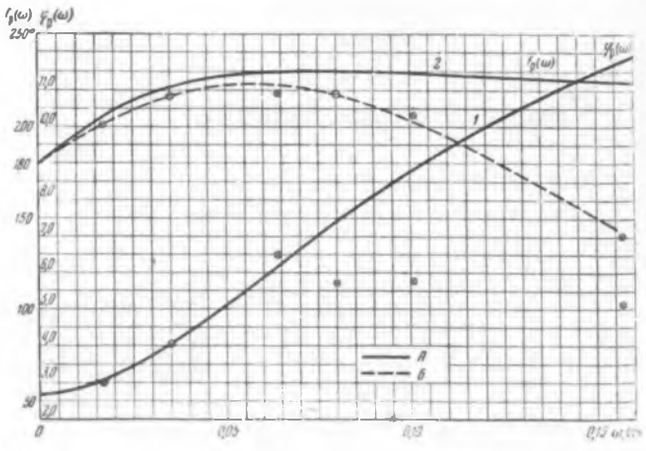


Fig. 3

Push-Pull Magnetic Amplifier with D-C Output, R. Kh. Bal'ian (12 pp; 11 figs, 3 tables). A new amplifier circuit is compared with the conventional type. Theoretical analysis of the two circuits yields the following figures:

Compared Indices	old	new
Power losses	$6P_H$	$0.5P_H$
Efficiency	14%	66.6%
Voltage drop as I_H changes from zero to its nominal value	70%	—
Amplifier power	$20.4P_H$	$5.9P_H$
Transformer power	$10.7P_H$	$3P_H$
Rectifier power	$25.6P_H$	$4.4P_H$

(Note—The subscript "H" denotes load parameters.)

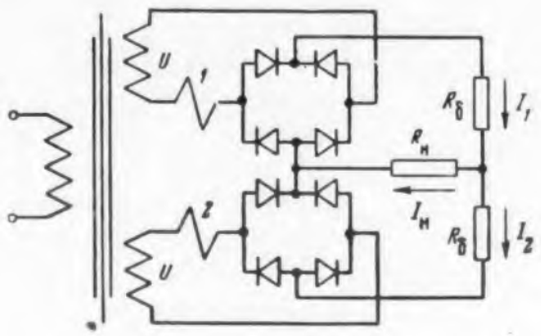


Fig. 1

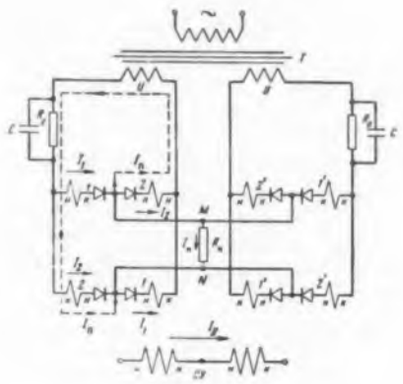


Fig. 2

Germanium Diodes, A. N. Puzhay, (7 pp; 10 figs; 2 tables). Survey of the properties, characteristics, and advantages of point contact and junction-type diodes used in the USSR. The tabulated and graphic data from this article will appear in a coming issue of ELECTRONIC DESIGN.

Design of Diode Function Generators, A. D. Talantsev, (11 pp; 10 figs, 1 table). Description of new diode circuits used as function generators in d-c analog computers. These are the same elements discussed in the description of the EMU Analog Computer (see ELECTRONIC DESIGN, July 1, 1956) and were briefly described in the review of that instrument. This article gives more details of diode circuits.

Comparison of Several Standard Magnetic Amplifiers with Internal Positive Feedback, A. B. Gorodetskii, (13 pp; 12 figs). The Ramey magnetic-amplifier circuit (Fig. 1) is compared with the standard positive-feedback amplifier (Fig. 2). A thorough theoretical analysis shows that in the standard amplifier the control-circuit inductance does not affect the value of the steady-state control current, but determines the time constant of the control circuit, while the opposite holds in the Ramey circuit—the time constant does not change, but the steady state control circuit varies. The two circuits become equivalent if a large resistance is inserted in the control circuit of the standard amplifier.

