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AUGUST 1, 1956



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Because of their excellent mechanical and dielectric properties, Epon resins are important materials in electrical and electronic manufacture. Epon resins combine high strength with low shrinkage on curing and extreme dimensional stability.

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Section of magnetic amplifier coils embedded in Epon resin by Westinghouse Electric Corporation, Pittsburgh, Pennsylvania.



Potting transformer with Epon resin at PCA Electronics, Inc., Santa Monica, California.

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 T. Richard Gascoigne

Advertising Representatives

New York: Owen A. Kean
 Lawrence Conover
 Bryce Gray, Jr.
 James P. Quinn
 Robert W. Gascoigne
 19 East 62nd St.
 New York 21, N. Y.
 TEmpleton 8-1940

Chicago: Thomas P. Kavooras
 Berry Conner, Jr.
 644 No. Michigan Ave.
 Chicago 11, Ill.
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Los Angeles: Robert E. Ahrendorf
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CIRCLE 1 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN

Vol. 4, No. 15

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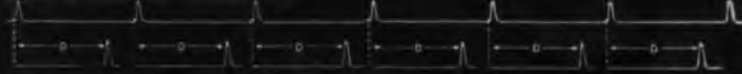


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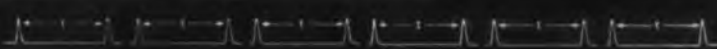
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115 Cutter Mill Road, Great Neck, N. Y.

CIRCLE 2 ON READER-SERVICE CARD FOR MORE INFORMATION

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CK1020 Thin wall beta, gamma counter, 900 volt
CK1021 Thin wall beta, gamma counter, 900 volt
CK1026 Halogen quenched, gamma counter, 900 volt
CK1049 Halogen quenched beta, gamma counter, 900 volt

Other counter types can be made to your order.

VOLTAGE REGULATOR TUBES

OA2	150 volts, 5-30 ma.
OB2-OB2WA	108 volts, 5-30 ma.
CK5787WA	98 volts, 1-25 ma.
CK5787WB	98 volts, 1-25 ma.
CK6542	150 volts, 5-25 ma.

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PERFORMANCE TESTED and backed by over THIRTY YEARS OF EXPERIENCE in the manufacture of gas tubes

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CK1042 2800 volt inverse, 8 ma. dc.
CK5517 2800 volt inverse, 12 ma. dc.
CK6174 2800 volt inverse, 3 ma. dc.

VOLTAGE REFERENCE TUBES

CK5651-CK5651WA	85 volts, 1.5-3.5 ma.
CK5783WA	85 volts, 1.5-3.5 ma.
CK5783WB	85 volts, 1.5-3.5 ma.
CK6213	130 volts, 1-2.5 ma.

CORONA VOLTAGE REGULATOR TUBES

CK5962	700 volts, 2-55 μ a
CK6437 (CK1037)	700 volts, 5-100 μ a
CK1038	900 volts, 5-100 μ a
CK8198 (CK1039)	1200 volts, 5-100 μ a

500 to 3000 volt ratings available on special order.



These tubes are but a few of the many types available. All are stable, rugged, reliable — worthy of your complete confidence.

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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, it's 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.

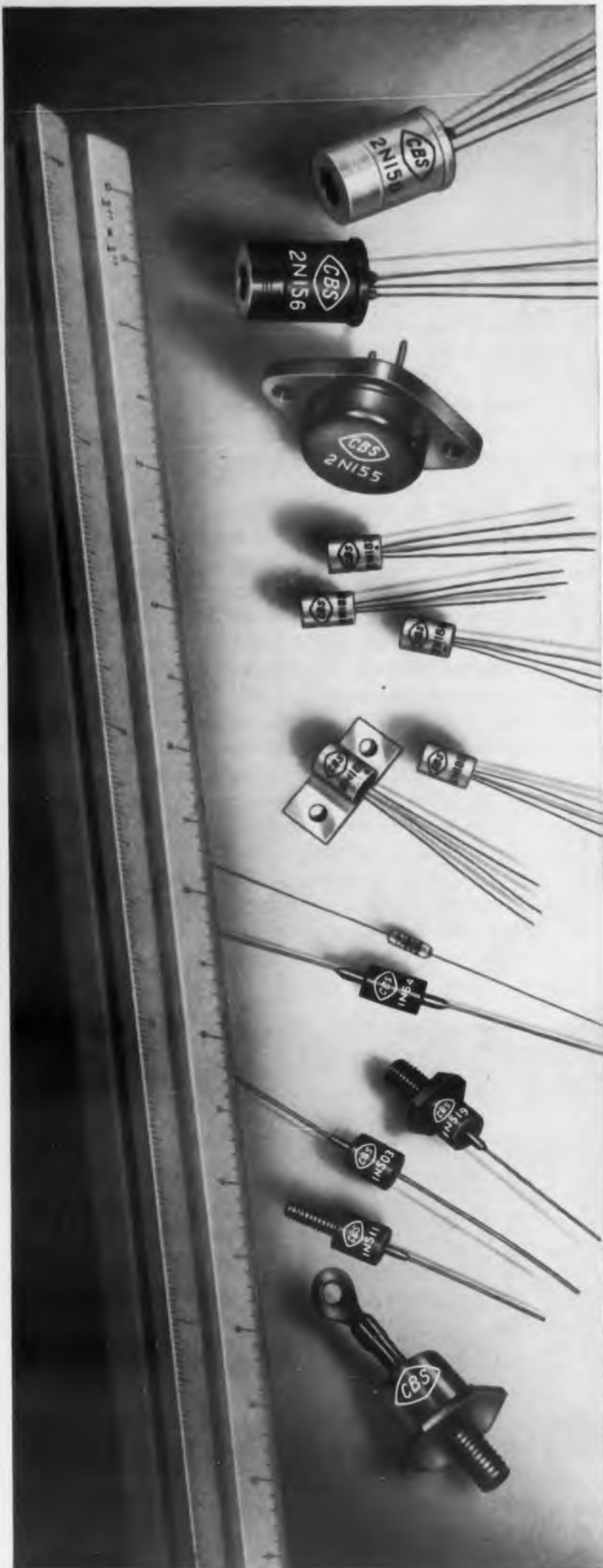
The specialized communications facilities are used to feed financial and production information to the data processing center. At the center, the giant "Univac" computer and subsidiary electronic equipment quickly converts the information into summarized data on which can be based decisions at the corporate, 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 Univacs "write" this new information back on to the magnetic tape and carry it along to the printer.



growing line of CBS semiconductors features uniformity and reliability

Users rate the rapidly expanding line of CBS semiconductors as "exceptionally uniform and reliable." They have also discovered that CBS' mass production insures dependable delivery and competitive prices. You, too, will prefer advance-engineered CBS semiconductors. Write for data and quotation on the types you need.

Power Transistors Popular auto-radio type 2N155. General-purpose 2N156 (12-volt) and 2N158 (28-volt). And new higher-power and higher-voltage versions for larger audio output systems and power supplies.

High-Frequency Transistors Uniform and reliable performance up to 20 mc. CBS 2N182, 2N183, 2N184 are NPN symmetrical, permitting unusual applications.

General-Purpose Transistors CBS 2N180 and 2N181 are noted for outstanding dependability. Integral C-clamp mounting of 2N181 permits dissipation up to 250 mw.

Diodes A complete line from one source: Glass . . . plastic . . . point-contact . . . bonded-junction . . . entertainment . . . general-purpose . . . and computer.

Silicon Power Rectifiers Series 1N503-1N508 rated at 1/2 amp . . . 1N511-1N516 at 1 amp . . . 1N519-1N524 at 1 1/4 amp. Also a new much higher-current series for heavy-duty power supplies.

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CBS-HYTRON

Semiconductor Products, Lowell, Mass.
A DIVISION OF COLUMBIA BROADCASTING SYSTEM, INC.

CIRCLE 4 ON READER-SERVICE CARD FOR MORE INFORMATION

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

Officials at Burroughs Corp., Electronic Div., disclosed that music-by-the-numbers has been carried 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, hostile 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.



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standard
PERKIN
model for
your every
need!

In addition to the 28 volt models featured at the top, the following units are also available:

OTHER 28 VOLT MODELS

Model	Volt	Amps	Reg.	AC Input	Weight
MR532-15A	28	15	±1%	105-125 V	12 lbs
M60V	28	25	±1%	115 V	12 lbs
MR1040-30A	28	30	±1%	100-130 V	12 lbs
28-30 WXM	28	30	±1%	100-125 V	12 lbs
MR2432-100XA	28	100	±1%	208-230-460 V	12 lbs

6, 12, 115 VOLT (NOMINAL) MODELS

Model	Volt	Amps	Reg.	AC Input	Weight
MR532-15A	6	15	±1%	105-125 V	12 lbs
M60V	12	25	±1%	115 V	12 lbs
MR1040-30A	115	30	±1%	100-130 V	12 lbs
28-30 WXM	115	30	±1%	100-125 V	12 lbs
MR2432-100XA	115	100	±1%	208-230-460 V	12 lbs

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Pittsburgh WA 1-2959	

PERKIN...THE LEADER

DC POWER SUPPLIES



Model MR532-15A

2-36 VOLTS @ 15 AMPS SPECIFICATIONS

Regulation: 5-32 Volt Range: ±½%
2-5 Volt and 32-36 Volt Range: ±2%

AC Input: 105-125 Volts, (for 2-32 V.DC), 110-125 V, (for 32-36 V.DC), 1 phase, 60 cps (8 amps)

Ripple: 1% rms max. (@ 36 volts and full load, increases to 2% @ 2 volts and full load).

Remote Sensing • Vernier Control



Model M60V

0-32 VOLTS @ 25 AMPS SPECIFICATIONS

Regulation: ±1% @ 28 Volts (Regulation increases to 2% over range of 24-32 volts; does not exceed 2 volts over 4-24 volt range. Not stabilized for AC line changes.)

AC Input: 115 Volts, 1 phase, 60 cps (12 amps).

Ripple: 1% rms (@ 32 volts and full load—2% rms max. @ any voltage above 4 volts).



Model MR1040-30A

5-40 VOLTS @ 30 AMPS SPECIFICATIONS

Regulation: ±1% (over entire 5-40 volt range)

AC Input: 100-130 Volts, 1 phase, 60 cps

Ripple: 1% rms



Model 28-30 WXM

24-32 VOLTS @ 30 AMPS SPECIFICATIONS

Regulation: ±½%

AC Input: 100-125 Volts, 1 phase, 60 cps (20 amps). (Unit rated for DC output of 28 volts ±10% for 95-130 volt input.)

Ripple: 1% rms



Model MR2432-100XA

24-32 VOLTS @ 100 AMPS SPECIFICATIONS

Regulation: ±½%

AC Input: 208, 230 or 460 Volts, ±10%, 3 phase, 60 cps (14, 12 and 6 amps respectively). 230 volt input will be supplied unless otherwise specified.

Ripple: 1% rms

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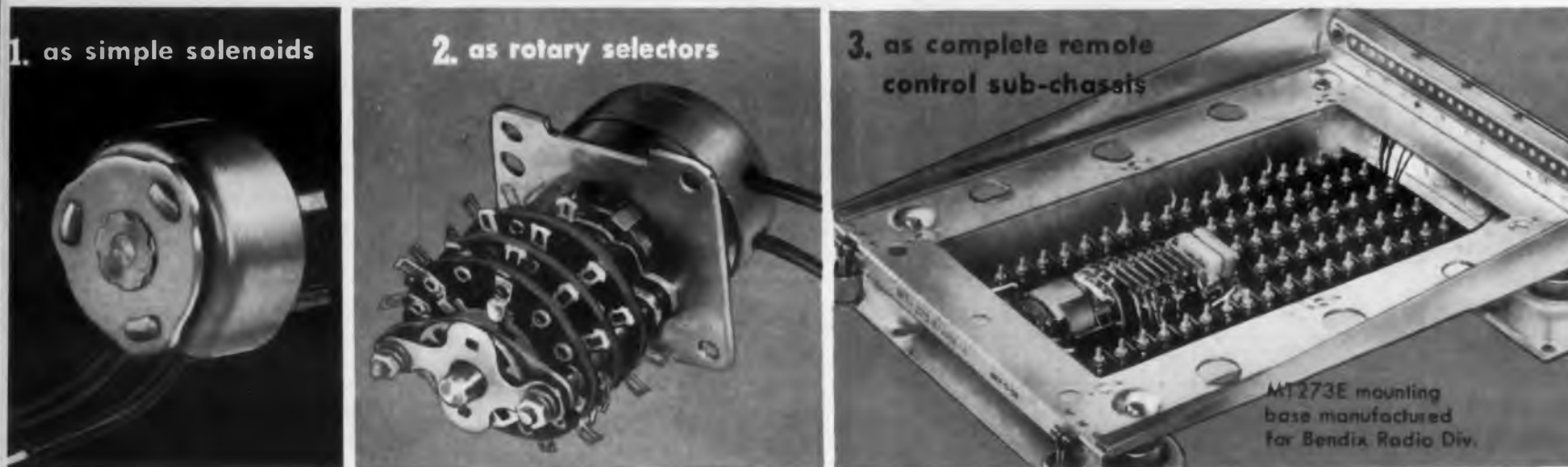
LEADER IN TUBELESS MAGNETIC AMPLIFIER REGULATION

PERKIN ENGINEERING CORPORATION

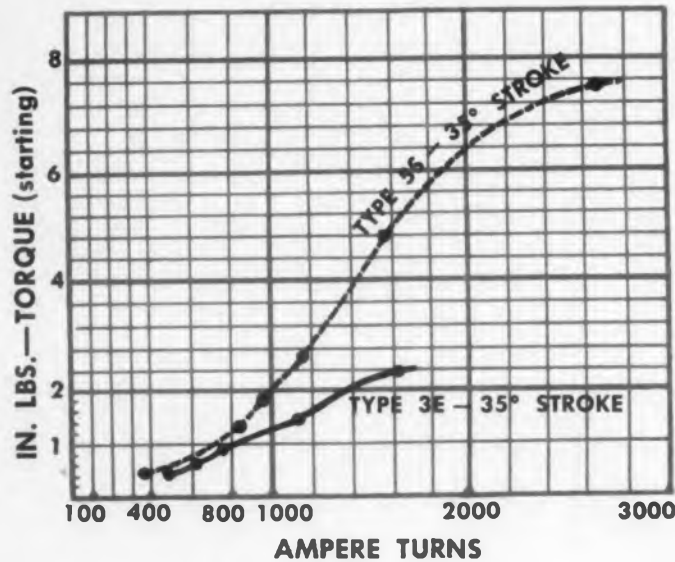
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vibrators, tuners, choppers and rotary solenoids.

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.

◀ CIRCLE 6 ON READER-SERVICE CARD

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.

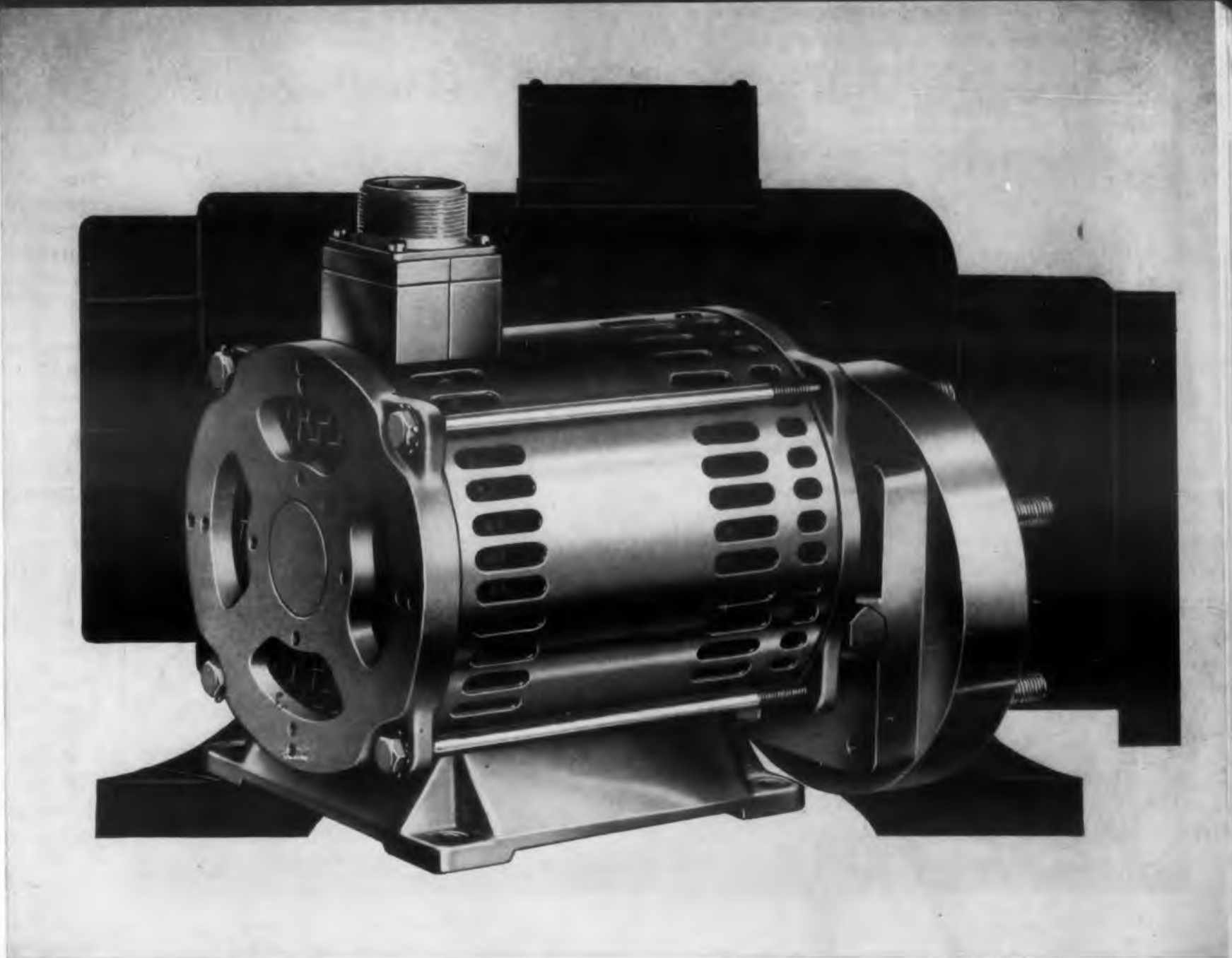
Plastics To Aid Conquest Of Space . . .

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.



CUSTOM DESIGN OF G-E AIRCRAFT MOTOR CUTS MOTOR WEIGHT 45% AT 22% LESS COST

Ordinarily, custom design is costly. Sometimes it isn't even necessary. But here is one example of how G-E custom aircraft motor design not only improved motor suitability but also substantially reduced cost to customer.

Two motors were submitted for a customer's application. Both motors performed satisfactorily. But the G-E motor weighed 45% less and cost 22% less than the other motor shown by the silhouette! The reason: as with most G-E aircraft motors, the motor above was specially designed—for this one application.

This is another example of the design service offered by

G-E aircraft motor engineers—specialists in designing motors to meet rigid size and operating requirements in aircraft and missile applications.

Expert application assistance in aircraft motors is backed up by advanced design features, outstanding testing laboratories, and modern manufacturing facilities—all adding up to on-time delivery of the right G-E aircraft motor for your application.

Contact your local G-E Apparatus Sales Office for prompt attention. Section 634-4, General Electric Co., Schenectady 5, New York.

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Korea Doubles Telephone Capacity . . . The ca-
 pacity 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 in-
 cluded to take care of the constantly increasing
 long-distance communications requirements. The
 equipment was manufactured by Federal Tele-
 phone 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 in-
 advertently 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 (cen-
 ter 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
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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 per-
 manent magnets having novel shapes and uses.
 Thin wafers are one suggested form.



Highly purified manganese-bismuth catches fire spon-
 taneously 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."

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Aerodynamic, Dynamic, Hydrodynamic, Nuclear, Propulsion Engineers and Aircraft Designers will enjoy tremendous growth potential at all experience levels through participation in the design and development of NUCLEAR POWERED AIRCRAFT.

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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.

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CAPACITORS



William H. Roberts, Supervisor of Tantalum Capacitor Engineering, and active member of the I.R.E., holds actual size Tantalum 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.

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Tantalytic* capacitors outperform ordinary tantalum capacitors

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"We're not going to tell people *how* we build Tantalytic capacitors," says Engineer W. H. "Bill" Roberts. "We've spent ten years in getting the answers. But we can tell them that those ten years have taught us a lot about tantalum, enough to enable us to build the best tantalum capacitor on the market.

"When Lee Foster and I along with chemists Al Jenny and Ralph Ruscetta attacked the tantalum problem, we knew that tantalum was rare (54th in occurrence in the earth's crust), that it was a valve-forming metal (its oxide forms a good dielectric), and that it was hard to isolate (its melting point is 2950C, just below tungsten).

"Basic research and hard work—we built hundreds of capacitors by hand in our pilot shop—led us to the development of 1. Fine gauge tantalum foil; 2. A hard, porous oxide; 3. The roll-crimp case; 4. The first successful etching process for tantalum. These four developments alone have made the Tantalytic

capacitor the smallest, highest rated, most rugged, and most versatile in performance of its type."

In other types of capacitors, the same kind of engineering teamwork has been applied and has now resulted in General Electric's new subminiature metal-clad tubular capacitor (pictured below) with mineral oil impregnant. This latest addition to General Electric's subminiature line is designed to meet MIL-C-25A specifications.

The new mineral oil unit is designed for "work-horse" applications in military electronic circuits. The superior Kovar glass-to-metal sealing process is highly resistant to oil leakage and moisture penetration.

Your General Electric Apparatus Sales Engineer has complete up-to-date buying information on mineral oil tubular capacitors. For assistance with your specific capacitor applications, just contact him or write to the General Electric Company, Section 442-37, Schenectady 5, New York.