The article discusses two classes of a-c magnetic amplifiers: those in which the control frequency is several times smaller than the carrier frequency and those in which the two frequencies are equal. The latter class is divided into three groups, depending on whether the input signal is rectified (Fig. 3), applied directly (Fig. 4) or biased (Fig. 5). The author reaches the conclusion that the most sensitive amplifiers are those with a phase-sensitive rectifier in the control circuit, and least sensitive are those in which the control signal is applied directly to the control winding.

Amplifiers with high carrier frequency (Fig. 6) are particularly useful in servo applications, where they reduce substantially the zero-signal drift, for variations in circuit parameters do not shift the zero point of the amplifier.

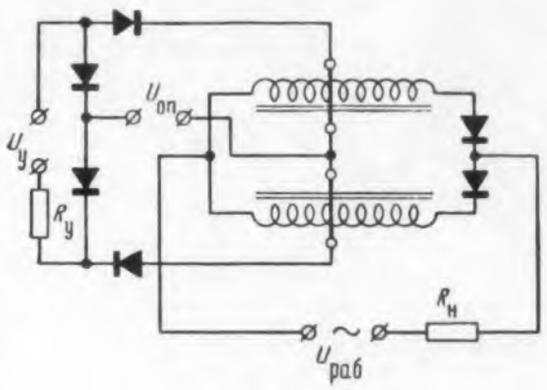


Fig. 1

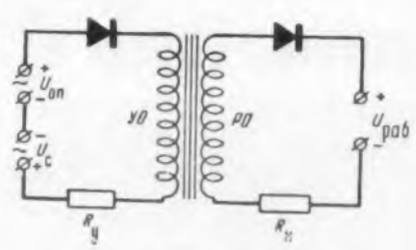


Fig. 2

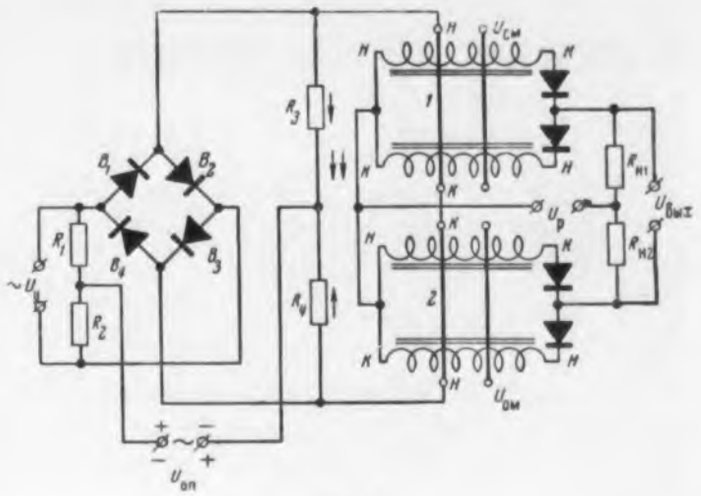


Fig. 3

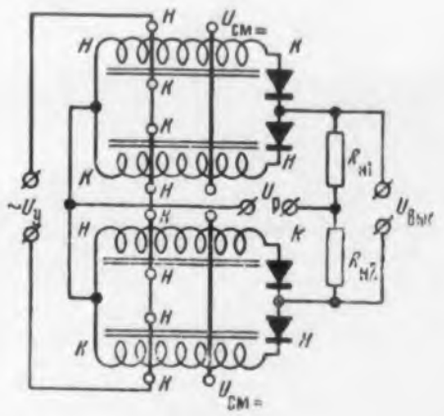


Fig. 4

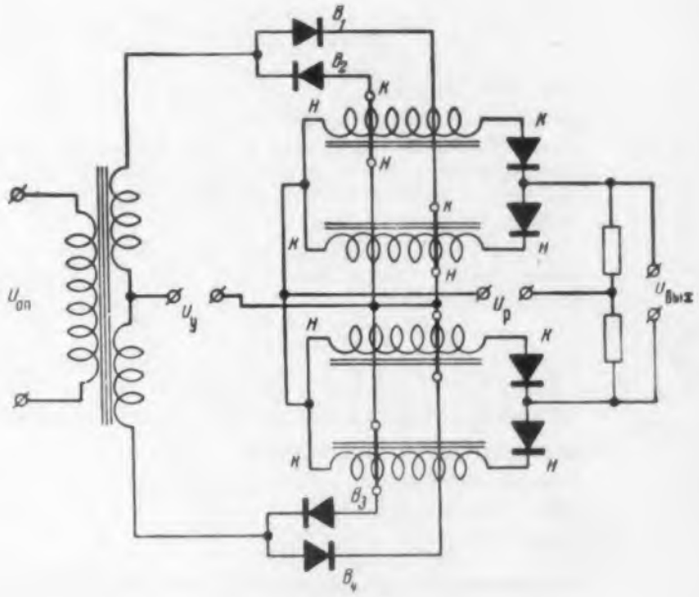


Fig. 5

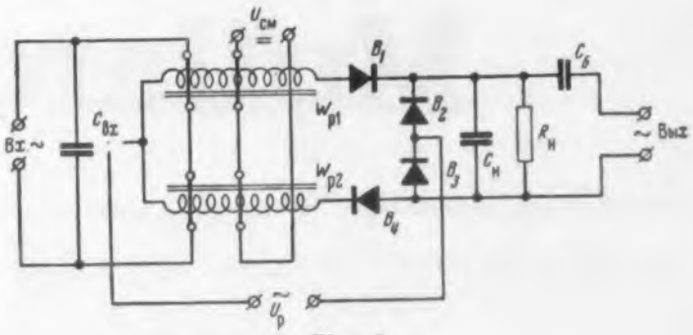


Fig. 6

Amplifier for Stroboscopic

A "STROBOSCOPIC" oscillograph is one in which high-speed recurrent voltages are observed or photographed by measuring instantaneously selected points of the pulse-modulated unknown voltage. The phase of the modulating pulse is varied continuously relative to the measured voltage, and the pulse frequency is either equal to the recurrence rate of the measured voltage or is an integral multiple of this rate. Each pulse produces a different point of the waveform, and persists for a considerable portion of the time between recurrences, slowly tracing out the entire waveform.