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METAL-CLAD TUBULAR CAPACITORS—85C, mineral oil impregnated. Built to MIL-C-25A. Ratings: .001 to 1.0 uf. 100-600 v. d-c. Tol: $\pm 5\%$, $\pm 10\%$, or $\pm 20\%$. Write for GEC-1390.



MIL-C-25A CAPACITORS—for filter, by-pass, and blocking in military equipment. Ratings: .05 to 15 uf at 100 to 12,500 v. d-c in case styles CP50, CP60, CP70 series. Temp. range: -55C to +85C, and -55C to +125C. Write for GEC-810.



CAPACITOR PULSE FORMING NETWORKS—for missiles and radar equipment. Capacitance tolerance: $\pm 7\%$ (at +25C). Temperature range: -55C to +125C. Write for GEA-4996.

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 air-paths 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.

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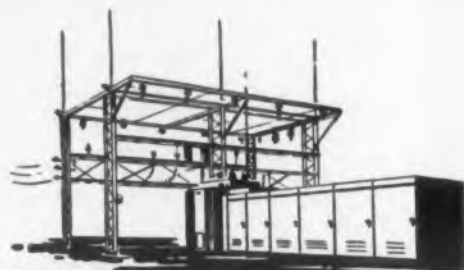
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Meetings

Aug. 20-21: National Telemetry 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 telemetry 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 telemetry 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.



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Oct. 16-18: Conference on Magnetism and Magnetic Materials, Hotel Statler, Boston, Mass. Sponsored by the AIEE, IRE, American Physical Society, American 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.

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VERSATILE . . . tests any cabling system or panel assembly without modification.

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FAST . . . checks circuits in 1/10 second each. Makes tests in minutes which once required hours.



Model 80 DIT-MCO Automatic Electrical Circuit Analyzer. This machine will test 80 circuits in 8 seconds.

DIT-MCO Automatic Electrical Circuit Analyzers

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Here is the first real solution to the production and maintenance bottleneck of testing out complex electrical circuitry. The DIT-MCO Automatic Electrical Circuit Analyzer makes all other circuit testing methods obsolete.

Where present hand and machine testers are laborious and complicated, the DIT-MCO Analyzer is fast and simple. DIT-MCO's exclusive matrix chart pinpoints errors without reference to manuals or diagrams. Non-technical personnel can easily spot the location and nature of errors on a front matrix panel, and go directly to the trouble spot for correction.

The DIT-MCO Analyzer is wonderfully versatile. It can be moved from one circuit testing job to another *without modification*. To prepare for a new test, the operator merely plugs in a simple, straight-forward adapter cable. The machine itself requires no changes at all to test any electrical cable system at any stage of production, modification, or maintenance. This even includes circuits connected together in various ways by switches, relay contacts, or a common point at a terminal such as a grounding lug. The circuits in the unit under test can be rearranged by switching mechanisms in the unit, and the tester will *automatically* test the new arrangement. The analyzer can functionally test external devices like relays, solenoids, actuators, and panel lights. The almost unbelievable accuracy of this new tester eliminates hit-or-miss testing for continuity or short resistance. Unlike meters, lights, or buzzers, the DIT-MCO Analyzer defines these errors with absolute accuracy. Continuity is closely defined with this test equipment to the point of rejecting 1/2 ohm continuity resistance as an open circuit at currents up to 2 amperes. Leakage resistance is closely defined to the point of rejecting zero ohms to 200 megohms as a direct short. These values are pre-set as desired.

In spite of its hairline accuracy and its ability to make fine measurements, the DIT-MCO Circuit Analyzer is a rugged, practically foolproof machine. Its component parts are the same as those used for years on automatic telephone systems, and most parts are pluggable. In laboratory tests, production line machines have been kept in operation for the equivalent of 10 years with no breakdowns at all.

The tremendous speed and accuracy of this machine plus its adaptability and capacity to test for all kinds of errors, make it a "must" for companies which manufacture, maintain, or overhaul products which include complex electrical circuitry. Basic sizes are built to test 80 to 200 circuits with multiplier sections to provide as much as 1600 circuits capacity.

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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. Experi-

ence 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 de-

sirable 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 should 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 on-time 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



There once was an ad which thought the very best way to attract attention was to have a headline that was bigger and bolder and blacker than all the rest. So it took the biggest letters it could find and said: CURDS AND WHEY. But lo and behold, when the advertisement appeared, the letters were so unusually large that some were cut off and all that remained was . . . HEY.

This, of course, made the ad very sad; but much to its surprise certain willful engineers, reasoning that HEY was derivative of WHEY, wrote in asking for gallons and gallons of the stuff.

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CIRCLE 14 ON READER-SERVICE CARD FOR MORE INFORMATION

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.

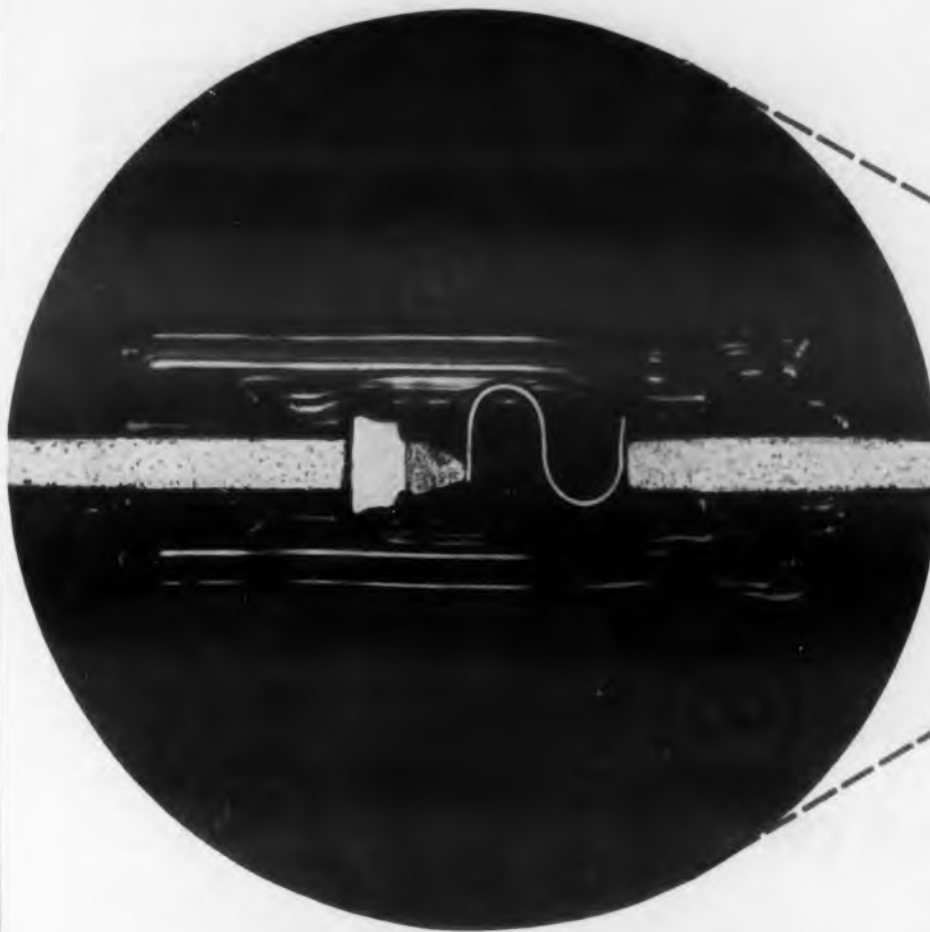
What's Being Done

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.

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The success of the Corporal is typical of the progress in guided missile technology which had its beginnings at JPL in the first early rocket experiments in 1940. Since then the Laboratory has grown to occupy an 80 acre site in the San Gabriel mountain foothills north of Pasadena and is staffed by the California Institute of Technology.

In missile development, JPL maintains a broad systems responsibility. For example, in the Corporal program, from earliest ideas to production engineering—from research and development in electronic guidance, propulsion, structures and aerodynamics, through field problems and actual troop use—full technical responsibility rests with JPL engineers and scientists.

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△ Ceramic Receiving Tubes

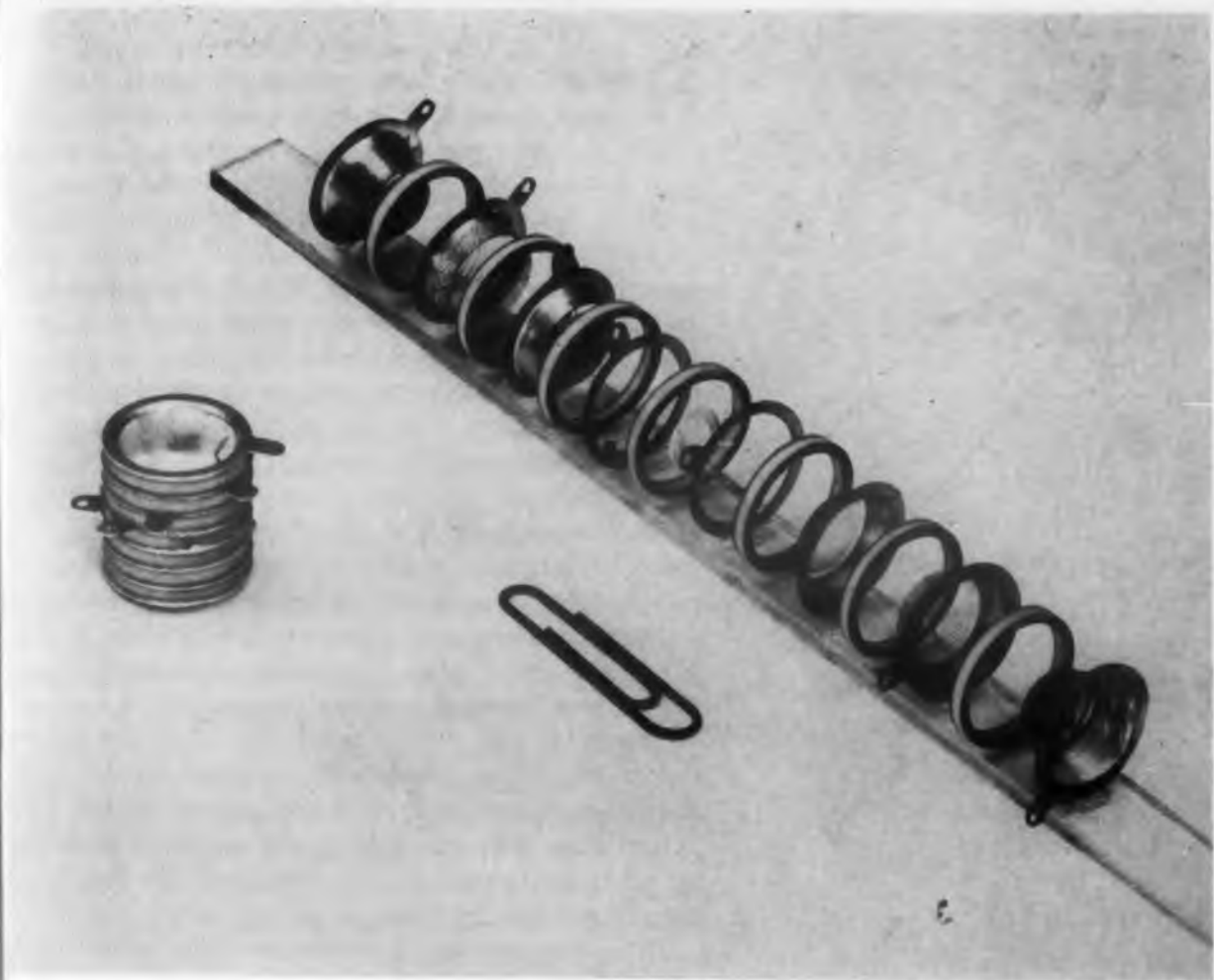
STACKED ceramic receiving tubes, equivalent to types 6SN7 and 6AK5, designed to withstand temperatures up to 300°C and heavy accelerative forces from shock and vibration, are in production. A departure from normal tube design, these ceramic units are especially adaptable to aircraft and missile applications.

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- μ 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.

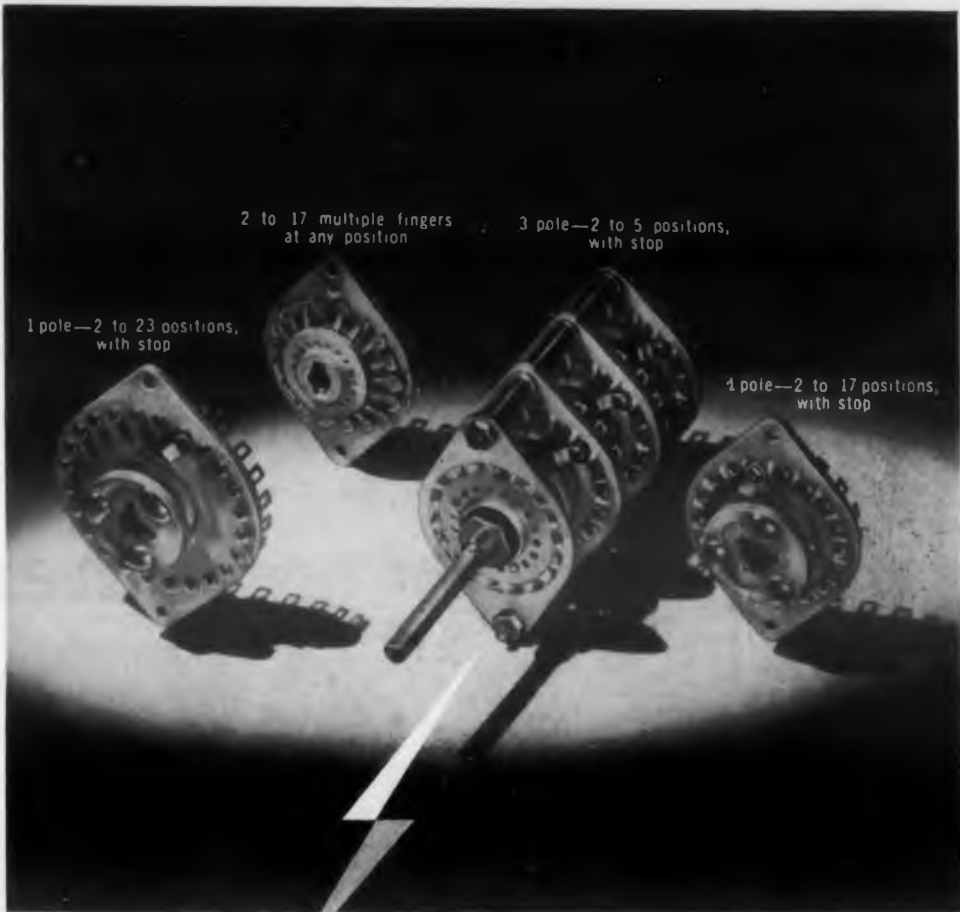
Maximum ratings of the 5C2A are: plate voltage = 200; plate dissipation = 2w, screen dissipation = 0.4w, and total current = 20ma. For more information on these ceramic receiving tubes turn to Reader's Service Card and circle 17. *Wescon Show, Booth Nos. 834-835.*



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.

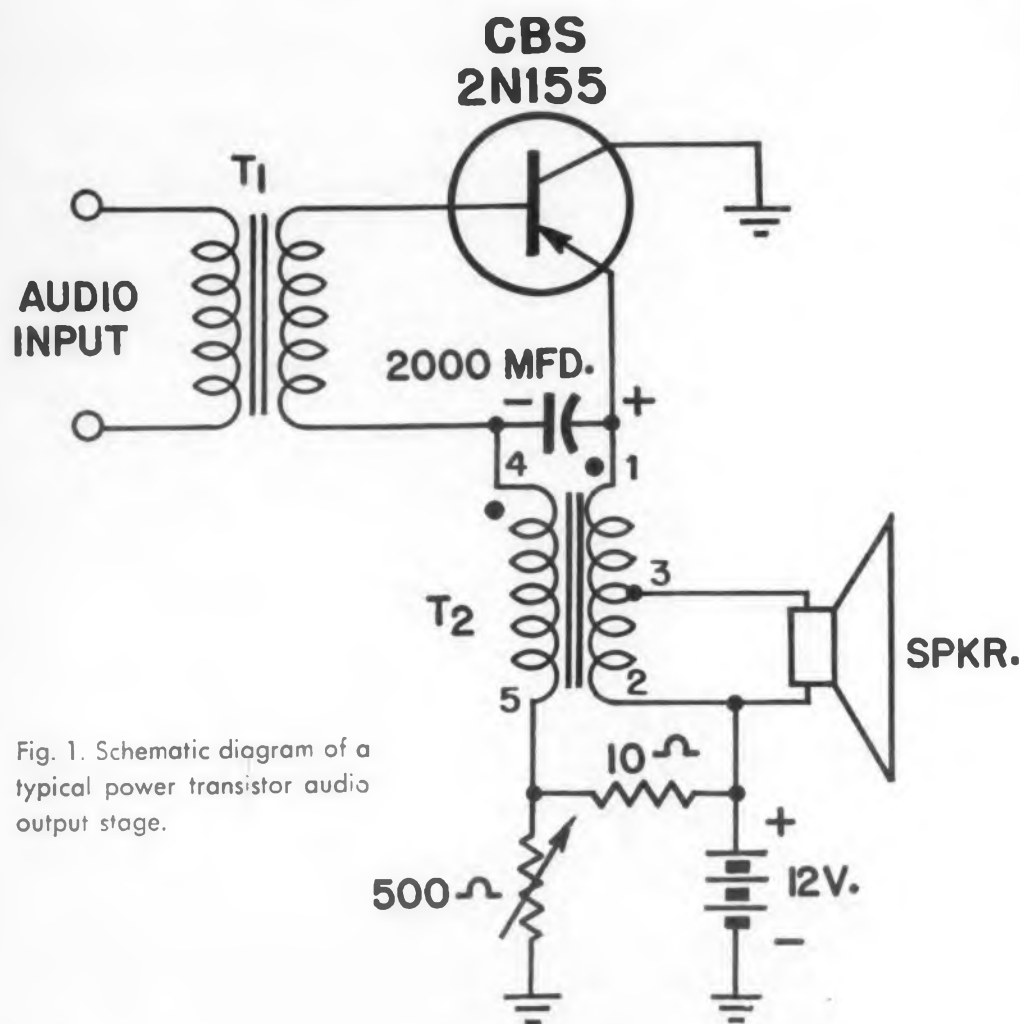


Fig. 1. Schematic diagram of a typical power transistor audio output stage.

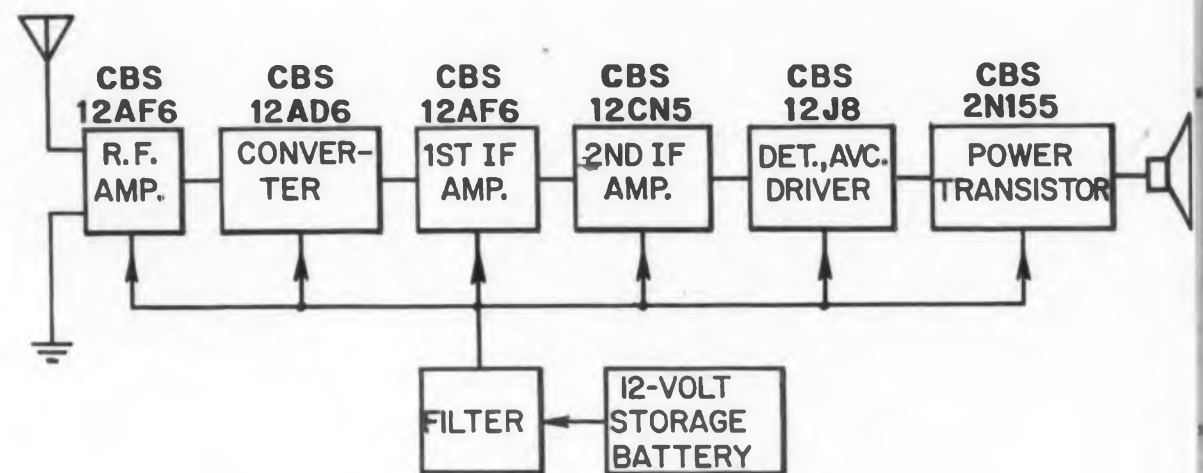


Fig. 2. Block Diagram of typical 12-v hybrid auto radio receiver.



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

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

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 auto-transformer 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 auto-transformer 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

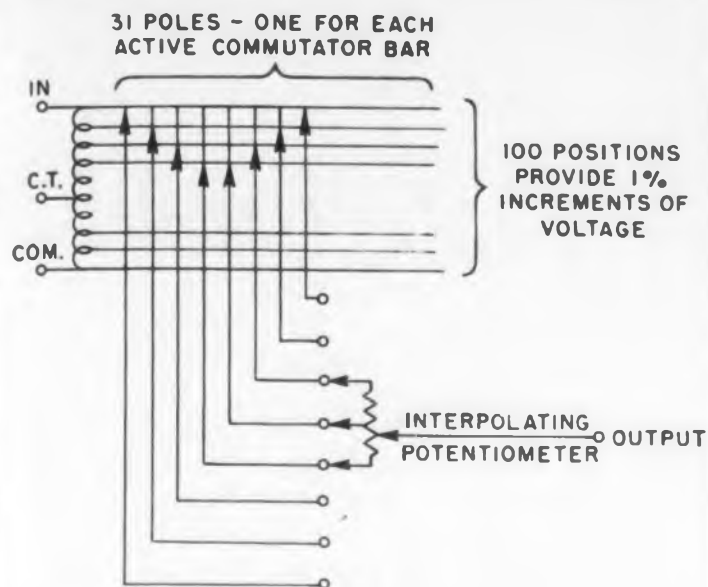


Fig. A. Schematic of the 31-pole, 100-position switch, permitting rapid adjustment of the output voltage curve.

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.

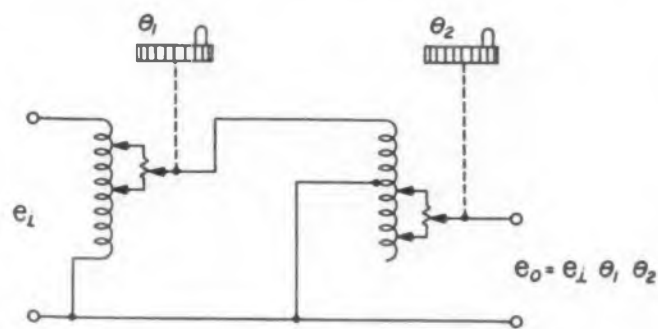


Fig. D. Schematic of the typical application as a voltage multiplier. Voltage e_1 is first multiplied by shaft angle θ_1 . The result is then multiplied by shaft angle θ_2 .



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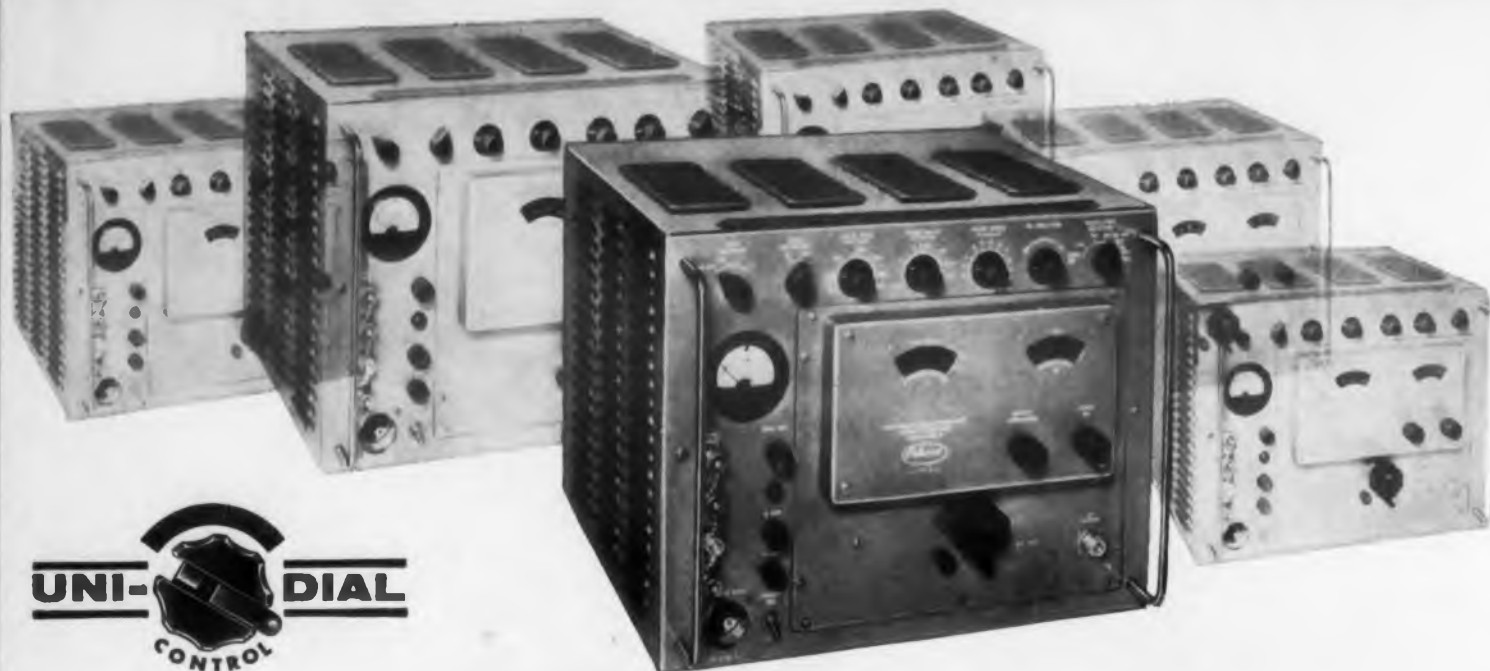
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MSG-2	2150 - 4600 mc	Delay: 3 to 300 microseconds	Rate: 40 to 4000 pps
MSG-3	4450 - 8000 mc	Rate: 40 to 4000 pps	Pulse width: 0.5 to 2500 microseconds
MSG-4	6950 - 10,800 mc	Synchronization: Internal or external, sine wave or pulse	Pulse separation (for multiple pulses): 1 to 2500 microseconds
MSG-4A	6950 - 11,500 mc		
Frequency accuracy: $\pm 1\%$		Internal FM:	Output synchronizing pulses:
Power output:		Type: Linear sawtooth	Polarity: Positive, delayed & undelayed
MSG-1 & 2: 1 mw		Rate: 40 to 4000 cps	Rate: 40 to 4000 pps
MSG-3, 4 & 4A: 0.2 mw		Synchronization: Internal or external, sine wave or pulse	Voltage: Greater than 25 volts
Attenuator range: 120 db		Frequency deviation:	Rise time: Less than 1 microsecond
Attenuator Accuracy: ± 2 db		MSG-1 & 2: ± 2.5 mcs	
Output impedance: 50 ohms nominal		MSG-3, 4 & 4A: ± 6 mcs	
		Internal square wave modulation:	Price:
		40 to 4000 pps	MSG-1, 2\$1,720.00
			MSG-3, 4\$2,190.00
			MSG-4A\$2,450.00



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CIRCLE 23 ON READER-SERVICE CARD FOR MORE INFORMATION

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

Design

Roy Heath

Consolidated Electrodynamics Corp.
Pasadena, California

Design
Forum

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.

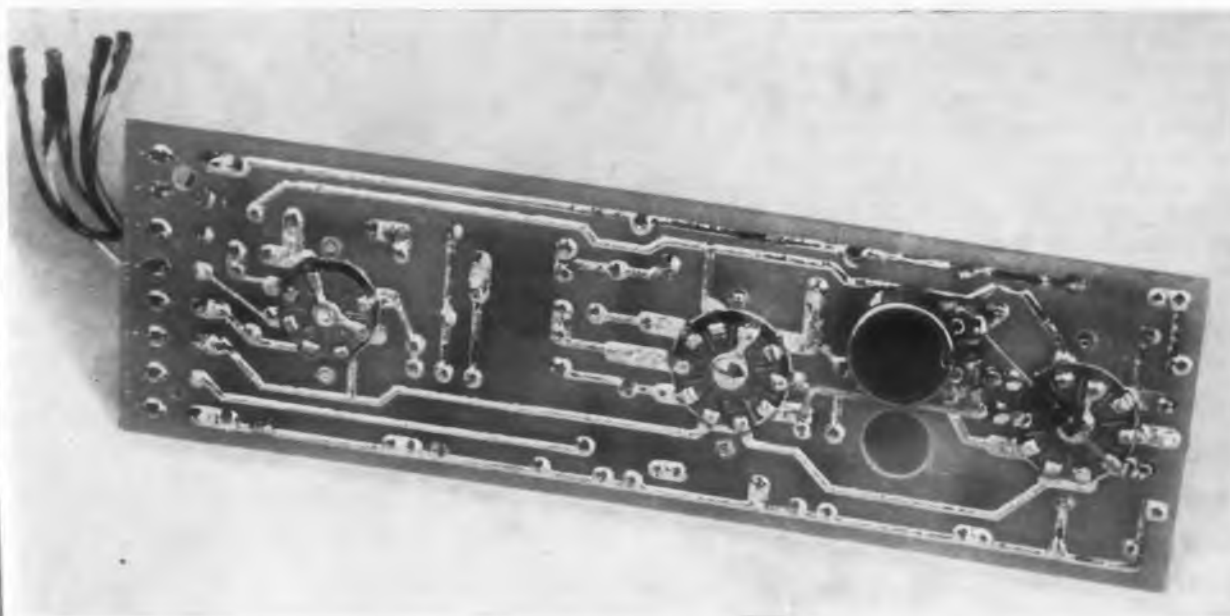
It was anticipated that the instrument would be used in different ways, also, stacking and rack-mounting possibilities were considered desirable. To provide for the stacking and latching requirement, the top and bottom panels of the enclosure were designed so that the bottom panel interlocks with the 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.



NEW 10 STAGE $\frac{3}{4}$ " multiplier phototube

Actual Size



DU MONT Type K1382

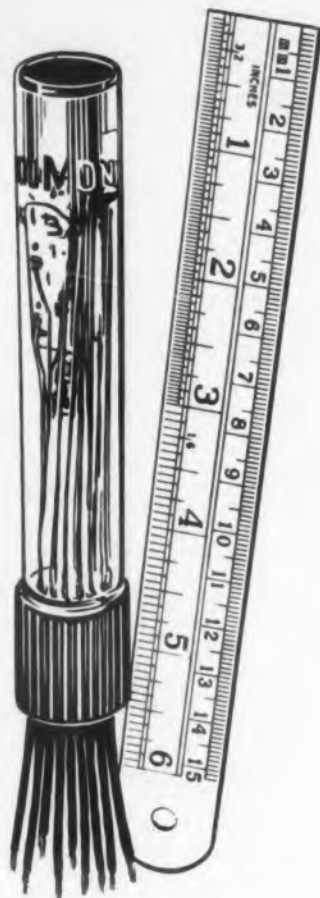
In the new Type K1382, Du Mont offers the first $\frac{3}{4}$ " multiplier phototube with the ruggedness of field equipment combined with the performance of a laboratory tube.

The average gain of the Type K1382 of 300,000 at 105 volts/stage exceeds that of many laboratory tubes, with no sacrifice in long-term stability for which Du Mont multiplier phototubes are noted.

In addition to its small size and superb operating characteristics, the Type K1382 is unusually rugged. This tube has been designed for the roughest service under the worst climatic conditions. The tube base is potted and all leads jacketed to permit operation under severest humidity without leakage between leads. Laboratory performance can be obtained from this tube even when it is being dropped as a probe into a drill hole far underground.

As in other Du Mont multiplier phototubes, the linear box-type dynode structure is used. This means optimum electron collection greatly improving signal-to-noise ratio. Also, long leakage paths minimize noise and dark current. Dark current is only 0.1 ua at 105 v/stage and 25°C.

The small size and excellent performance of the new Type 1382 mean an extra bonus to users in the geological surveying field where, for example, its extra gain permits much longer signal transmission from underground locations before signal level becomes too low to be useful. It should be exceptionally useful in medical physiological probing. Batteries of these tubes may be used for speedier diagnostic procedure. In addition, the small size will help greatly in the miniature and portable designs that can function at least as well as laboratory equipment.



CONDENSED SPECIFICATIONS

Average gain:	300,000 at 105 v/stage
Maximum dark current:	0.1 ua max. at 105 v/stage and 25°C
Photocathode sensitivity:	40 ua/lumen
Average anode sensitivity:	12 a/lumen
Maximum outside diameter:	no greater than $\frac{3}{4}$ "
Physical Characteristics:	potted base, jacketed leads

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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).

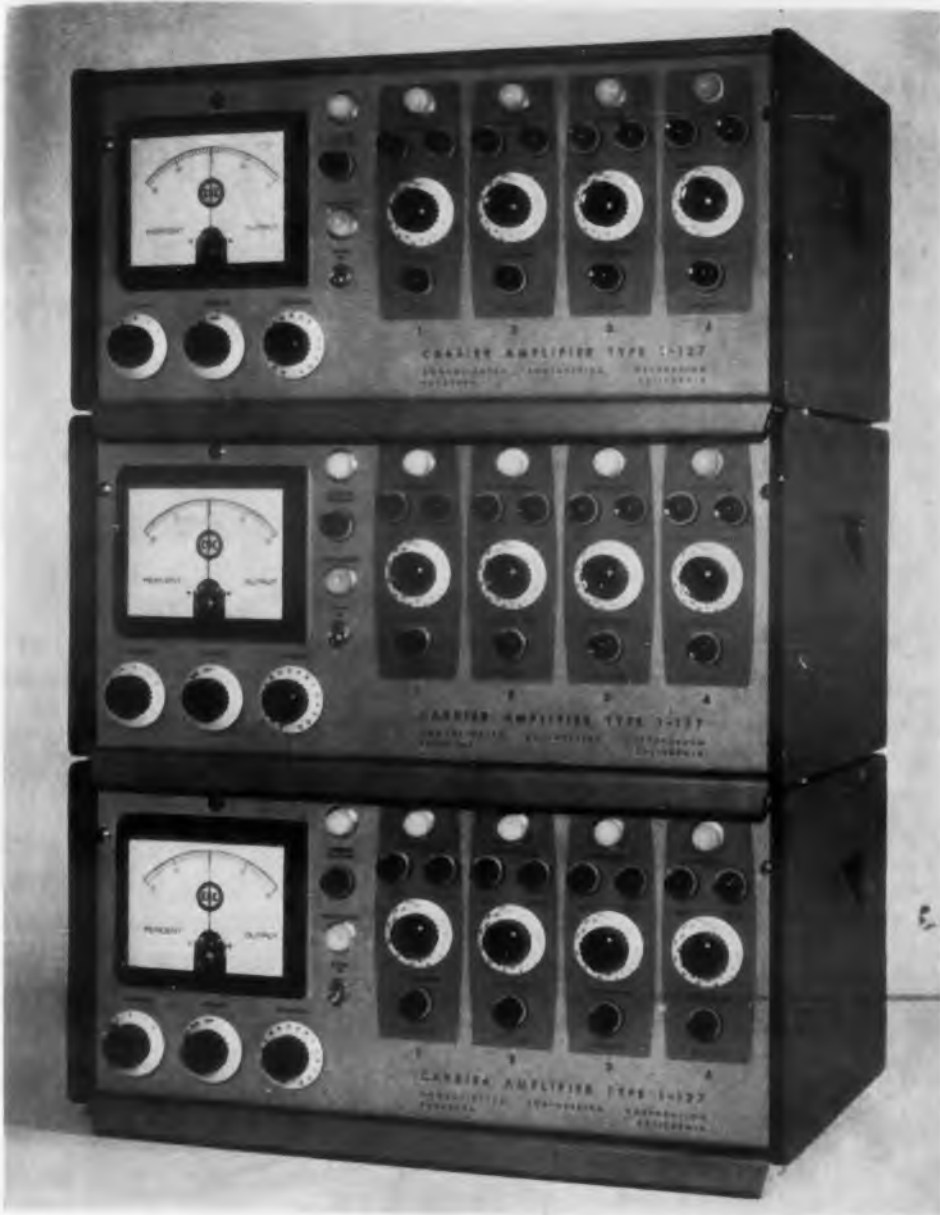


Fig. 5 Three of the amplifier units stacked to show use of latching system. The units can be rack mounted, if desired.

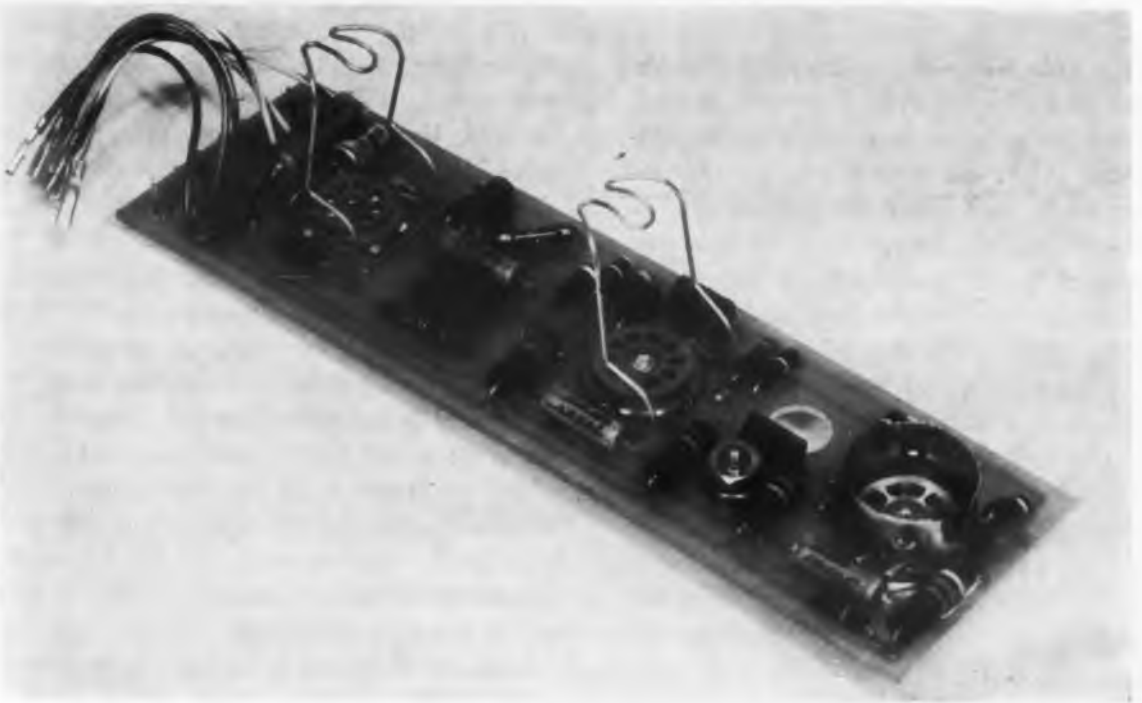


Fig. 4 Top side of circuit board showing wire retainers for holding tube in place.

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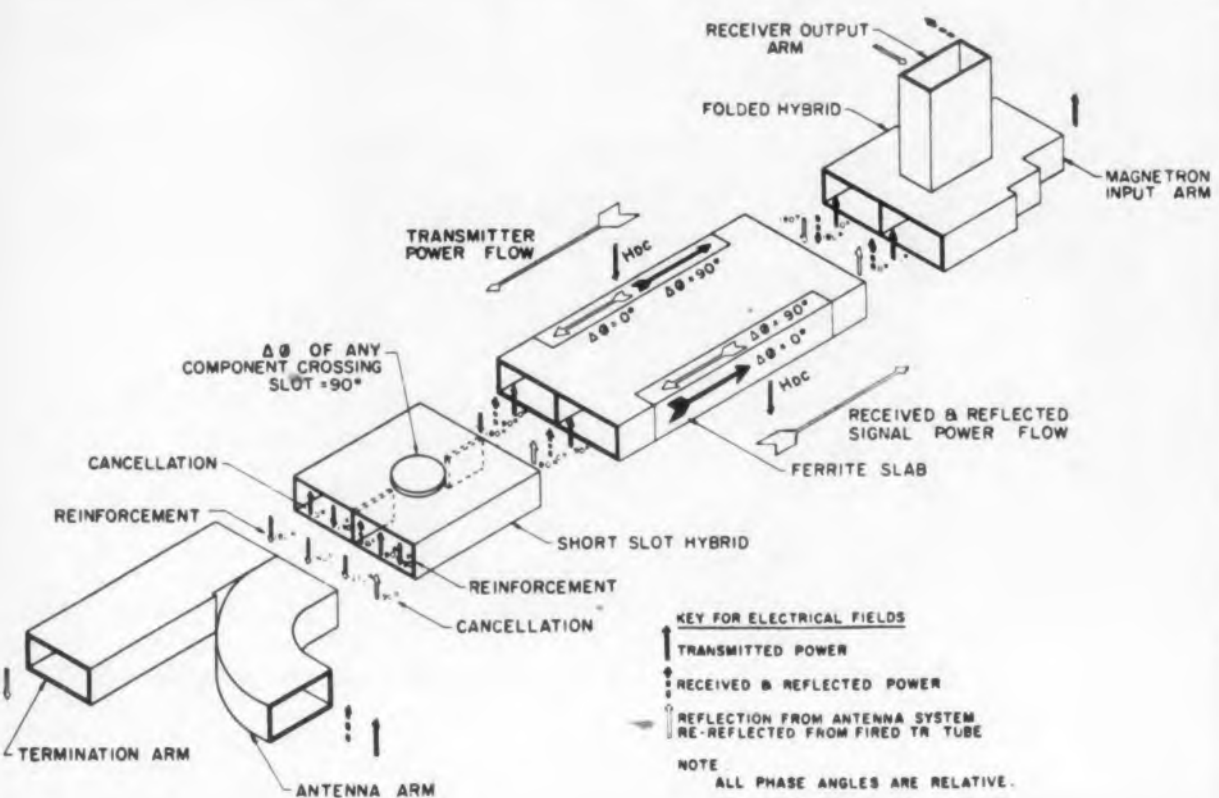
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CIRCLE 26 ON READER-SERVICE CARD FOR MORE INFORMATION

△ 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 mismatches 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.

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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.

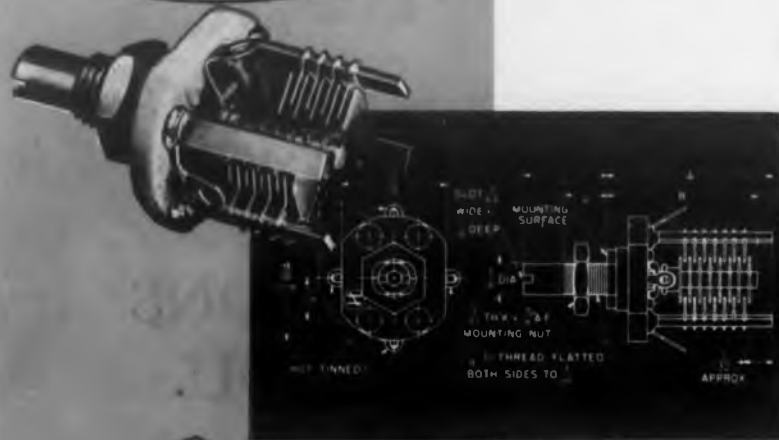
When used in a radar system, the duplexer can aid in giving lower receiver recovery time since a low power TR tube can be used even with high level transmitted power.

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.