One of the first practical circuits for such a circuit is due to J. G. McQueen (*Electronic Engineering*, v. 24, p. 436, Oct. 1952) and is shown in Fig. 1. The two tubes are normally cut off by a negative bias applied to the control grids. Applying a narrow negative pulse (10^{-9} seconds) to the common cathode load causes the tubes to conduct. The measured voltage is applied to the input of the first tube, and the tube current depends therefore not only on the gating-pulse amplitude, but also on the practically instantaneous value of the measured voltage (if the frequency is on the order of 300mc or less). As a result, the pulses in the plate current of the first tube are modulated by the measured signal, while the plate pulses of the second tube are practically constant in amplitude. The difference between the amplitudes of the two pulses depends only on the instantaneous value of the measured signal. Such a difference pulse is produced during each recurrence, and by causing the selected point to occur at a slightly different instant during each recurrence it is possible to trace out relatively slowly the entire waveform.

The shortcoming of this scheme is that the difference pulse has too steep a front (Fig. 2a) to be applied directly to the oscilloscope plates, and a special low-pass filter must be used to trace the waveform. A specially designed amplifier, the equivalent diagram of which is shown in Fig. 3, converts the exponential difference pulse into a bell-shaped pulse which can be applied directly

Russian Translations

Oscillograph

to the oscilloscope plates. Figs. 2b, 2c, 2d, and 2e show the pulses produced when one, two, three, and four such amplifiers are used in tandem.

A mathematical analysis of the amplifier is included in the article. *Amplifier For Stroboscopic Oscillograph, V. A. Vol,* Radiotekhnika, *Oct. 1955, 5 pages, 4 ill., 2 tables.*

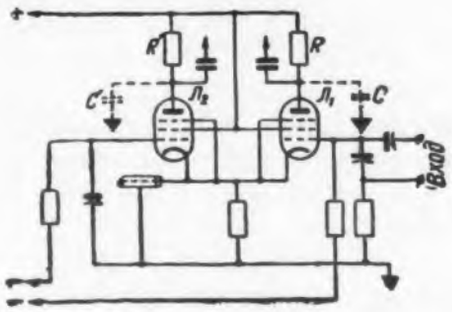


Рис. 1

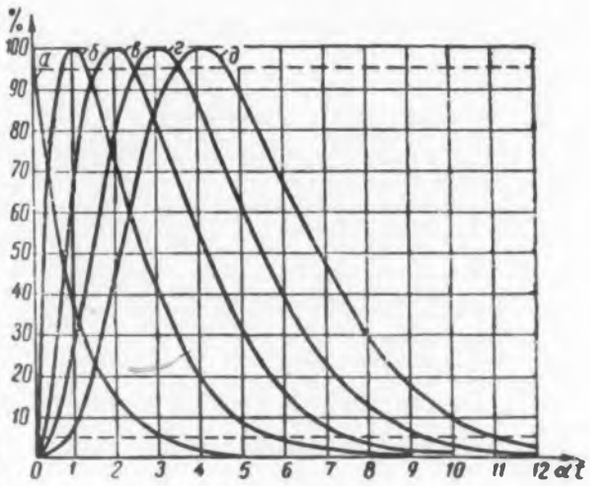


Рис. 2

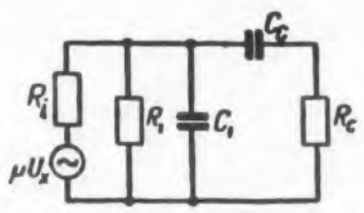


Рис. 3

Capacitors

Abstract

AN important element in the design and maintenance of electronic equipment is the correct selection of the type of capacitor to be used for a specific purpose. This requires careful consideration of the requirements to be met, and the economy and quality of operation which can be obtained. Only by understanding the capabilities and limitations of the many types of capacitors presently available can the requirements of the equipment be completely fulfilled.

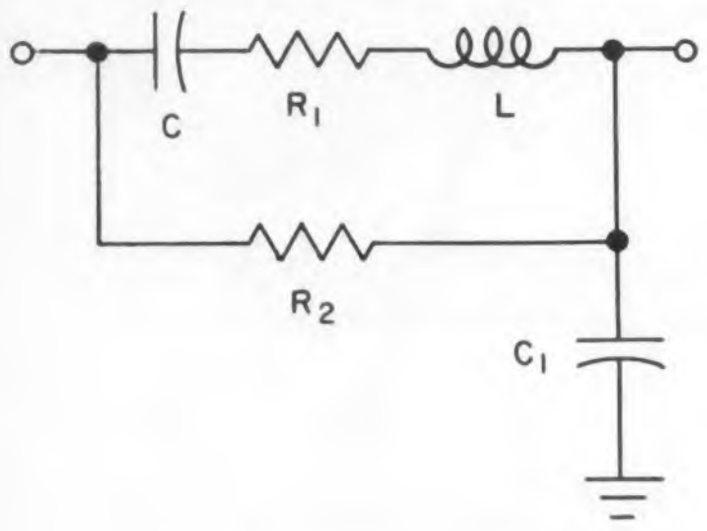
Electrical Properties

Although the most important property of a capacitor is its capacitance, several other properties are also significant. Fig. 1 shows the complete equivalent circuit of a capacitor, which includes the normal capacitance, leakage resistance, inductance, capacitance to ground, and series resistance.

The leakage resistance, R_2, represents a shunting current path through the capacitor dielectric and across the insulation between the capacitor terminals. This resistance permits a very small, usually undesired, direct current to flow through a capacitor. The magnitude of this current depends upon the type and condition of the dielectric and the method of capacitor manufacture. When necessary, a leakage resistance of millions of megohms can be achieved by using a very high grade of dielectric and hermetically sealing the capacitor in metal or glass.

Since inductive reactance increases with frequency, at higher frequencies the inductance of a capacitor is electrically important. At some frequency, the inductance of a capacitor will be resonant with the capacitance, and the capacitor itself will appear as a resonant circuit.

In some cases, the stray capacitance between conductors of a capacitor and other nearby conductors may be important. This is especially true in the higher frequency ranges or in high impedance circuits. The magnitude of the effect can be minimized by using capacitors which are physically small, by allowing a large air space between the capacitor and ground, and by connecting the outside conductor of the capacitor to a low impedance circuit whenever possible. The series resistance has very little effect on the characteristics of a capacitor and can be neglected except at very high frequencies. This resistance represents the inherent resistance of the dielectric, terminals, leads, and conductors composing the capacitor.