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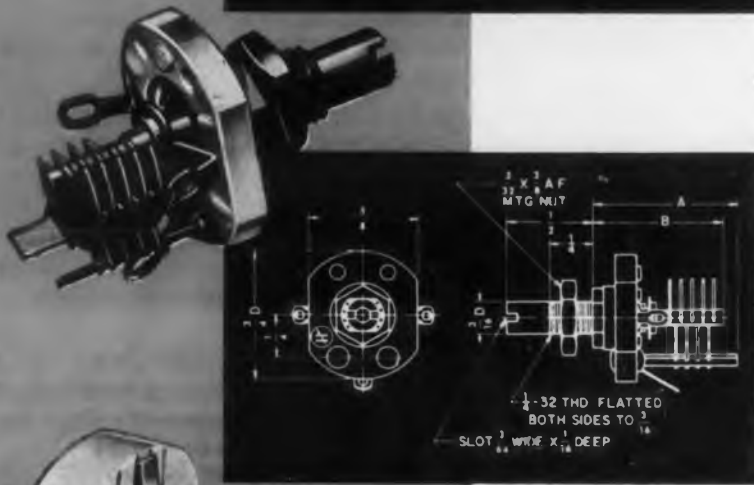


TYPE MACBF

Butterfly design provides extremely low capacity for VHF range. Silicone-treated steatite base. Rotor and stator soldered brass, nickel-plated. Screwdriver or knob adjustment. Air gap 0.017" nominal. Tested at 750 V RMS, 60 cps. Straight line capacity.

CODE	*CAPACITY (mmf.)		PLATES Per Sect.	DIMENSIONS (in.)	
	Max.	Min.		A	B
MACBF-3	3.1	1.3	7	4 ⁵ / ₆₄	3 ³ / ₆₄
MACBF-5	5.0	1.6	9	1 ¹ / ₁₆	2 ³ / ₃₂
MACBF-8	7.9	2.0	15	1	2 ³ / ₃₂
MACBF-11	10.8	2.4	21	1 ¹ / ₆₄	1 ³ / ₆₄

*Nominal value per section.

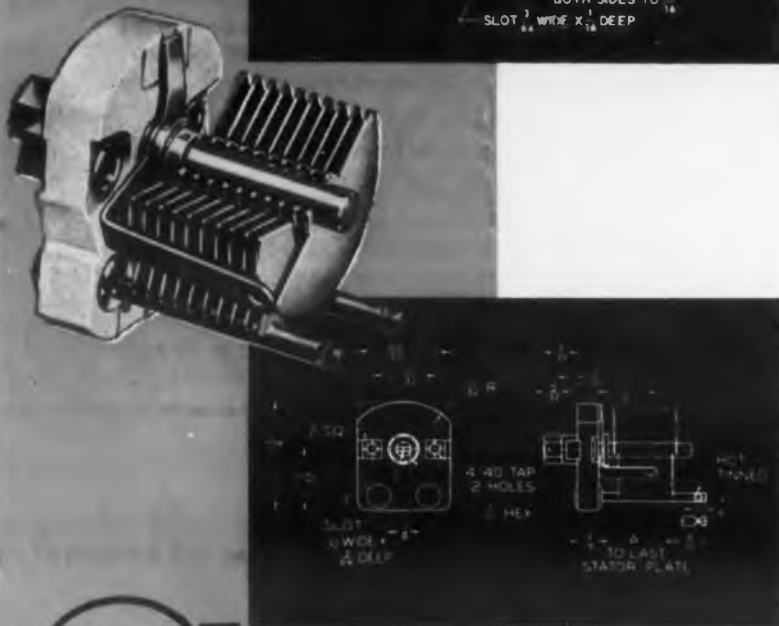


TYPE MAC

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CODE	*CAPACITY (mmf.)		PLATES Per Sect.	DIMENSIONS (in.)	
	Max.	Min.		A	B
MAC-5	5.4	1.3	5	4 ⁵ / ₆₄	3 ³ / ₆₄
MAC-10	9.6	1.5	9	1 ¹ / ₁₆	2 ³ / ₃₂
MAC-15	15.8	1.9	15	1	2 ³ / ₃₂
MAC-20	21.5	2.2	21	1 ¹ / ₆₄	1 ³ / ₆₄

*Nominal value.



TYPE MAPC

Low minimum capacities and low inductance. Ideal for VHF use. Rotor and stator soldered brass, nickel-plated. Nickel-plated beryllium copper wiper. Silicone-treated steatite base. Screwdriver or hex wrench adjustment. Tapped brass mounting studs permit mounting without grounding rotor. Air gap 0.0135" nominal. Tested at 600 V RMS, 60 cps. Straight line capacity.

CODE	*CAPACITY (mmf.)		PLATES Per Sect.	DIMENSIONS (in.) A
	Max.	Min.		
MAPC-15	15.0	2.3	6	1 ¹ / ₆₄
MAPC-25	25.0	2.6	10	3 ³ / ₆₄
MAPC-35	35.0	2.9	14	1 ¹ / ₃₂
MAPC-50	50.0	3.2	19	3 ³ / ₆₄
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MAPC-100	100.0	4.5	38	1 ³ / ₆₄

*Nominal value.

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CIRCLE 29 ON READER-SERVICE CARD FOR MORE INFORMATION

Design
Forum

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 SoundScriber Model 200 portable.

In some of the previous models of the SoundScriber 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.

ELECTRONIC DESIGN • August 1, 1956

g Machine

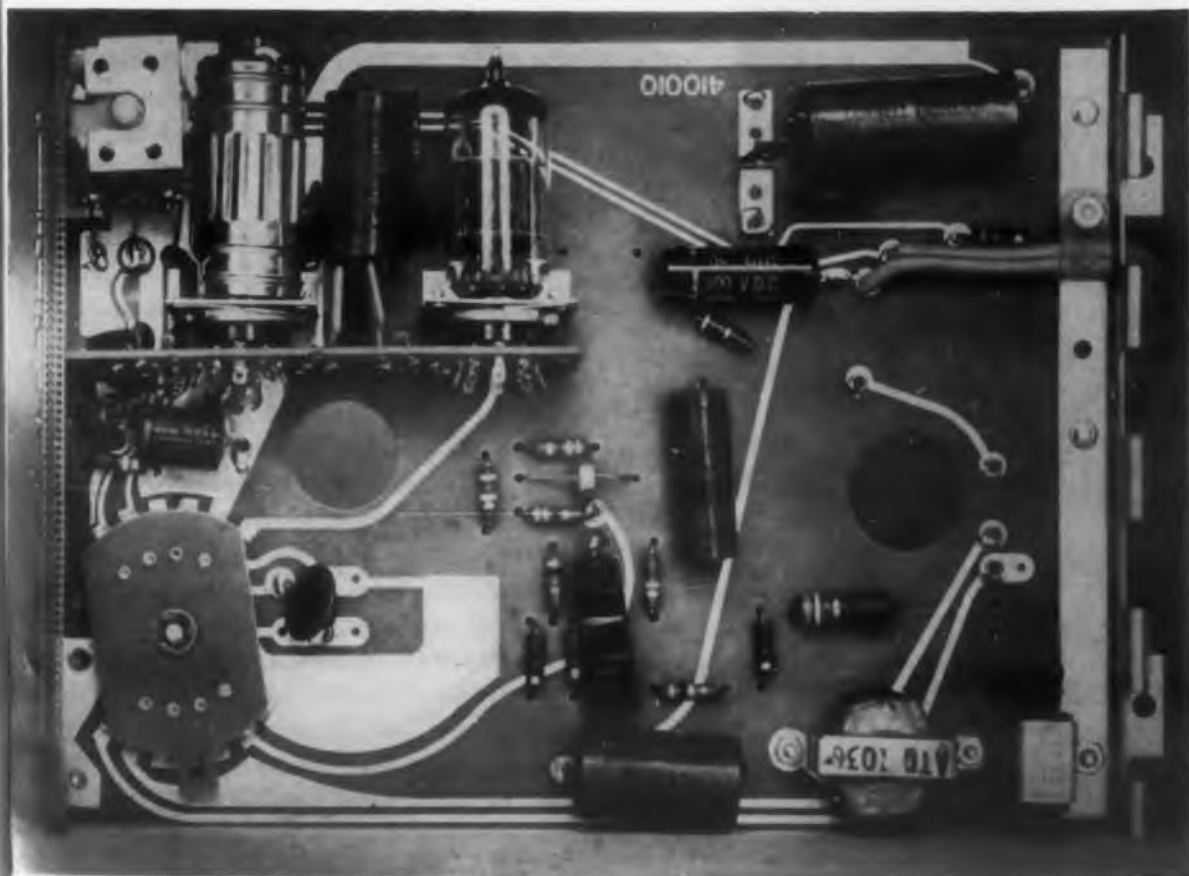
Two printed circuits eliminate bulky wiring. One large printed-circuit board makes up the main part of the assembly. Another smaller board, mounted at right angles on the larger board, holds the tube sockets.

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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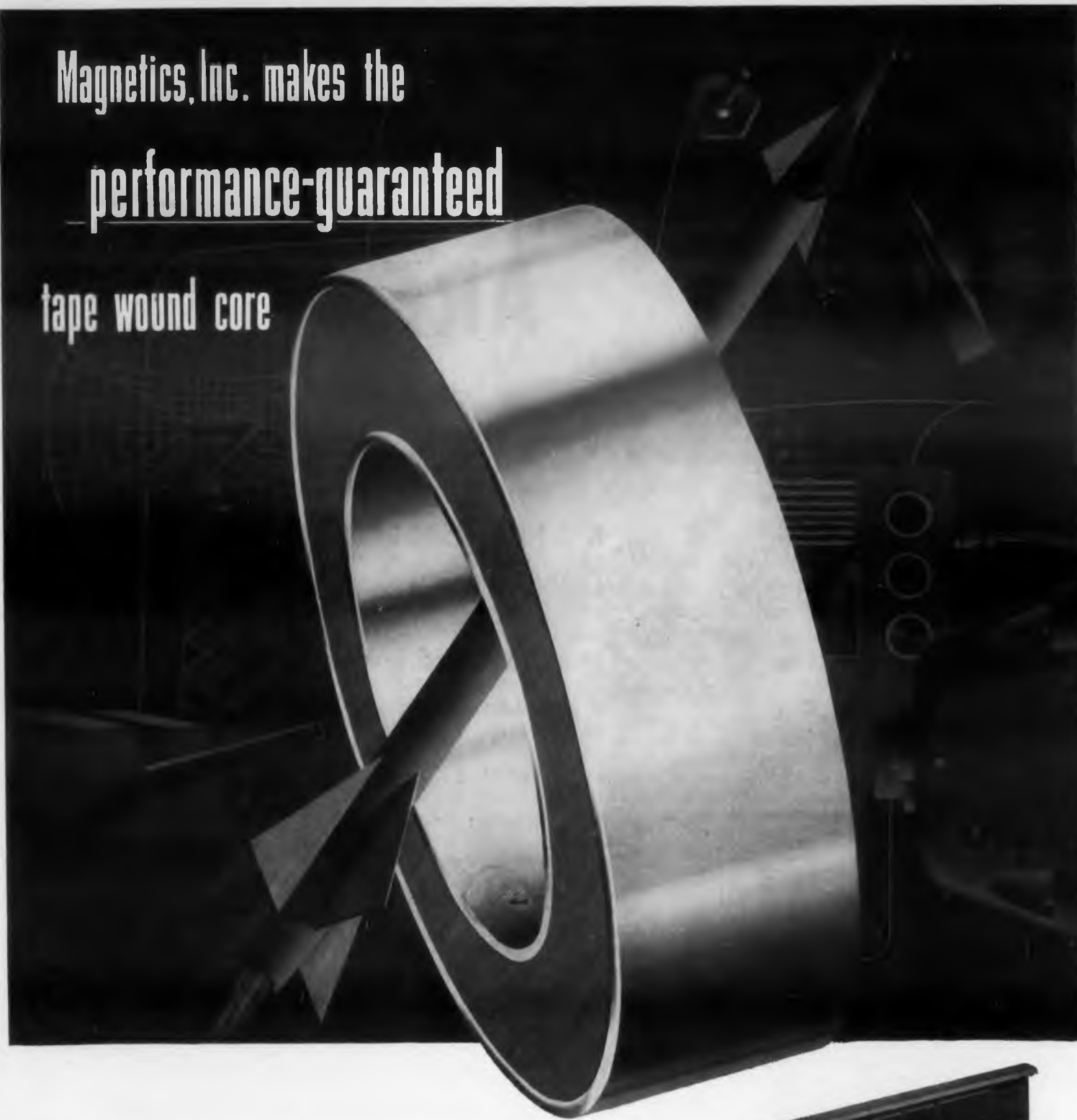
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Why not write today for your copy of Catalog TWC 100-A? And if you have an application problem, our sales engineers are ready to provide you with expert assistance. *Magnetics, Inc., Dept. 29-ED, Butler, Pennsylvania.*

*Patent Pending

MAGNETICS inc.

CABLE: Magnetics

CIRCLE 31 ON READER-SERVICE CARD FOR MORE INFORMATION

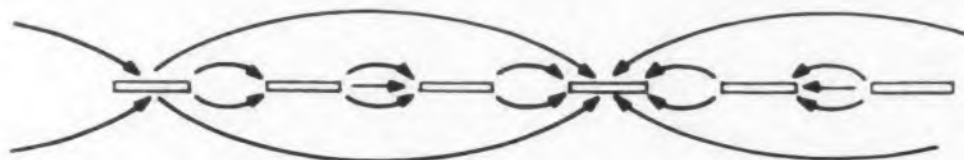
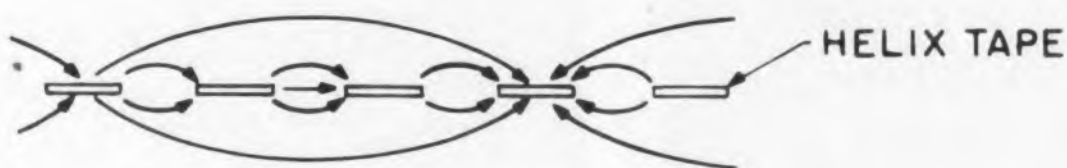


Magnetics' bobbin cores, too,
are performance-guaranteed!

△ 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.

LAPP INSULATION

FOR

WATER-COOLED

SYSTEMS

For carrying cooling water which must undergo a change in potential, use of Lapp porcelain eliminates trouble arising from water contamination and conductivity, sludging and electrolytic attack of fittings. Permanent cleanness and high resistance of cooling water is assured with the completely vitrified, non-absorbent Lapp porcelain.

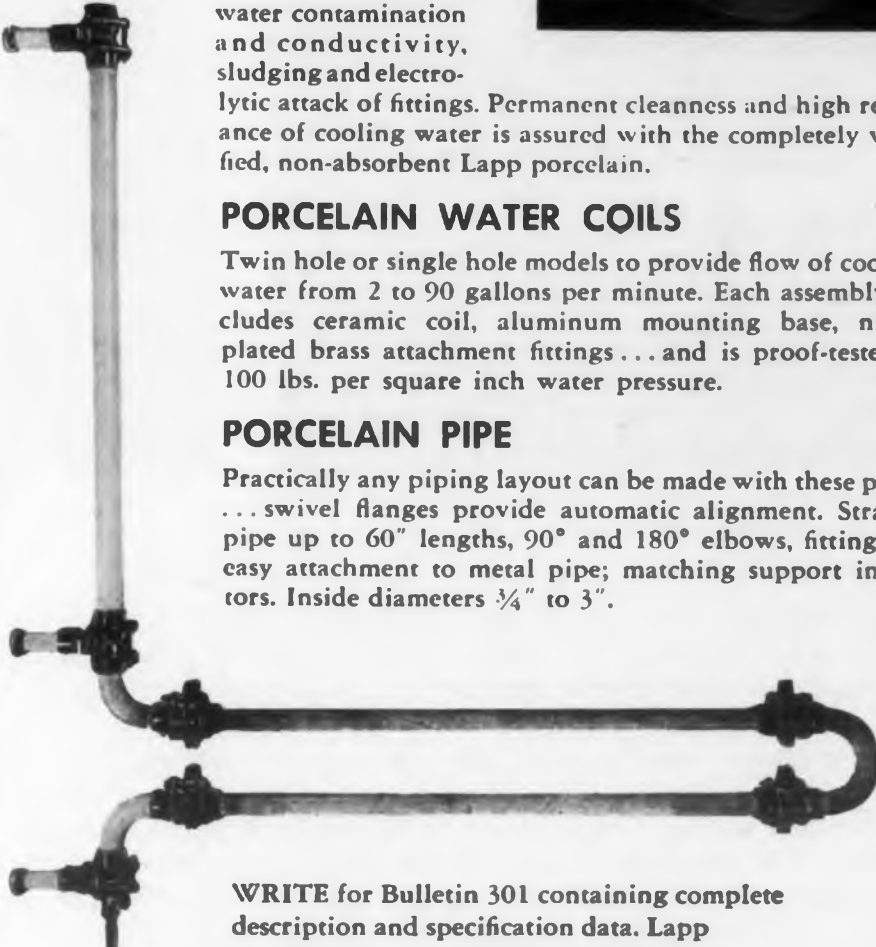


PORCELAIN WATER COILS

Twin hole or single hole models to provide flow of cooling water from 2 to 90 gallons per minute. Each assembly includes ceramic coil, aluminum mounting base, nickel plated brass attachment fittings... and is proof-tested to 100 lbs. per square inch water pressure.

PORCELAIN PIPE

Practically any piping layout can be made with these pieces... swivel flanges provide automatic alignment. Straight pipe up to 60" lengths, 90° and 180° elbows, fittings for easy attachment to metal pipe; matching support insulators. Inside diameters $\frac{3}{4}$ " to 3".



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

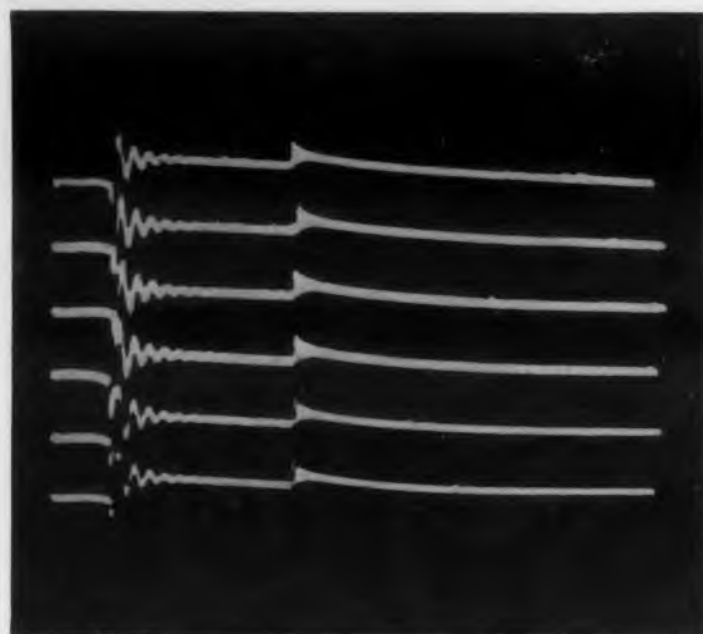


Fig. 2. (a) Normal six cylinder ignition presentation. Large transients (left) are spark plugs firing. Smaller transients are distributor points closing.

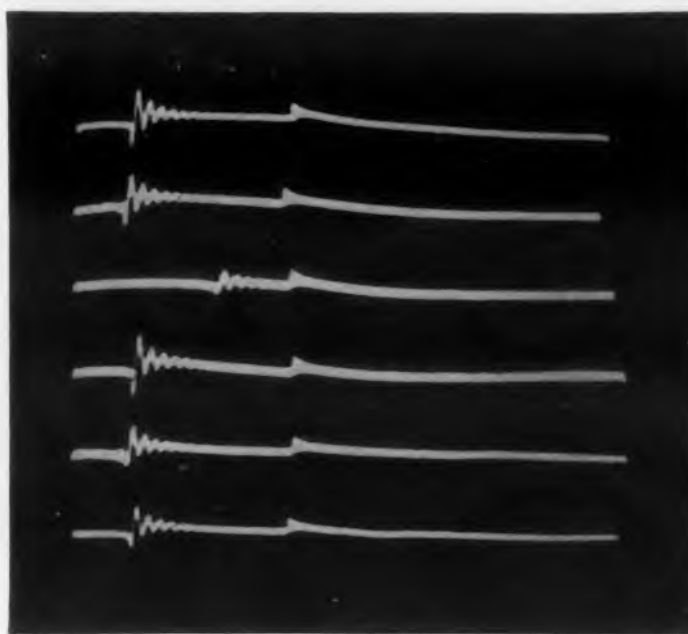


Fig. 2. (b) No. 3 spark plug not firing; distributor working ok.

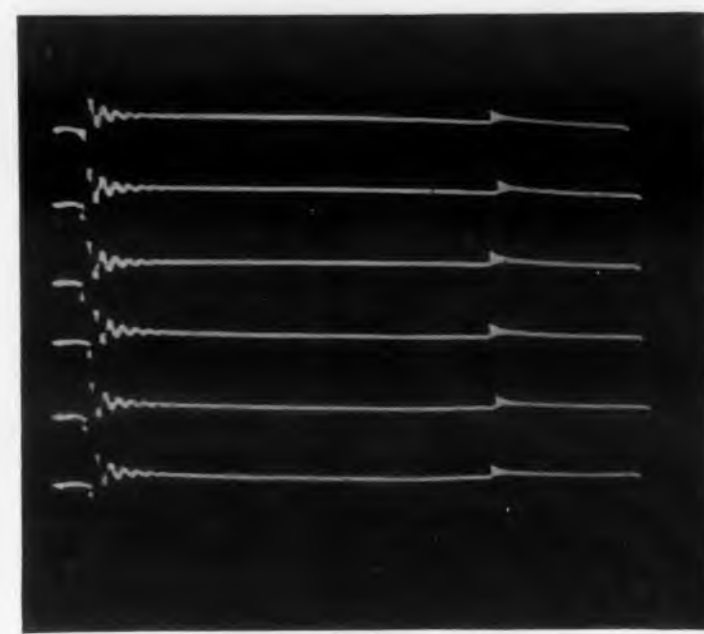


Fig. 2. (c) Spark plugs ok; points closing late (insufficient dwell angle).

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 heretofore 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.