The equivalent circuit of a capacitor

Capacitor Types

The stability of a capacitor, as well as most of its other electrical properties and operating characteristics, depends upon the kind of dielectric used and the type of construction.

The dielectrics commonly in use today are air, mica, plastics, ceramics, paper, and chemical films. The first

Characteristics and Applications of Various Capacitor Types

TYPE OF CAPACITOR	CHARACTERISTICS	PRINCIPAL APPLICATIONS
Air	Lowest possible a-c loss Continuously variable High stability Precisely adjustable Low values of capacitance	Tuning of resonant circuits Padding of larger capacitors
Mica	Low a-c loss (high Q) Good temperature stability Little change in capacitance with age High insulating strength Low values of capacitance	Resonant circuits Coupling and bypassing at high frequencies High voltage circuits Padding of larger capacitors As standard capacitors
Polystyrene	Low a-c loss (high Q) Very high insulation resistance Larger values of capacitance than readily available with mica Stable with temperature and aging	In resonant circuits Coupling and bypassing at medium to high frequencies As standard capacitors In high-quality circuits
Ceramic	Positive or negative temperature coefficient Low values of capacitance Stable with aging Available in many sizes and shapes Low losses	Compensating for temperature variations in resonant circuits Coupling and bypassing at high frequencies
Paper	Available in larger values of capacitance Can be built for high voltage operation Large losses at high frequencies Medium stability	Coupling and bypassing at low frequencies Power factor correction Contact protection
Electrolytic	Large capacitance in small sizes Low cost per microfarad Poor stability Operation in d-c circuits only Deteriorates during shelf life or at high temperatures	Power supply filtering Cathode and screen bypassing
Mylar	Better than paper at high temperatures Smaller, more stable and easier to manufacture than paper	Bypassing primarily

four dielectrics in this group are generally used in capacitors for resonant circuits, while the last two types have primary application in capacitors for a-c coupling circuits.

Air Capacitors

For resonant circuits, a capacitor is required which is stable, has low losses and high insulating strength, and can provide the required capacitance in a reasonable size. Low losses at the frequency of operation are especially important because the dissipation of power in a capacitor reduces the Q of the resonant circuit. Capacitors with the lowest possible high frequency loss utilize air as the dielectric.

Variable air capacitors are commonly used in resonant circuits to facilitate changing the frequency or resonance (tuning), or in parallel with larger capacitors to adjust the total capacitance to the desired value.

Because of the necessary mechanical arrangements and the low dielectric constant of air, a variable capacitor has a greater size per microfarad than other types. However, when carefully manufactured, it provides a precise capacitance with good stability and very high Q.

Mica Capacitors

Featuring excellent stability, very low losses, and high insulating strength, mica capacitors find their greatest application where a high degree of stability is required. This is because they are only slightly affected by temperature, moisture, frequency, and aging. They are also valuable for high-frequency applications because of their very low losses, and consequently high Q. Since the smaller sizes of mica capacitors are relatively inexpensive, they are often used in applications where other types of capacitors would be equally satisfactory from the electrical standpoint.

Polystyrene Capacitors

In recent years, shortages of mica and the need for extremely small size capacitors have led to a search for suitable dielectric materials from the many types of plastic films that have been developed. One of the more successful plastic films has been polystyrene.

In some respects, polystyrene has characteristics superior to mica. It has less leakage resistance, a higher Q over a wider frequency range, and greater flexibility. It also has a negative coefficient of capacitance. This is very useful in filters and other resonant circuits as it tends to keep the resonant frequency of a coil-capacitor combination constant despite temperature variations. In the values needed for electric wave filters (about 5000 to 75,000 μμf), polystyrene capacitors are smaller and less expensive to manufacture than mica.

Tolerances of 1 to 2 per cent are quite readily obtained. By padding (connecting in parallel) with small mica capacitors, tolerances within 1/4 of 1 per cent can be achieved.

Ceramic Capacitors

Modern ceramic capacitors use a wide range of insulating materials that often have unique characteristics. They are made in a wide range of temperature coefficients, either positive or negative, and some have very high dielectric constants.

Because they can be made with different temperature coefficients, ceramic capacitors are often used in tuned circuits to compensate for variations of resonant frequency with temperature. They are also used for coupling and bypassing at high frequencies because they can be manufactured in convenient shapes. (Shape is important at high frequencies.) The high dielectric constant results in a relatively large capacitance in a small space.

Chemical Film Capacitors

Since chemical film or electrolytic capacitors have high losses, a relatively large leakage resistance, and very poor accuracy and stability they are applicable only in noncritical circuits which need large values of capacitance in a form that is inexpensive and occupies little space. Their typical applications are in power supply filters and for cathode and screen bypass in vacuum tube circuits.

Capacitors for A-C Coupling

For coupling in high-frequency circuits, small capacitances are satisfactory; consequently, capacitors suitable for resonant circuits, such as micas or ceramics, can be used. However, in low-frequency or low-impedance circuits, relatively large capacitances are necessary so that the impedance of the capacitor is low with respect to the rest of the circuit at the operating frequency. Three types of capacitors usually meet these requirements: paper (dry or oil impregnated), polyester film, and chemical film.

Paper capacitors are most widely used. They provide large capacitances in a reasonable size at a relatively high voltage rating. Their losses are relatively high so they cannot be used in such applications as precision electric wave filters at high frequencies. Also the capacitance varies widely with changes in temperature, frequency, and age so that they cannot be used in many critical circuits. Main applications are in low-frequency circuits for coupling and bypassing, in power filter networks, in power factor correction networks, and for contact protection in relays.

In miniaturized equipment, paper capacitors are often so bulky that ceramic or polyester film capacitors are used. For instance, capacitors made with a Mylar dielectric have characteristics similar to those of paper capacitors except that they are usually smaller, operate at higher temperatures, are easier to manufacture, and have fairly good stability. They range in capacitance from 0.001 to 1.0 μf.

Abstracted from The Lenkurt Demodulator, *Vol. 5, No. 6, June, 1956, Lenkurt Electric Co., San Carlos, Calif.*

Tube Reliability

MAXIMUM tube ratings are given by manufacturers to define the physical capabilities of a tube. A single numerical value is presented for each rated quantity. The physical limitations of the tube which these ratings represent, however, are not discontinuous barriers below which satisfactory operation can continue indefinitely and beyond which immediate tube failure occurs. In general, as a rating is approached, the life expectancy decreases in a regular manner; and as the rating is exceeded, the degradation of performance continues, often at an accelerated rate.

Unfortunately, the single-valued ratings present no information with regard to any of the following questions:

1. What increase in reliability can be gained by operation at a given percentage below a maximum value?
2. What sacrifice in reliability will be required by operation at a given percentage above a maximum value?

3. What is the relative importance of the various ratings with respect to one another?

Although the equipment designer needs information which will enable him to extrapolate the published ratings as a function of the reliability requirements of his equipment, the tube manufacturer is not normally in a position to supply this information. The equipment designer also requires a basic understanding of the magnitude and nature of the effects that such operational and environmental factors have on the reliability of the final equipment.

Launched by the Electron Devices Division, Signal Corps Engineering Laboratories, in 1952, a reliability analysis program was executed by the General Electric Company at Owensboro, Kentucky and has been continuing since that time.

Recommendations given here are due primarily to tests on one tube, the G.E. type *5670*. The six variables studied were: 1. plate voltage, plate current, and plate dissipation; 2. ambient temperature; 3. mechanical excitation; 4. pulse operation; 5. heater cycling; and 6. heater voltage.

General Recommendations

As a result of tests to date, the following general recommendations with respect to the use of the *5670* are:

1. The absolute maximum plate-dissipation rating should never be exceeded.
2. The absolute maximum plate-voltage rating should never be exceeded.
3. The absolute maximum bulb-temperature rating should never be exceeded. In applications where extremely long life is of paramount importance, the tubes should operate at bulb temperature about 1/3 under maximum rating.
4. Conditions under which the tubes are subjected to mechanical accelerations should be avoided or minimized wherever possible.
5. For pulse operation, the plate dissipation should be held to a minimum. In the design of the equipment, allowance should be made for early-life instability under pulse conditions. A relatively constant degradation of pulse-current capability with life should also be expected.
6. High-heater-voltage operation should be avoided under any circumstances. The heater should normally operate at a center of 6.3v; however, it may also be operated at a center value slightly less than 6.3v provided that no tube ever goes below 5.7v as the result of heater-supply-voltage variations, and that the circuit can tolerate the decreased circuit performance. In all cases good regulation of the heater voltage should be supplied.