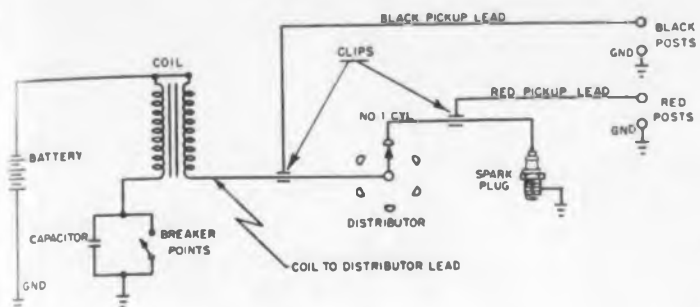
Some of the specific requirements that the analyzer needed to provide were the following: ignition testing under actual operation; no effect on engine performance by connection of test equipment, complete information on each cylinder separately or in concert with the others; measurement of engine rpm; 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 thyatron 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.

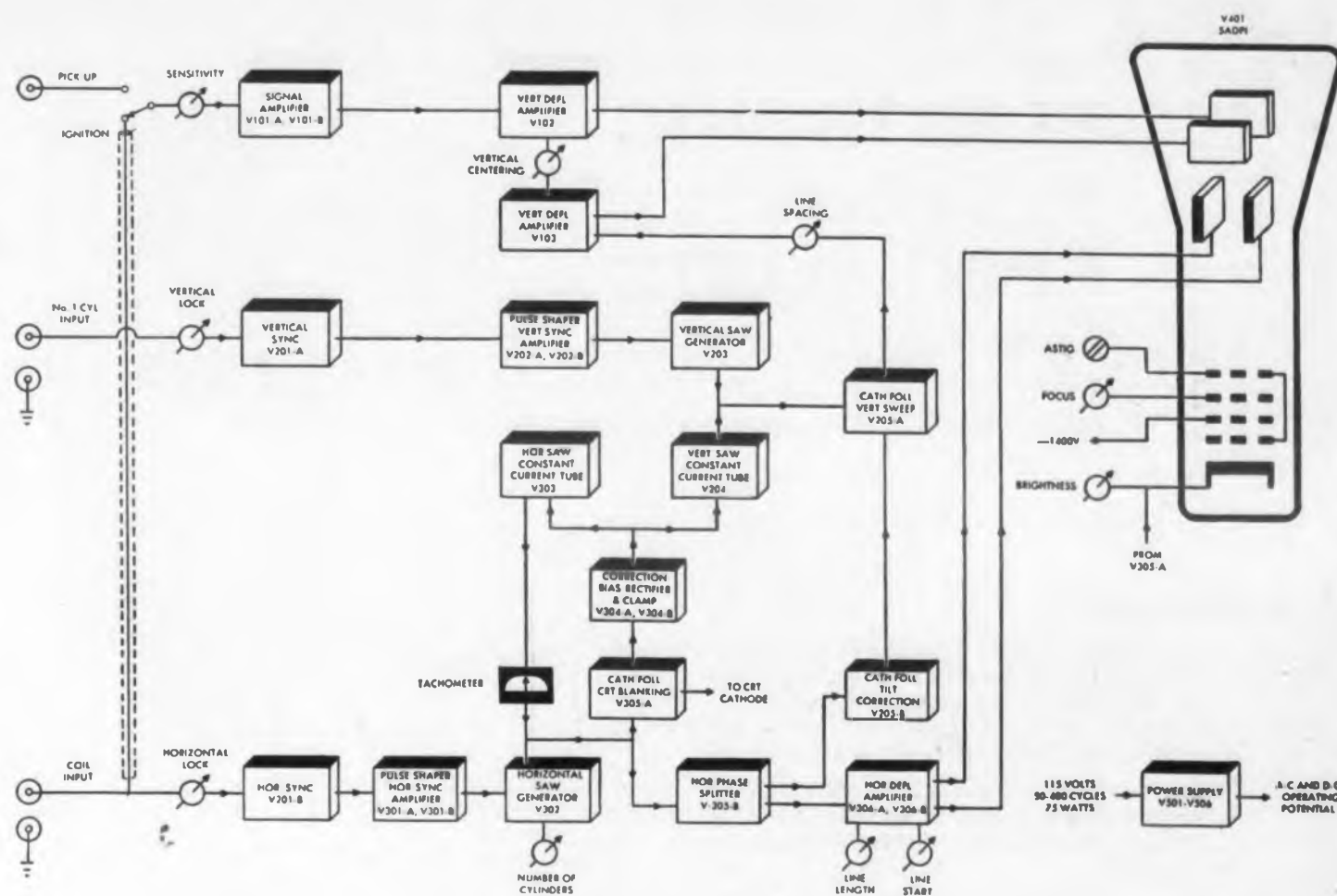


Fig. 3. Block diagram of Du Mont EngineScope.

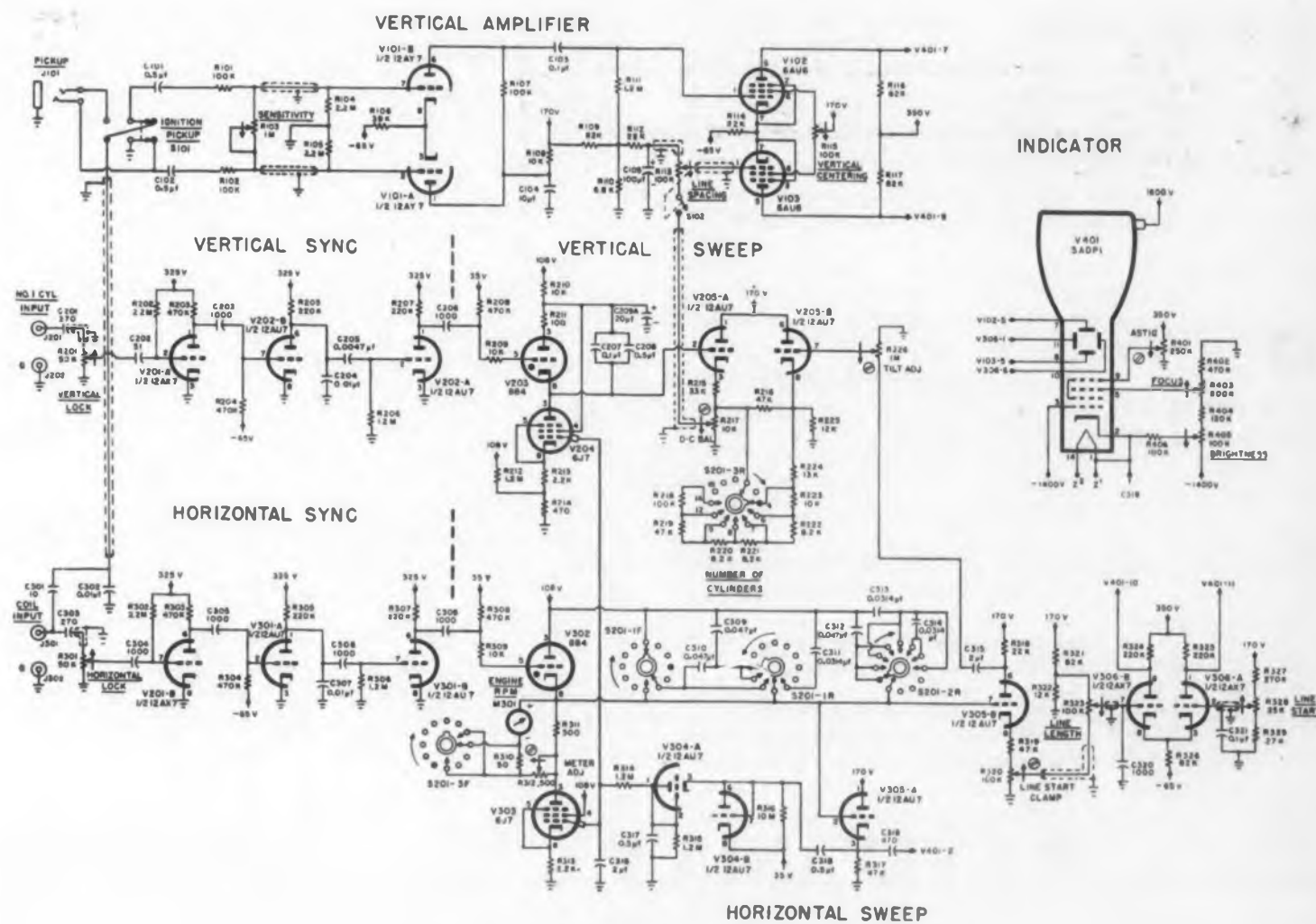


Fig. 4. Schematic diagram.

ELECTRONIC SYSTEMS SPECIALISTS

Here are some typical problems Sylvania engineers and physicists meet and solve at our Buffalo, N. Y. and Waltham, Mass. plants.

AT BUFFALO:

1. How do you design 10 similar microsecond timing circuits whose delay times can be varied over a range of 100 times by analog control voltage maintaining a tracking accuracy of $\pm 0.1\%$ in an environment of -65°C to $+125^{\circ}\text{C}$ at sea level to 100,000 feet?
2. If you know which bits of a code group are in error, can you modify the hamming code to use this data to provide maximum information capacity in a noisy channel?
3. Can you design a crystal mixer to operate with latest production type crystals and having a noise figure less than 12db above KTB operating in the "S"-band?

AT WALTHAM:

4. Under what conditions can signal fluctuations improve radar performance?
5. What are the limitations on allowable smoothing time for target tracking radars?
6. Under what conditions can random noise introduce systematic errors in radar measurements?

Continuing product diversification means long-range security and advancement... and both locations offer good housing and ample leisure-time activities, as well as unusual opportunities for advanced studies.

If you believe that you can assist us in the solving of these problems, please write:

WALTHAM LABORATORIES

Erling Mostue
100 First Ave.
Waltham, Mass.

BUFFALO LABORATORY

E. F. Culverhouse
175 Great Arrow Ave.
Buffalo 7, New York



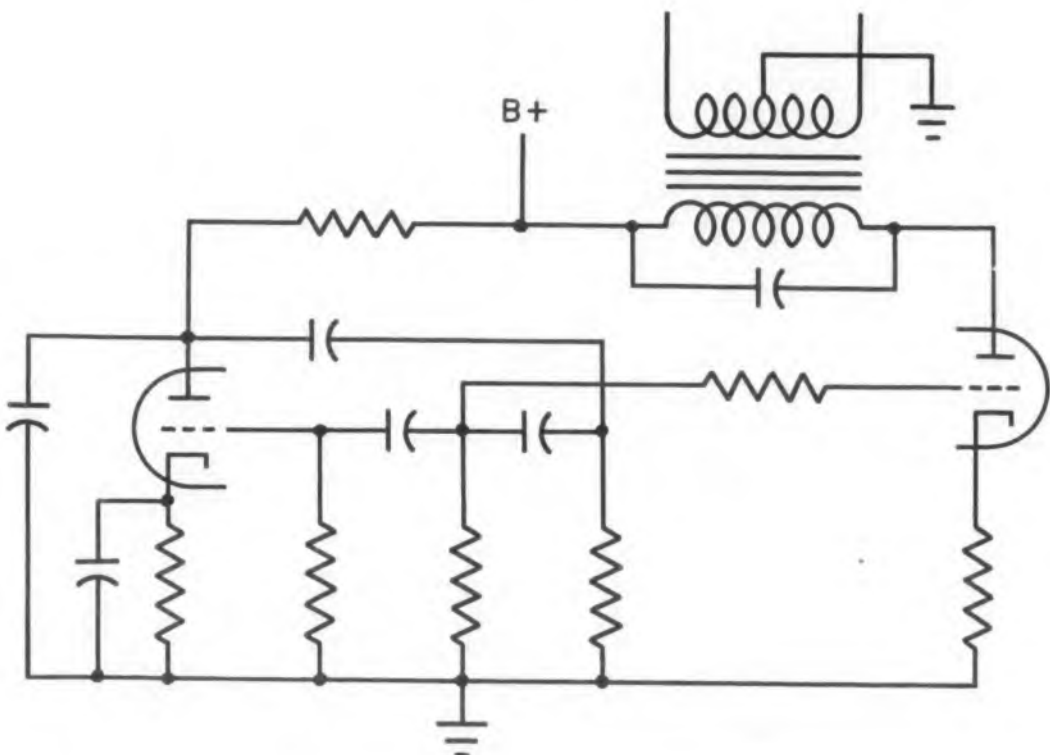
Your inquiries will be answered within 2 weeks.



△ 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 ± 20 cps over an ambient temperature range of -65 to 100°C .

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



Simplified Schematic of Chopper Driver

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PRECISION

for 400-cycle Chopper

be of one or two types depending upon application. The Type 202-1 drives one (Airtax 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.



329-A

In one phrase, that's the story of the Du Mont Type 329-A. From the input attenuators, right through to the cathode-ray tube, tolerances have been held to a level that means what you can read — you can trust. Accuracy of measurement is limited primarily by the size of the fluorescent spot (and with the superb characteristics of our mono-accelerator cathode-ray tubes, that's an especially significant statement).

Prove to yourself what the extra precision and convenience of the Type 329-A will mean to you. Call your nearest Du Mont representative for a demonstration, or write to Technical Sales Dept. at the address below.

CONTINUOUS SWEEP CALIBRATION. If you can read numbers you can make precise time measurements. Adjust the event to be measured to fill exactly a major interval on the screen. Then read time directly from the large legible dial with no interpolation, no need to count squares. Accuracy? Better than 5% (including sweep generator and cathode-ray tube).

REAL SWEEP LINEARITY. Our test spec reads "no 10% increment of sweep shall vary from another 10% increment by more than 5% in time interval represented." In short, any non-linearity of sweep will be less than a trace-width!

CALIBRATED SWEEP EXPANSION. Exclusive Du Mont "Notch" speeds a segment of the sweep by a factor of exactly 10. Result — effectively two calibrated rates during the same sweep. Expanded portion is displayed in proper relation to the unexpanded portion. Uncalibrated notch offers greater expansion (up to 100 times on lower sweep ranges).

AMPLITUDE CALIBRATION. Accurate ($\pm 2\%$) voltage standard is applied by a flick of a convenient front-panel switch to calibrate screen in any of 11 full-scale ranges from 0.2 to 400 volts.

HIGH PRECISION TYPE 5ATP- CATHODE-RAY TUBE. Only a tube built to our stringent tolerances could exploit fully the precision inherent in the circuitry of the Type 329-A. Based on the mono-accelerator principle, the Type 5ATP- offers the superb deflection linearity as well as the freedom from spot and field distortions required to render measurements valid right down to the resolving power of the trace.

DC TO 10 MC (30% DOWN) VERTICAL RESPONSE is the nominal bandwidth of the Type 329-A. But owing to the gradual fall of the frequency response beyond this point, the amplifier is usable to 20 mc and beyond. Unique amplifier design assures display of d-c signals with no d-c slump.

HIGH-LOW-GAIN SELECTOR permits doubling deflection sensitivity (at some sacrifice in bandwidth) to 0.05 volt per major scale division for studies involving very low signal levels.

DUAL INPUT CONNECTORS permit switching from one signal source to another without changing leads.

MAJOR SPECIFICATIONS

Frequency response: dc to not more than 3 db down at 10 mc; rise time, .035 usec

Deflection factor: 0.1 d-c volt/major division†; high-gain switch gives optional double sensitivity at 5 mc bandwidth approx.

Sweep rates: driven or recurrent sweeps, continuously variable, calibrated from 1 sec to 0.1 usec/major div.†; max. rate, 7"/usec (20 milli-microseconds/minor scale division).

Sweep expansion: notch expansion, variable or calibrated rate, 10 times sweep rate on most ranges with calibrated notch and up to 100 times rate with uncalibrated variable notch

Amplitude Measurement: 11 full-scale ranges from 0.2 to 400 volts full scale

Cathode-ray tube — Type 5ATP- Mono-accelerator, operated at 6000 volts (equivalent light output to post-accelerator tube operated at 10KV. Price \$1090.00

TYPE 336-A

The Type 336-A offers all of the superb measuring facilities of the Type 329-A, but has a vertical frequency response extended to 18 mc (3 db down) at a sensitivity of 1 dc volt full scale. With pulse response of 0.02 usec, the Type 336-A is particularly well suited for measurement of very high-speed phenomena. Price, \$1125.00

*Spot Size = 0.02" (approx.) †Major scale division = 0.7 inch (10 minor divisions)

DU MONT

Technical Sales Department • ALLEN B. DU MONT LABORATORIES, INC. • 760 Bloomfield Ave., Clifton, N. J.

Don't Miss the Du Mont Instrument Exhibit at Wescon Booths 939-940
CIRCLE 36 ON READER-SERVICE CARD FOR MORE INFORMATION

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 1/16" to 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 in-

cluding 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 ger-

manium-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.

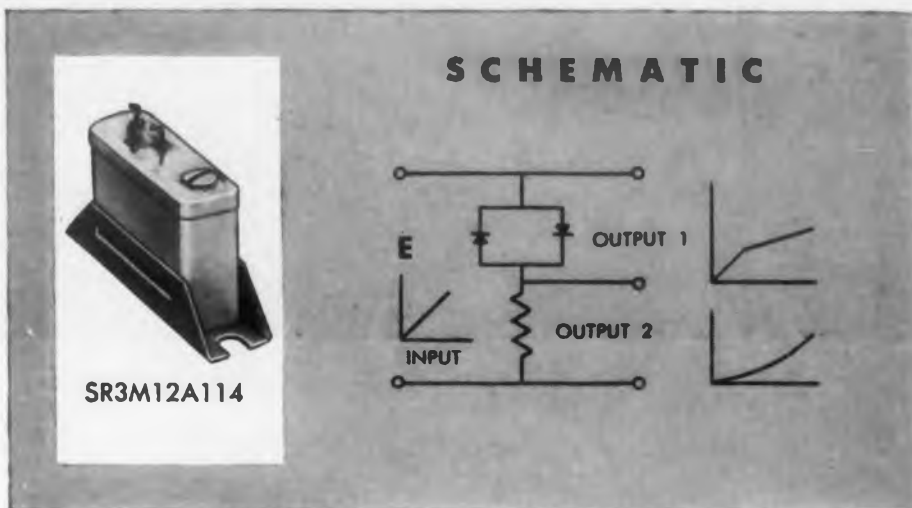
Other electrical features are low mu-factor, high plate current at low plate voltage, and a high operating ratio of plate current to grid-No. 2 current.

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

CIRCLE 44 ON READER-SERVICE CARD

CIRCLE 45 ON READER-SERVICE CARD

Bradley VARISTORS SOLVE non-linear circuit requirements



TYPICAL USES

- Voltage and/or current regulation.
- Meter protection.
- Expansion and compression circuits.
- Arc suppressors.
- Contact protection.
- Servo systems.
- Gating circuits.
- Limiters, slicers and clippers.

"Compact, rugged Bradley varistors can be used for non-linear resistance purposes practically in any circuit. They can be supplied in voltage ranges from less than a hundred millivolts to as high a voltage as required. Current range is from a few microamperes on up. Bradley selenium and copper oxide varistors display unusual life and stability characteristics. Non-linear characteristics of both selenium and copper oxide are developed to the highest degree by Bradley's exclusive vacuum process, assuring superior performance."

RECTIFIER HANDBOOK: Complete information for product designers. Most comprehensive manual available. Kept up to date. Cost: \$2.00 postpaid.

BRADLEY LABORATORIES, INC.

174 Columbus Avenue, New Haven 11, Connecticut

VACUUM PROCESSED FOR PERFORMANCE AS RATED

Bradley

**DIRECT HITS
REQUIRE PERFECT
CONTROLS**



*...and Radio Receptor Selenium Rectifiers
help make that accuracy possible!*

Power supply and
amplifier cabinet made by
Belock Instrument Corp.,
New York, for U. S. Navy
gun fire control systems.
Five Radio Receptor
rectifiers are utilized
in this unit.



The timing and precision of U. S. Naval gunfire depends on complex fire control systems for which Radio Receptor's customer, **Belock Instrument Corp.** manufactures power supply and amplifier cabinets. Five Radio Receptor power rectifiers are included in each unit because the manufacturer knows that ruggedness, long life and reliability are always prime features of every RRco. stack.

On target with the fleet — and in hundreds of other applications for government and industry, RRco. rectifiers constantly prove they can pass the stiffest requirements with flying colors. If you have a problem involving rectification, submit your specs to our engineering department. We'll be glad to make recommendations, without obligation of course.

Semiconductor Division

RADIO RECEPTOR COMPANY, INC.

Radio and Electronic Products Since 1922

240 Wythe Avenue, Brooklyn 11, N. Y. • EVergreen 8-6000

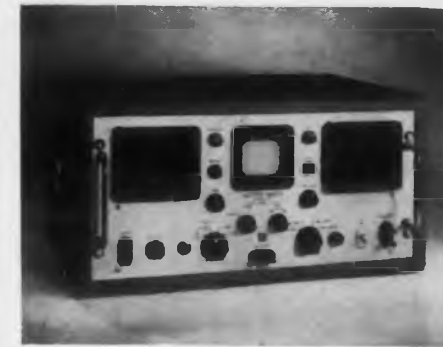
Radio Receptor Products for Industry and Government: Selenium Rectifiers • Germanium Diodes
Theratron Dielectric Heating Generators & Presses • Communications, Radar & Navigation Equipment

CIRCLE 47 ON READER-SERVICE CARD FOR MORE INFORMATION



△ **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 $\pm 2\%$ 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

ELECTRONIC DESIGN • August 1, 1956

△ Miniature Telemetering Filters

For Every Channel and Bandwidth



This is a complete line of miniature telemetering filters for every channel and bandwidth. A typical miniature band-pass filter (illustrated) in the MIL style GB case has 15% bandwidth at ± 1.0 db and phase shift linearity within $\pm 5\%$. Attenuation at $\pm 15\%$ 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.

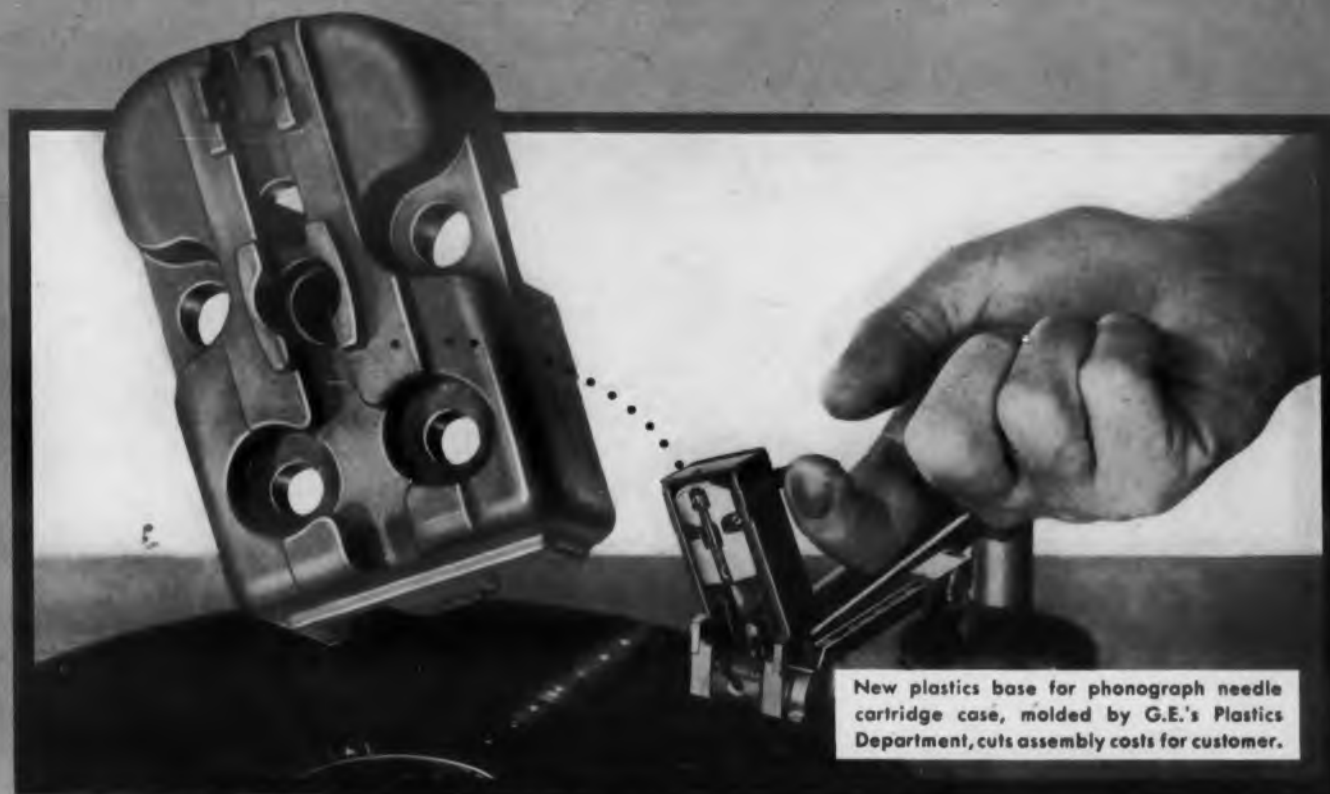
Specifications include: plotting speed: 60 points per minute, max; accuracy: 0.10% for digital to analog conversion; plotting scales: 10, 20, 50, 100, and 200 points per inch; zero offset: 100 to 900 points in steps of 100 by calibrated front panel switch.

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

*A good product... made even better
... with plastics parts by G.E.*



New plastics base for phonograph needle cartridge case, molded by G.E.'s Plastics Department, cuts assembly costs for customer.

PLASTICS PARTS SAVE TIME AND MONEY! Inserts in this cartridge case base were formerly added through a costly cementing operation. Working closely with the customer, General Electric Plastics Department engineers redesigned the base... used steel instead of beryllium for the mold... suggested a new high-impact styrene. **RESULT?** Now the customer can force inserts in place under pressure at high speed. They hold fast without cement because of the part's close tolerances and resilience. Further cost reductions are achieved because the part's high-impact resistance reduces rejects for-

merly incurred during the customer's riveting and soldering operations.

Where can YOU use plastics parts by G.E. to make a good product even better? If you are contemplating a new product, or are looking for a way to improve a present one, keep plastics in mind! As one of the world's foremost custom-molders, General Electric has helped scores of manufacturers improve product performance and appearance, realize important cost savings. G.E.'s custom-molding service will be happy to help you in engineering and developing your products—through plastics.

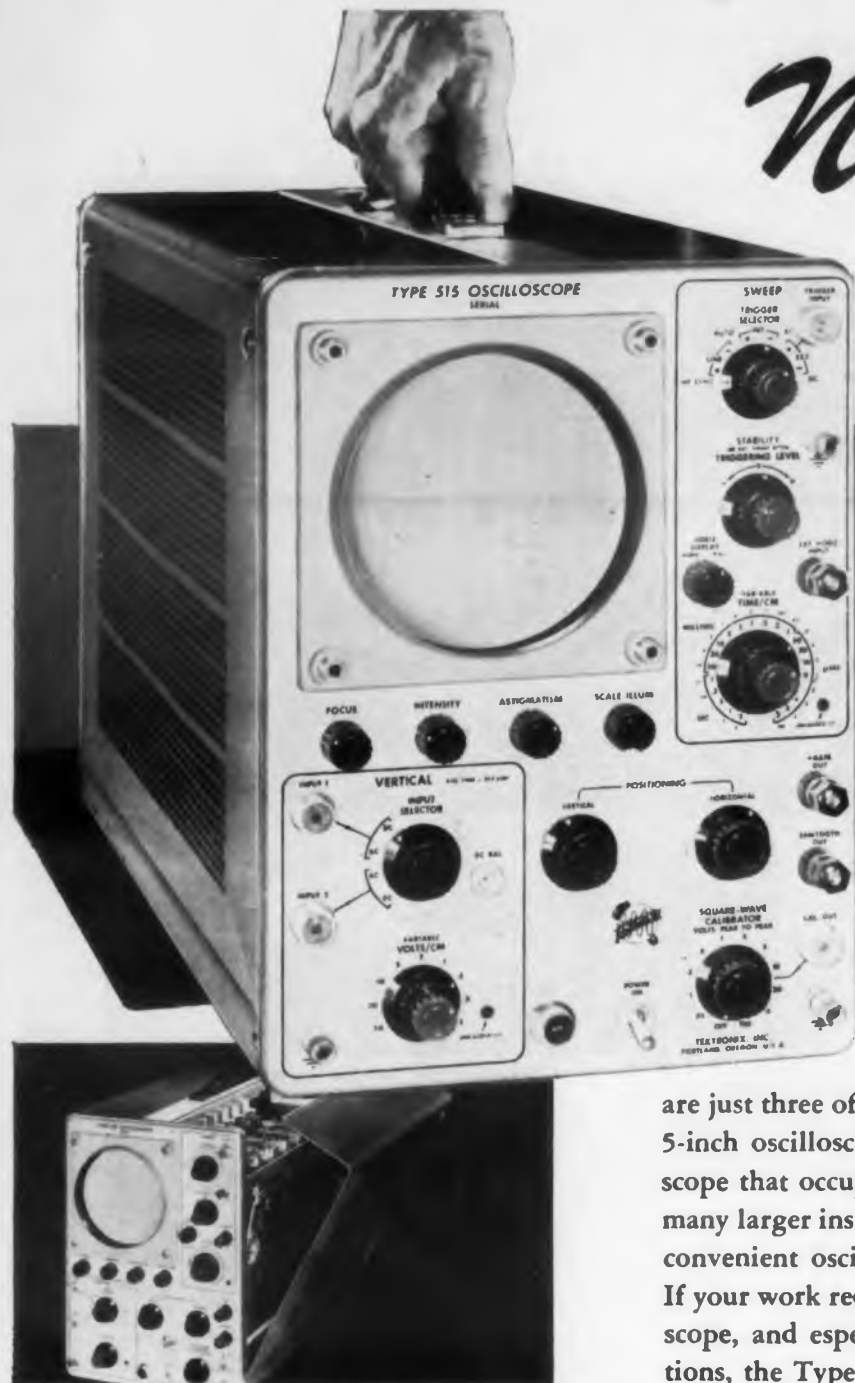
Write today on your company letterhead for a free copy of "The G-E Plastics Story," containing stimulating case histories of how customers profit through plastics. Just write: Plastics Department, General Electric Company, Section 6X5A1, Decatur, Ill.



Progress Is Our Most Important Product

GENERAL ELECTRIC

CIRCLE 52 ON READER-SERVICE CARD FOR MORE INFORMATION



New 

WIDE-BAND OSCILLOSCOPE

*Small
Light
Versatile*

Small size, light weight, and operating versatility are just three of the many things you'll like about this new Tektronix 5-inch oscilloscope. It is primarily a wide-band laboratory oscilloscope that occupies less bench space and has wider application than many larger instruments. But because of its compactness it is the most convenient oscilloscope for those more exacting field applications. If your work requires a reliable high-performance top-quality oscilloscope, and especially if you must sometimes use it in field applications, the Type 515 merits your consideration.

TYPE 515 BASIC SPECIFICATIONS

VERTICAL RESPONSE

Passband—dc to 15 mc.
Risettime—0.023 μ sec.

VERTICAL SENSITIVITY

0.1 v/cm to 125 v/cm, continuously variable.
9 calibrated steps from 0.1 v/cm to 50 v/cm.

SWEEP RANGE

0.04 μ sec/cm to 6 sec/cm, continuously variable.
Single control selects any of 22 calibrated steps from
0.2 μ sec/cm to 2 sec/cm.
5x magnifier is accurate on all ranges.



See the new Type
515 Oscilloscope
and other Tektronix
instruments at
WESCON
August 21-24.

Tektronix, Inc.

P. O. Box 831 • Portland 7, Oregon

Phone CYpress 2-2611 • TWX-PD 265 • Cable: TEKTRONIX

TRIGGERING FACILITIES

Internal, external, line, ac or dc-coupled.
Amplitude level selection or automatic triggering.

4-KV ACCELERATING POTENTIAL

DC-COUPLED UNBLANKING

SQUARE-WAVE AMPLITUDE CALIBRATOR

0.25 μ sec BALANCED DELAY NETWORK

ELECTRONICALLY-REGULATED POWER SUPPLY

Type 515 — \$750

f.o.b. Portland (Beaverton), Oregon

ENGINEERS—interested in furthering the advancement of the oscilloscope? We have openings for men with creative design ability. Please write to Richard Ropiequet, Vice President, Engineering.

CIRCLE 53 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.

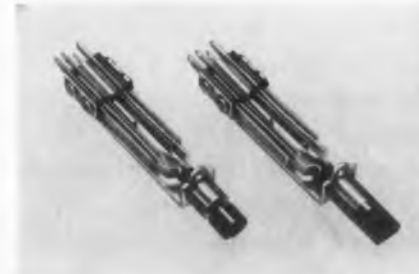
Rheem Mfg. Co., Dept. ED, 9136 E. Hall Rd., Downey, Calif.

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.



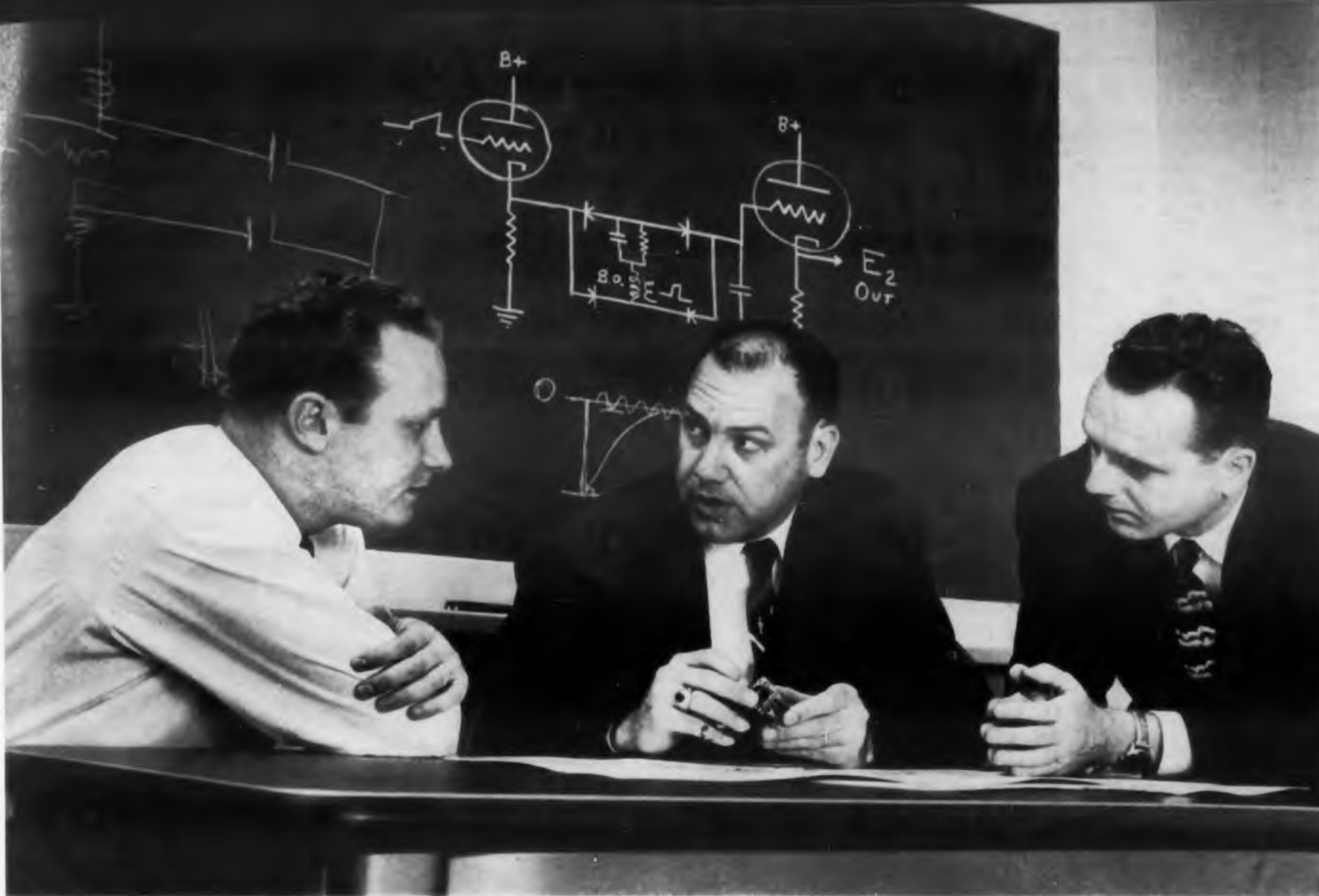
Available in 2 series: Series 11000—Push button switch for momentary action and in push-to-lock, pull to release action or locking type. Series 11200—2 position turn button switch for non-locking and locking action; button faced with a wide white line making it easy to see the position of the knob.

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**
research and engineering staff

LOCKHEED AIRCRAFT CORPORATION

VAN NUYS • PALO ALTO • SUNNYVALE • CALIFORNIA

WESCON SHOW

Los Angeles
August 21-24

A. A. Daush and senior members of the technical staff will be available for consultation at the convention hotel. Phone DUnkirk 5-3286.

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

- Instrumentation and telemetering
- Integration of ground and flight test data to evaluate dynamic performance
- RF propagation, microwave and antenna research and development
- Advanced electronics and radar systems
- Analytical systems analysis of guidance and control problems
- Design and packaging of electromechanical systems

NATIONAL TELEMETERING CONFERENCE

Los Angeles
August 20-21

L. A. G. ter Veen, R. B. Morgan and senior members of the technical staff will be available for consultation at the convention hotel. Phone MICHigan 0442

Lockheed

MISSILE SYSTEMS DIVISION

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	
	●●●	●●	●●	●●	●●	●●	●●	●●	●●	●●	●●	●●	●●	Precision Mechanics, Optical Devices, Ceramics
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	●●	●●	●●	●●	●●	●●	●●	●●	●●	●●	●●	●●	●●	Electronics
	●	●	●	●	●	●	●	●	●	●	●	●	●	Hydraulics, Liquids Processing, Heat Exchange
	●	●	●	●	●	●	●	●	●	●	●	●	●	Television: Studio, Theatre, Business, Institutional, Industrial
	●●●	●	●●	●●	●●	●●	●●	●●	●●	●●	●●	●●	●●	Instruments, Servos, Controls: Hydraulic, Pneumatic, Magnetic, Electronic
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	●●●	●	●●	●●	●●	●●	●●	●●	●●	●●	●●	●●	●●	Radar, Microwave, Ultrasonics
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Librascope Desk-Size Computer



Link Aviation
F-89D Jet Simulator



GPL Industrial-Institutional TV System



Griscom-Russell
Shipboard Distilling Plant



Askania Electro-Jet
Power Package

SYSTEMS ENGINEERING

The GPE Companies are leaders in that small, select group in American industry which is broadly qualified to develop and produce the systems needed today for defense and industry. GPE leadership accounts for some of the most advanced systems in use in business, television, aviation, marine, steel, oil, and other industrial fields.

In Systems Engineering, highly advanced capacities and resources are prerequisite. Yet, no matter how highly advanced, they are of little use if limited to a few areas. Finding optimum solutions to complex systems problems calls for *balanced competences*. And beyond that, success calls for the consistent application of such competences at every stage — beginning with research, and extending all the way through development, production and final testing.

No GPE company is limited by the boundaries of its own specialties. The basic GPE operating policy, GPE Coordinated Precision Technology, places at the command of each company in the group all GPE research, development and production

facilities, and the skills and experience of the more than 2500 GPE technical men working in depth in the wide range of advanced capacities indicated in the chart above.

Behind each group working on a specific problem in one GPE company stands the whole group of GPE scientists, engineers and technicians with the answers — or the knowledge that will find the answers — to questions underlying and related to that problem. To the customers of GPE Companies this means that the concept and development of equipment, components and systems are not restricted or distorted by traditional allegiance to specific competences.

The five systems illustrated, while products of different GPE companies, are all examples of the consistent application of balanced competences, achieved through GPE coordination. For brochure describing GPE Coordinated Precision Technology and the work of the GPE Companies, or help on a specific problem, write: General Precision Equipment Corporation, 92 Gold Street, New York 38, N. Y.

GENERAL PRECISION EQUIPMENT CORPORATION

THE GPE
PRODUCING
COMPANIES

① KEARFOTT COMPANY, INC. ② INTERNATIONAL PROJECTOR CORPORATION ③ BLUDWORTH MARINE
④ GENERAL PRECISION LABORATORY INCORPORATED ⑤ THE GRISCOM-RUSSELL COMPANY ⑥ LINK AVIATION, INC.
⑦ SHAND AND JURIS CO. ⑧ THE HERTNER ELECTRIC COMPANY ⑨ THE STRONG ELECTRIC CORPORATION
⑩ J. E. MCAULEY MFG. CO. ⑪ ASKANIA REGULATOR COMPANY ⑫ AMPRO CORPORATION ⑬ LIBRASCOPE, INCORPORATED

△ Wide-Band Preampifier Usable With Any Oscillograph

This new self-contained, wide-band differential preampifier 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 preampifier 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 ➤

Transitron

SILICON DIODES

HIGH CONDUCTANCE

RATINGS AT 150° C

Type	Maximum Average Forward Current ma	Continuous Inverse Operating Voltage Volts D.C.	Minimum Saturation Voltage Volts
IN484B	50	130	150
IN486A	50	225	250
IN488A	50	380	420
IN457	25	60	70
IN458	25	120	135
IN459	25	180	180

HIGH FREQUENCY

SPECIFICATIONS AT 125° C

Type	Forward Current At + 1 V ma	Inverse Current At Specified Voltage µa at Volts	Maximum Operating Voltage Volts D.C.
IN252	10	10 @ - 5	20
IN251	5	10 @ - 10	30
S9G	2	10 @ - 20	40

Typical Shunt Capacitance: 0.8 uufd
Typical Pulse Recovery time: 0.15 usec
Operating Frequency Range: 0-1000 mc

Write for Bulletin TE-1350

THE PROVEN PERFORMANCE of Transitron's silicon rectifiers and diodes has led to their widespread use in critical high temperature applications. The large number of types available allows optimum design for any given circuit.

For low level power supply or magnetic amplifier service, the subminiature diodes or miniature rectifiers are recommended. For higher power requirements, the stud-mounted rectifiers provide up to 30 KW.

SILICON RECTIFIERS

UP TO 35 AMPS AT 150° C

RATINGS AT 150° C

	Maximum Average Forward Current Amps	Peak Recurrent Inverse Voltage Volts	RMS Inverse Voltage Volts
Miniature (Pig Tail Leads)			
TJ10A	0.2	100	70
TJ20A	0.2	200	140
TJ40A	0.2	400	280
Military Types			
IN253*	1.0	100	70
IN254*	0.4	200	140
IN255*	0.4	400	280
IN256*	0.2	600	420
Medium Power Types			
IN249A	20	100	70
IN250A	20	200	140
TR352	20	350	250
High Power Types			
IN412A	35	100	70
IN413A	35	200	140
TT352	35	350	250

* JAN types Rated at 135° C

Write for Bulletin TE-1351

WESCON SHOW
BOOTH 903

Transitron

electronic corporation • melrose 76, massachusetts



Germanium Diodes

Transistors

Silicon Diodes

Silicon Rectifiers

T

TRIPLETT

Reliability... through 15,631 accepted types



Clear plastic (PL) meters feature;

- Longer scale length
- Visibility unlimited
- Light unobstructed—no shadows
- Interchangeability—universal
- Appearance revolutionized

UNIQUE FEATURES AND CHARACTERISTICS

These guarantee superior quality in *all* TRIPLETT meters:

- High torque to weight ratio for extra rugged movement. Specially developed bearings withstand severe vibration and reduce friction to a minimum.
- Bearings are microscopically graded not only for depth and radius, but also for *polish*. Only best quality jewels are used.
- Unique hardening method assures uniformly hard pivots.
- High flux scientifically aged alnico magnets for greatest permeability. Micrometrically balanced all metal frame construction protects bearings against vibration from any direction.