Abstracted from "Tube Reliability Studies—the 5670", *Tube Department, General Electric Co., Schenectady 5, N. Y. (Bulletin ET-B37).*

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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.

Audio Systems

56IRE3.S1, Audio Systems and Components: Methods of Measurement of Gain, Amplification, Loss, Attenuation, and Amplitude-Frequency-Response, 1956 . . . Methods for making measurements on systems and components primarily intended for application or operation at audio frequencies are covered in this standard. The standard does not cover performance standardization. A brief discusison of the principles involved is included with each type of measurement. A selected list of 24 references on this subject is also included in the standard. Copies of this standard are available from IRE for 80 cents per copy.

Facsimile

56IRE 9.S1, Definitions of Facsimile Terms, 1956 . . . The terms relating to the process by which fixed graphic material is scanned and the information converted into signal waves which are used to produce a copy either locally or remotely are defined in this newly released standard. Copies of this standard are available from the Institute of Radio Engineers, 1 E. 79th St., New York, N.Y., at $0.60 per copy.

Printed Wiring

MIL-STD-275 (Ships), Printed Wiring for Electronic Equipment, 23 February 1956 . . . Principles governing the fabrication of formed-in-place electronic equipment wiring referred to as printed, prefabricated, or processed are established by this standard. The requirements of the standard do not apply to the fabrication of parts, such as, resistors, capacitors, inductors, or transmission lines, using the printed wiring techniques. An appendix is included which covers the requirements for printed conductor temperature tests and for tensile bond tests.

Manuals

MIL-M-16616 (Ships), Manual, Technical, Electronic Equipment, 4 February 1956 . . . Superseding 16B16(RE), dated 1 July 1946, this spec covers the minimum requirements for preparing technical manuals and revisions for ship and shore based electronic equipment. In addition, it covers the requirements for the preparation of reproducible copy, negatives of reproducible copy, paper offset masters, as well as the

mechanical requirements for typography and reproduction. The various types, classes, and grades of technical manuals are defined.

Resistors

MIL-R-14205 (SIG C), RESISTORS, FIXED, NON-WIREWOUND (HIGH TEMPERATURE, POWER TYPE), 7 DECEMBER 1955 . . . Non-wirewound fixed resistors, capable of withstanding high relative humidity, continuous operation at rated voltage, and high hot-spot temperatures (350°C), are covered in this spec. These resistors have a resistance tolerance of ±5%, and a resistance range of 10 ohms to .422 megohms. The resistors covered by this spec are capable of nominal full-load operation at any ambient temperature up to and including 25°C. A typical type designation for a resistor covered by this spec is RD29T10ROJ.

Ultrasonics

The Ultrasonic Manufacturers Association has formed an engineering standards committee. Composed of members from 17 leading ultrasonic manufacturers in the United States, this committee intends to establish a uniform and coherent system of engineering, terminology, and systems of units so as to unify engineering and manufacturing practices in the ultrasonic industry. Further information concerning this committee can be obtaind from the Ultrasonic Manufacturers Association, P.O. Box 555, West Chester, Pa.

ASA Standards

ASA has recently announced the release of the following two new standards:
Z24.17-1955, Specification for the Design, Construction and Operation of Class HI (High-Impact) Shock-Testing Machine for Lightweight Equipment.
Z24.18-1956, Specification for Ultrasonic Therapeutic Equipment.

ASTM Standards

Included in the reports presented at the Fifty-ninth annual meeting of the American Society for Testing Materials in Atlantic City, N.J. June 17 through 22, were the reports of the committees on Acoustical Materials and Wires for Electrical Conductors. The committee on Acoustical Materials recommended the acceptance of a Method of Test for Impedance and Absorption of Acoustical Materials by the Tube Method. The committee on Electrical Conductors recommended that six specs be revised.

Specifications listed on these 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.

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