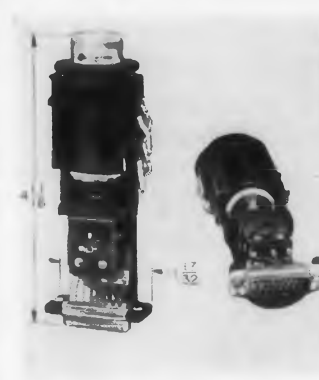
- Simplicity of frame construction assures easy, accurate alignment in servicing.
- Dials are all metal—no paper dials are ever used—will not become abrasive, warp, crack or discolor under normal conditions. (Printing presses in Triplet's own plant allow fast, inexpensive service on special dial requirements.)
- Extra strong ribbed pointers precisely balanced with triple "slide and lock" adjusting weights.
- Insulations provide extra allowance for breakdown voltages.
- All metal parts processed, all molded parts pre-cured to eliminate distortions from stresses and strains.

TRIPLETT ELECTRICAL INSTRUMENT COMPANY • 52 years of experience • BLUFFTON, OHIO

Triplet design and development facilities are available for your special requirements for meters and test equipment.

CIRCLE 65 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Pushbutton Switch Lights In 3 Different Colors



This is a new, indicating push button 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 cir-

cuits, 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 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

ELECTRONIC DESIGN • August 1, 1950

△ 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

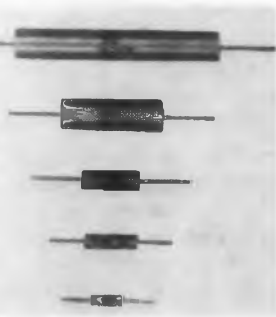
has a cast aluminum housing and is tropicalized against humidity and fungus. A gear train reduces shaft speed from 7344 to 1836rpm.

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.

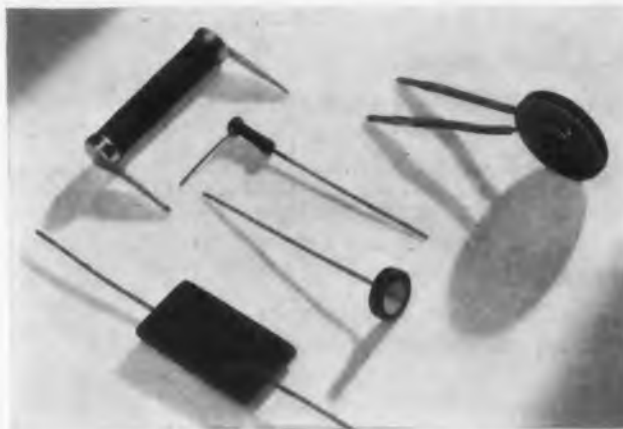
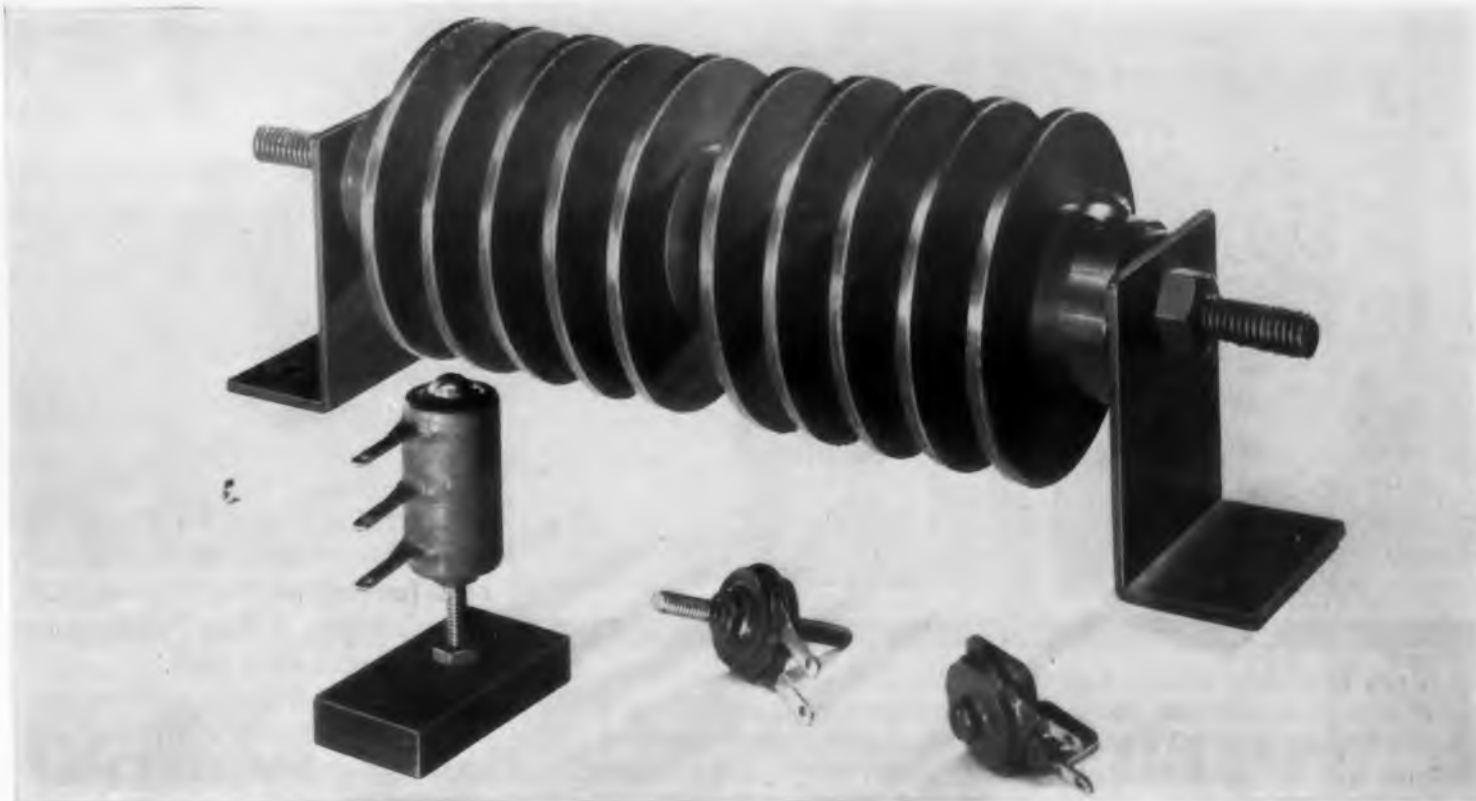
Molded deposited carbon and molded boron carbon resistors are particularly suited for applications where unmolded units cannot be used due to the risk of mechanical damage to their coating, insulation breakdown or moisture change. They are recommended for computer and amplifier circuits requiring superior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

Q • Where can I get **CUSTOM-ENGINEERED** resistors
 • for my circuit... **IN A HURRY?**

A: **GLOBAR® Ceramic Resistors**
 Thermistors • Varistors • Fixed Non-Inductive Resistors
 by **CARBORUNDUM**
REGISTERED TRADE MARK



COMPLETE ASSEMBLIES... like these recent designs... are engineered by Globar resistor specialists to meet the particular electrical, thermal and packaging requirements of *your* circuit.

SPECIAL TERMINATIONS can be designed for Globar Thermistors and Varistors of any size and shape.

GIVE US YOUR PROBLEM... whenever you require single or multiple resistor assemblies, or special resistor terminations. You'll get prompt attention from competent, experienced engineers, plus Globar's flexible manufacturing facilities to meet your tightest delivery schedules for *production quantities*.

A GLOBAR DIVISION Sales Engineer will be glad to discuss your application. Or send details of your problem direct. Write Globar Division, The Carborundum Company, Dept. ED87-629, Niagara Falls, N. Y.

Globar Ceramic Resistors
 by **CARBORUNDUM**
REGISTERED TRADE MARK

CIRCLE 70 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 AB₁ 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-AB₁ 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 AB₁ 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 μ mhos

A COMPLETE LINE OF HIGH-EFFICIENCY POWER TUBES

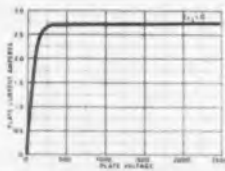


Plate current curve at zero grid voltage shows why the PL-172 gives high power gain and operates efficiently at low voltages.

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 as 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

**HOLTZER
-CABOT**



R-24 Motor

**Synchronous and
Induction Capacitor
Type Motors**



R-25 Motor

R-24. Typical applications for this reversible, 4-pole induction motor are in servo mechanisms, as a balancing motor in recording instruments or as a control motor for voltage regulators. It has low rotor inertia for fast response applications. When operated 2 phase, it can be controlled electronically; or operated single phase as a permanent split capacitor motor.

R-25. Typical uses are for recording instruments, dictating and adding machines. Approximately 2 1/2" in diameter, it is available in either induction or synchronous construction with reversible rotation.

Both the R-24 and R-25 are available with gear case speeds from 1/2 to 3600 RPM, torque ratings up to 75 oz. inches or higher, and single phase, 2 or 3 phase.



**HOLTZER-CABOT MOTOR DIVISION
NATIONAL PNEUMATIC CO., INC.**

125 Amory Street, Boston 19, Mass.

GENTLEMEN: Please send me data sheets on the Holtzer-Cabot R-24 and R-25 Size Motors.

Please have representative call _____ (date)

Name _____

Company _____

Street _____

City _____ Zone _____ State _____

CIRCLE 74 ON READER-SERVICE CARD

△ 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 expectancy of more than one billion readings.

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

It has automatic polarity indication; gives three complete readings per second. Absolution accuracy: $\pm .01\%$ of value read or \pm 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.

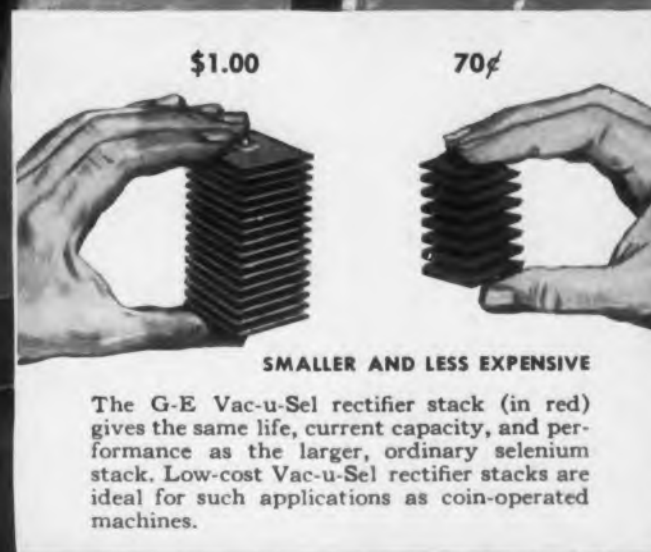
Exceptionally smooth surfaces make these cores ideal for use in ink and metal film resistors—a great advantage for even and uniform application of such finishes.

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. & Mfgs. Rd., Chattanooga 5, Tenn.

CIRCLE 76 ON READER-SERVICE CARD

CIRCLE 77 ON READER-SERVICE CARD ▶



DESIGNED TO HELP YOU MEET PRICE COMPETITION . . .

G-E *Vac-u-Sel** Rectifiers Cost You Up to 30% Less

Here is a component rectifier stack that will out-perform ordinary selenium stacks, and yet cost you up to 30% less!

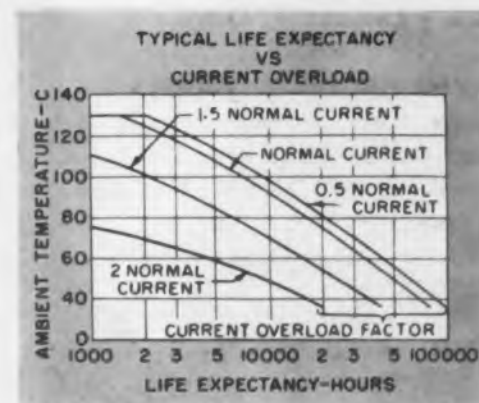
INITIAL COST IS OFTEN 30% LOWER: G-E Vac-u-Sel rectifiers can be made up to 30% smaller for any given application, due to the greater current-carrying capacity of the individual cells. Smaller size means a lower cost to you. These cells are produced by a unique G-E sphere-type vacuum-evaporation process that enables us to accurately predict the output and life characteristics of any model number. We are thus able to give you a stack with the exact life you require. You don't pay for more life than you need.

PICK THE LIFE YOU WANT: You can select a Vac-u-Sel rectifier that will last up

to 80,000 hours—or more. But if your application calls for shorter life, we can give you a smaller, less expensive stack, which operates at greater than normal-rated current. You will find that even when overrated these top-quality G-E Vac-u-Sel rectifier stacks will perform with greater predictability than ordinary selenium. So, by tailoring each stack to meet your exact requirements, you receive the benefit of top quality at lower cost.

Contact your G-E Apparatus Sales Office, or write for Bulletin GEA-6273 to: Section 461-41, General Electric Co., Schenectady 5, N. Y.

* Vac-u-Sel is a trade-mark of the General Electric Co. It designates top-quality selenium rectifier cells manufactured by a unique sphere-type vacuum-evaporation process by the Rectifier Department, Lynn, Mass., headquarters for silicon, germanium, selenium, and copper-oxide component rectifiers.



LONG LIFE is provided by G-E Vac-u-Sel rectifier stacks—even at high operating ambients and better than normal-rated current.

Progress Is Our Most Important Product

GENERAL  ELECTRIC



- A**
- Advertising Age
Advertising Agency Magazine
Aero Digest
Aeronautical Engineering Review
Agricultural Chemicals
Agricultural Engineering
Agricultural Leaders' Digest
Air Conditioning and Refrigeration News
Air Conditioning, Heating and Ventilating
Air Transportation
American Artisan
American Automobile (The)
American Aviation
American Boxmaker
American Brewer
American Builder
American Business
American City (The)
American Druggist
American Drycleaner
American Egg & Poultry Review
American Engineer
American Exporter
American Exporter Industrial
American Exporter's Automotive World
American Funeral Director
American Fur Breeder
American Gas Journal
American Hairdresser and Beauty Culture
American Journal of Gastroenterology
American Journal of Medicine
American Journal of Nursing
American Journal of Proctology (The)
American Laundry Digest
American Lumberman
American Machinist
American Milk Review
American Motel Magazine
American Paint & Wallpaper Dealer
American Painter & Decorator
American Paint Journal
American Paper Merchant
American Perfumer
American Practitioner
American Press (The)
American Printer and Lithographer
American Professional Pharmacist
American Restaurant Magazine
American Roofer & Siding Contractor
American Shoemaking
American Soft Drink Journal
America's Textile Reporter
Analytical Chemistry
Appliance Manufacturer
Applied Hydraulics
Architectural Forum
Architectural Record
Arizona Beverage Journal
Arizona Builder & Contractor
Arizona Grocers
Army-Navy-Air Force Journal
Army-Navy-Air Force Register
A.S.T.A. Journal (The)
A.S.T.A. Travel News
Audio
Automatic Control
Automatic Machining
Automation
Automotive Chain Store
Automotive Industries
Automotive News
Aviation Age
Aviation Week
- B**
- Bakers Review
Bakers Weekly
Baking Industry
Bankers Monthly
Banking
Bar Management
Beer Distributor
Better Farming Methods
Better Maintenance
Better Roads
Beverage Bulletin & California Beverage Guide
Beverage Dealer & Tavern News
Beverage Industry News
Beverage Media
Beverage Retailer Weekly
Beverage Times
Blast Furnace and Steel Plant
Boat & Equipment News
Boating Industry
Boot and Shoe Recorder
Bottling Industry
Boxboard Containers
Boxoffice
Brake & Front End Service
Brewers Digest
Brewers Journal
Brick and Clay Record
Buckeye Tavern Buildings
Building Specialties
Building Supply News
Burroughs Clearing House
Business Education World
- C**
- Business Publication Rates and Data
Bus Transportation
Butane-Propane News
Buyers Purchasing Digest
- D**
- California Oil World
California Stylist
Caminos Y Construcción Pesada
Candy Industry
Canner & Freezer (The)
Canning Trade
Casket and Sunnyside
Catholic Building & Maintenance
Catholic School Journal (The)
Ceramic Industry
Chain Store Age
Chemical and Engineering News
Chemical Engineering
Chemical Engineering Progress
Chemical Processing
Chemical Week
Chicago Electrical News
Civil Engineering
Cleaning Laundry World
Club Management
Coal Age
Coin Machine Journal
College and University Business
Combustion
Commercial Bulletin
Commercial Car Journal
Commercial Refrigeration & Air Conditioning
Compressed Air Magazine
Concrete
Concrete Manufacturer
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
Constructioner
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
Grocery 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
- E**
- 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
- F**
- Explosives Engineer
Export Buyer (The)
Export Trade and Shipper
- G**
- 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
Fuel Oil & Oil Heat
Fuel Oil News
Furniture Age
Furniture Manufacturer
Furniture News
Furniture Production
Furniture Retailer
- H**
- 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
Goldform
GP
Grain & Feed Review (The)
Graphic Arts Monthly
Grocer-Graphic
- I**
- 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
- J**
- Ice Cream Field
Ice Cream Review (The)
Ice Cream Trade Journal (The)
Illinois Beverage Journal
Implement & Tractor
Implements 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
- K**
- 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)
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 Domestic
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)
- N**
- 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)
- O**
- 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
- P**
- 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
- Q**
- 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)
- R**
- 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 News
- S**
- Qualified Contractor
Quick Frozen Foods
- T**
- 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
- U**
- 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
- V**
- 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
- W**
- 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
- X**
- Underwriters' Report
Underwriters Review
Upholstering
Utilization
- Y**
- Variety Store Merchandiser
Vend
Veneers & Plywood
Voluntary & Cooperative Groups Magazine
- Z**
- 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
- 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 sub-miniature 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 $\pm 5\%$, lower tolerances to $\pm 1\%$ 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

ew



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)

ew



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 μ mhos
- plate voltage —12.6 volts
- heater voltage —12.6 volts

CIRCLE 83 ON READER-SERVICE CARD FOR MORE INFORMATION

low distortion*

pack for

HYBRID AUTO RADIO

**combined engineering forces produce new power transistor
and detector-driver tube—full line of 12-volt tube types
completes auto radio complement.**

SYLVANIA, in close co-operation with leading auto radio manufacturers, has just completed a full-time joint engineering project to develop a transistor-tube "power pack" for new hybrid auto radio designs.

Result of this combined engineering program is a new power transistor and the type 12J8 detector-driver tube especially designed to produce high current at low plate voltage for optimum power coupling to the output transistor.

Other important power transistor features include a heliarc-weld hermetic seal for ruggedness and a storage temperature of 85° C to eliminate heat problems under inoperative conditions.

Sylvania also offers a full line of 12-volt tubes to complete auto radio complements.

Designers of transistorized equipment will find Sylvania's new transistor highly useful in all power applications calling for a maximum collector dissipation of 10 watts.

Engineering Sample Offer

Sylvania will honor all bona-fide requests for engineering samples of the new hybrid "power pack" including the new power transistor and driver tube 12J8, plus samples or information on 12-volt types to complete your auto radio complement.

For samples of the power transistor for use in other applications, write on your company letterhead indicating your intended use.



SYLVANIA®

SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway, New York 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd.
University Tower Bldg., Montreal

LIGHTING • RADIO • TELEVISION • ELECTRONICS • ATOMIC ENERGY
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 50µmf.

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.

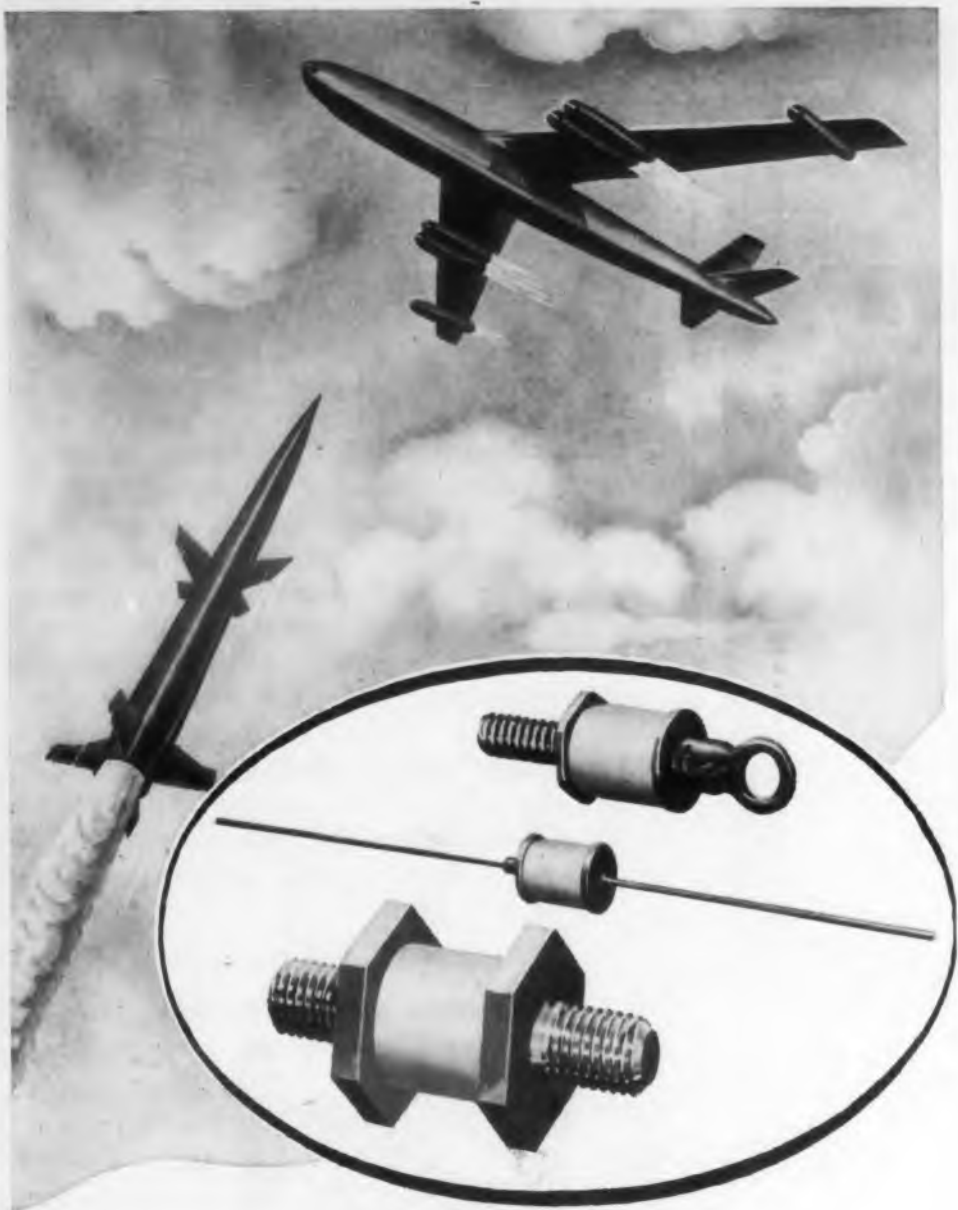
When mounted, the drive motor may be disengaged from the dial for manual operation of the instrument with a direct-coupled knob on the dial drive. This knob is also used to rotate a friction coupling to center the potentiometer about any dial setting.

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?"



**SILICON
POWER
RECTIFIERS**

Sarkes Tarzian, Inc., RECTIFIER DIVISION
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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 $\pm 2\%$ under normal conditions including warm-up and tube aging. Frequency response is ± 1 db 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.

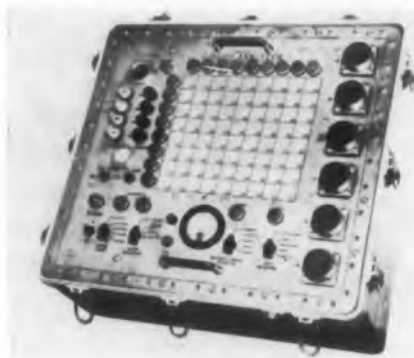
Hewlett-Packard Co., Dept. ED, 275 Page Mill Rd., Palo Alto, Calif.

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 water-

proof, 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

GUDEMAN

NEW MINIATURE FEED-THRU CAPACITORS

Paper Dielectric — Hermetically Sealed
Gudeman Impregnant #257
Types 271 and 272



The Gudeman Feed-Thru Capacitor, Types 271 and 272, is a three-terminal component designed to be used for R.F. Interference suppression in a manner similar to a low pass filter. The typical insertion loss characteristics for these Feed-Thru Capacitors when measured in a 50 ohm line are in accordance with MIL-Standard 220.

The internal construction of these Feed-Thru Capacitors is designed so as to minimize the inherent inductance; therefore, these units perform functionally as nearly as possible to an ideal capacitor.

NEW RADIO INTERFERENCE FILTERS



- Screw neck mounting
- Hermetically sealed tubular construction
- Glass compression or ceramic solder seal terminals
- High insertion loss from .15 to 1000 MC
- Ratings range from 1 to 20 amps at 125 V.A.C. (0-400 cycles) or 400 V.D.C.
- Operating temperature range: -55° C. to $+85^{\circ}$ C.

THE **GUDEMAN** CO.

340 W. Huron, Chicago 10

CIRCLE 90 ON READER-SERVICE CARD

GUDEMAN

NEW "XC" PLASTIC FILM DIELECTRIC CAPACITORS

Hermetically Sealed (Glass to Metal) Tubular Cased



The development of the Gudeman "XC" capacitors results in a new line of high temperature capacitors that has exceptionally high insulation resistance, low power factor and low dielectric absorption. The case sizes were selected whereby no voltage derating is required when the capacitors are used within a temperature range from -65°C . to $+165^{\circ}\text{C}$.

The Gudeman "XC" capacitors as shown are hermetically sealed, tubular, oil filled (Gudeman Impregnant #258), plastic film dielectric. Other case styles such as bathtub and rectangular types are available.

NEW MINIATURE DRY ELECTROLYTICS



- Gudeman "EMM" Type
- Size Range $3/16''$ to $3/8''$
Diameter— $1/2''$ to $1''$ Long
- Capacity Range: 1 MFD to 100 MFD
- Voltage Range: 3 V.D.C. to 50 V.D.C.
- Operating Temperature: 65°C .
- Hermetically Sealed
- 99.99% Purity Foil
- Low Leakage Current
- Low Equivalent Series Resistance

THE **GUDEMAN** CO.

340 W. Huron, Chicago 10

CIRCLE 92 ON READER-SERVICE CARD

△ 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



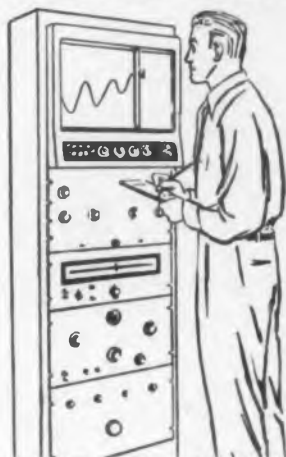
MODEL 2



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

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

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.

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409 N. Fair Oaks Ave., Pasadena, California

CIRCLE 95 ON READER-SERVICE CARD FOR MORE INFORMATION



PERHAPS WE'LL HAVE TO ADD A PINCH, FOR YOU . . .

Just ask us for an alloy we haven't got — we'll be delighted.

Because that's how each of the more than 112 resistance and electronic alloys Driver-Harris makes had its beginning. Each of these highly specialized alloys is custom-made — produced exactly to the specifications of our customers.

The physical and chemical properties of an electrical resistance alloy can be altered greatly by a minute difference in its constituents. Often just a few ounces to the ton can make the difference you need.

One thing you can always rely on in any Driver-Harris alloy: it is made to the most precise metallurgical checks and controls known to the industry. It is these exclusive quality controls that have made Nichrome V and Nichrome* the standard for over 50 years by which all other electrical resistance alloys are measured.

Perhaps in a sense Nichrome is *too* well known. For we don't want people to forget that we make many other resistance alloys of sustained high quality to meet other special needs. And that, as we said at the outset, our engineers will be more than delighted to start afresh tomorrow to devise a new one, custom-made for you. Just tell us as exactly as you can what you wish to accomplish.



NICHROME V and NICHROME
are manufactured only by

**Driver-Harris
Company**

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Louisville,
Los Angeles, San Francisco

In Canada: The B. GREENING WIRE COMPANY, Ltd.,
Hamilton, Ontario.

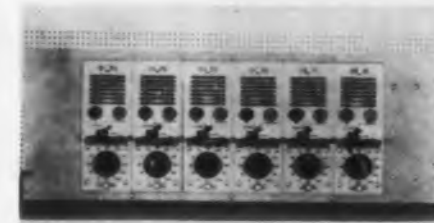
*T. M. Reg. U. S. Pat. Off.

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CIRCLE 97 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Decade Amplifier

Gain Accuracy $\pm 1\%$ 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 volt-

tage 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— $\pm 1\%$ d-c; input impedance—100,000 ohms; capability at d-c —0 to ± 25 v with load impedance greater than 1000 ohms; output impedance—less than 1 ohm in series with 25 μ h; 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. To-

gether with forward current ratings up to 200ma, these units have inverse current of less than 0.25 μ amp 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

ELECTRONIC WEEK

Vol. 1 No. 5

announcing a new
publication serving
MANAGEMENT
in the electronic
industries

ELECTRONIC NEWS . . . Business
. . . Finance . . . Marketing . . . Labor
. . . Washington Report . . . International
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“.. 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 programming 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 counter-clockwise rotation can be made with this single, direct-reading instru-

ment. 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 $\pm 5\%$ 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

ATLAS helps put

TRAFFIC LANES IN THE AIR



with TACAN ANTENNA BASE PEDESTAL ASSEMBLY

● Whether a jet searching for its carrier base . . . or a commercial liner flying an intercity run, TACAN, developed for the United States Navy and Air Force by Federal Telecommunication Laboratories, and manufactured by Federal Telephone and Radio Company, both divisions of the International Telephone and Telegraph Corporation, provides super accurate radio high-ways.

The antenna base pedestal contains equipment which rotates and stabilizes the radiating portion of the antenna, and, in addition, supplies pulses which affect the radiated pattern. These units are part of the equipment precisioneered by Atlas, as well as other electro-mechanical assemblies.

From pilot stage to production efficiency Atlas furnishes the practical engineering and facilities between the idea and finished product. Atlas production facilities, engineering service, toolmakers and mechanics offer you one source of electro-mechanical assemblies. Write for new facilities catalog to Atlas Precision Products Co., Phila. 24, Pa.

FROM DRAWING
BOARD TO
PRODUCTION LINE



ATLAS
Precision Products

CIRCLE 107 ON READER-SERVICE CARD

HYCOR
Miniature
MAGNETIC CLUTCHES



Only 1 watt of power required...

to develop 15 oz. in. of torque with a response time of 5 milliseconds. Only two moving parts which eliminate all maintenance problems.

Minimum dimensions (only 1" o.d.) facilitate their use in compact assemblies. Extremely low cost enables designers to utilize the benefits of multiple clutching in inexpensive electronic equipment.

Send for
Bulletin C-1
for complete details

Hycor's systems engineers will be pleased to assist in special design applications.

Representatives in principal cities

HYCOR

DIVISION OF INTERNATIONAL RESISTANCE COMPANY
12970 Bradley Avenue, Sylmar 4, Calif.

CIRCLE 109 ON READER-SERVICE CARD

△ 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 10.8μmfd.

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.
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CIRCLE 112 ON READER-SERVICE CARD FOR MORE INFORMATION

made for TOUGH duty



TEXAS INSTRUMENTS

HERMETICALLY SEALED RESISTORS

PRECISION DEPOSITED CARBON TYPE

Built for hard service far exceeding MIL-R-10509A specifications . . . with $\pm 1\%$ 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.

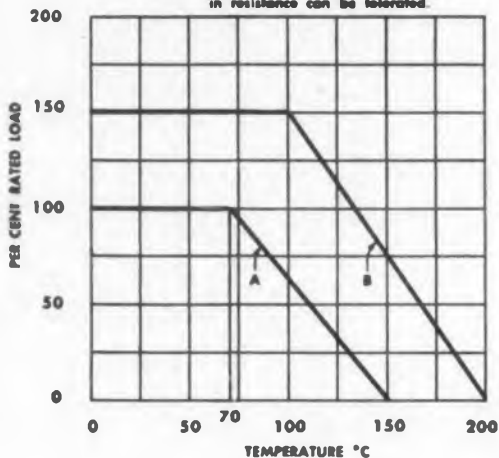
Mass-produced to the same exacting tolerance and quality standards, Texas Instruments Industrial Line and MIL-Line deposited carbon resistors provide exceptional accuracy and reliability throughout a wide range of applications. For *increased* reliability — at economical prices — design with TI precision resistors. All three types are available in five sizes from $\frac{1}{2}$ watt to 2 watts . . . with resistance values from 25 ohms to 30 megohms.

FOR COMPLETE DATA, WRITE
FOR BULLETIN DL-C 539

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.



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



CORROSION

WITH

RHODIUM PLATING

—and be sure it's a BAKER SOLUTION!

Yes . . . the problem of better electrical contact performance is easily solved . . . with Rhodium-plated contacts. Rhodium protects permanently against corrosion . . . provides hard, oxide-free contact surface . . . low, stable contact resistance . . . permits higher pressures, provides low noise level in moving contacts . . . and it wears longer! For uniformly ideal results . . . make sure it's BAKER Rhodium Plating Solution.

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booklet on
Rhodium Plating
and its
advantages.



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ENGELHARD INDUSTRIES

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facilitate
the design
of advanced
computer and
radar systems
with **ESC's**
Continuously
Variable
Delay Lines

OPERATION:

A single control shaft covers, in ten turns, the entire delay range from zero to your selected maximum delay. Resolution is better than .001 usec. Write for complete data covering our special design service.



ESC

CORPORATION

536 Bergen Boulevard
Palisades Park, N. J.

CIRCLE 119 ON READER-SERVICE CARD

△ 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 $+71^{\circ}\text{C}$.

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 threshold controls permitting adjustment of trigger levels at any voltage from -50 to $+50\text{v}$ with the resolution of 70mv; frequency range from 0 to 100,000cps; period measurement range from 10 μsec to 100,000sec; time interval range from 10 μsec 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 20A

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 20A TIME-FUNCTION TRANSLATOR. The 20A 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 20A fills a long recognized need in electronic measurement.

Write for complete information and detailed specifications on the Model 20A 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: 1/2 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 millise. steps, 0.001 to 100 sec. in 1 millise. 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 8 3/4" H x 13 1/2" D
Weight:	35 lbs. net.
Finish:	Panel: Light grey baked enamel Case: Dark grey baked enamel <i>Data Subject to Change Without Notice</i>

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



Computer-Measurements Corporation

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

CIRCLE 122 ON READER-SERVICE CARD FOR MORE INFORMATION



TORRINGTON

can make your
small precision
metal parts

**faster, better
and for less**

*than you can make them
or buy them elsewhere!*

These are typical of parts that Torrington produces daily by the hundreds or millions. If you use similar small precision parts, mail the coupon today for the Torrington Small Precision Parts condensed catalog. Even better, send a sketch, blueprint or sample part. We will give you a prompt quotation which will mean substantial savings to you.

Please send the Torrington Small Precision Parts condensed catalog
 Please have a salesman call

Name _____

Title _____

Company _____

Address _____

City _____ Zone _____ State _____



THE TORRINGTON COMPANY
Specialties Division
37 Field Street, Torrington, Conn.

TORRINGTON SPECIAL METAL PARTS

Makers of Torrington Needle Bearings

CIRCLE 124 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 instru-

ment 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.

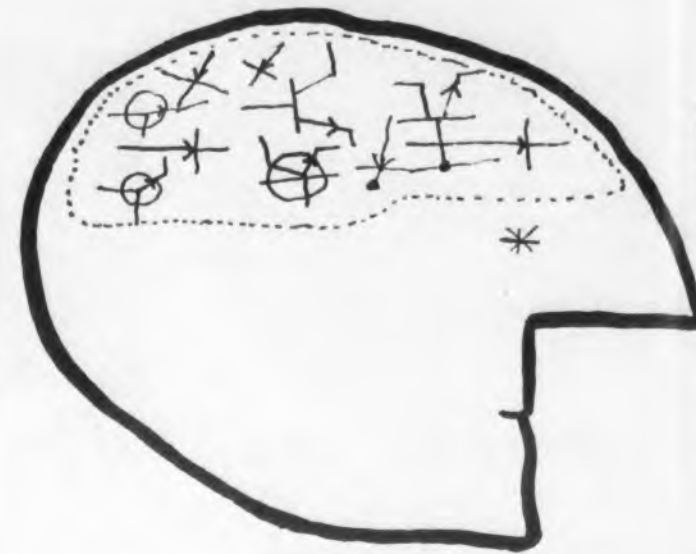
The precision machining removes adjustment problems by assuring complete interchangeability of heads, the elimination of any potting compound at the head surface prevents oxide build up, and the use of a laminated core consisting of strips of a special alloy 0.002" in thickness results in greater efficiency.

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

TRANSISTORS ON THE BRAIN?



Then you need **REGULATED DC POWER SUPPLIES**

especially designed for the testing and development of transistor circuits. UE models



keep several jumps ahead of the field with transistor power supplies from

0-100 Ma, 0-100 V to higher current

lower voltage models, 0-2 Amps, 0-100 V.

For complete details write for descriptive literature.

UNIVERSAL ELECTRONICS COMPANY

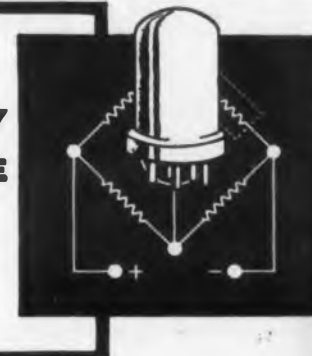
1720 Twenty-Second Street, Santa Monica, California

Representatives in principal cities, U. S. and Canada

CIRCLE 127 ON READER-SERVICE CARD FOR MORE INFORMATION

Null Detector Relay

**SOLVES MANY
TEMPERATURE
CONTROL
PROBLEMS**



An Edison Sensitive D. C. Relay and an ordinary bridge circuit are versatile tools in solving temperature control problems.

In the bridge shown assume the dotted resistor to be a resistance temperature detector and the other resistors adjusted so that the bridge will reverse current flow through the relay at a given temperature. The polarized relay will sense the reverse current flow to close (or open) its contacts at the null point.

This circuit is useful in temperature warning systems since the relay automatically reopens when the current reverses again—to actuate an "all clear" signal.

The Edison Relay is reliable at values from 30 microamperes to 12 milliamperes. Overloads to 10,000 X coil input power are absorbed without damage. Contacts are rated at 1/2 ampere at 28 volts d.c. in SPST or SPDT arrangement.

For full information send for free bulletin, No. 3037

Thomas A. Edison

A GREAT NAME CONTINUES GREAT NEW ACHIEVEMENTS

Thomas A. Edison

INCORPORATED

INSTRUMENT DIVISION • 55 LAKESIDE AVENUE • WEST ORANGE, NEW JERSEY

CIRCLE 128 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.

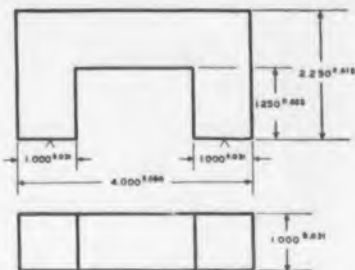
They are available in 7 or 9-pin miniature and in 8-pin octal types.

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



HIGHER EFFICIENCY H-F POWER TRANSFORMERS



THIS IS A TYPICAL FERROXCUBE
MAGNETIC CORE DESIGN

Smaller, lighter and less costly H-F power transformers of outstanding efficiency are being designed around Ferroxcube magnetic cores. The unique advantages of Ferroxcube are particularly marked in transformers required to handle up to 2 kilowatts of power in the frequency range from 2 kilocycles to 2 megacycles.

Ferroxcube-cored transformers are being used successfully in ap-

plications as diverse as ultrasonic power generators and rectifier power packs operating from an aircraft's normal a-c supply. In the latter application, the low leakage field of Ferroxcube eliminates the need for external shielding—for further reduction in transformer size and weight.

Ferroxcube cores are designed and produced to specifications. Our engineering department offers a complete, prompt service to assist in the design of Ferroxcube cores for specific applications. Your inquiry will receive immediate attention. ★ ★ ★ ★ ★



FERROXCUBE CORPORATION OF AMERICA

• A Joint Affiliate of Sprague Electric Co. and Philips Industries, Managed by Sprague •

347 BRIDGE STREET • SAUGERTIES, NEW YORK

CIRCLE 131 ON READER-SERVICE CARD FOR MORE INFORMATION

△ Wire Wound Potentiometer Operates From -55 To 150°C

The X-500 is a sub-miniature 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 $\pm 0.3\%$ 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

956 ELECTRONIC DESIGN • August 1, 1956

problem:

who can make rubber parts with close tolerances consistent from piece to piece?

answer:

minnesota rubber and gasket company

evidence:

Rubber bellows for a widely used ALLEN-BRADLEY pneumatic timing relay. Size: approx. 1 1/2" dia., 3/4" high. Convolution wall thickness: .015 ± .002. Metal insert molded into base. Base has flash-free O-ring sealing surface. Produced of Buna N and silicone compounds. Bellows must be of correct thickness and flexibility—and absolutely free of pin holes—or timing accuracy is lost. M.R.'s exclusive injection molding process keeps tolerances at .015 ± .002 consistent from piece to piece and wall thickness constant within each piece. Injection molding securely bonds metal to rubber—as well as keeping all sealing surfaces free of flash and trimming blemishes. M.R.'s 100% quality control makes sure every part is delivered free of pin holes. M.R. can give you the same fine service also. And at low cost!

FREE SAMPLES: Custom molded rubber parts. Silicone rubber. Kel-F elastomer. Rubber bonded to metal. Seals. Sub-miniature rubber parts. What is your rubber problem?

minnesota rubber and gasket company *Originators of modern rubber injection molding*

Dept. 306 • 3630 Wooddale Avenue, Minneapolis 16, Minn. • Phone WEst 9-6781

CIRCLE 132 ON READER-SERVICE CARD FOR MORE INFORMATION

where you need

- performance that's

- over-all size that's **small**

big

- think first of LEACH relays

Yes, we offer miniaturization, all right . . . for example, our new *System Designed Avionic Relays* require only a fraction of the space needed by round cans. A designer's dream right there . . . but that's not all. In achieving such space saving—vital in today's electronic, aircraft and missile circuits—we haven't sacrificed a single bit of Leach's famous reliability; you can still stake your system's success on a Leach relay.

Our offer is this: buy any of the new *System Designed Relays* (or any other Leach unit, simple or complex), and *test it* against any similar relay on the market. You'll learn in your own laboratory why the electronic and electrical industries have learned to specify Leach when system reliability is a must.

System designed relays...Leach's newest line

HERMETIC SEALING . . . every relay checked by mass spectrometer
OPTIONAL LEADS . . . solder terminals, potted leads or plug-in bases
SQUARE CANS . . . 20% more relays can be installed in the space required by round cans
SHOCK RESISTANCE . . . vibration and shock properties exceed the requirements of MIL specs
HIGH TEMPERATURE . . . dependability assured at 120°C ambient

LEACH

The latest Leach Relay Catalog is your best starting point when selecting ANY relay—industrial, electronic or aircraft. SEND FOR YOUR COPY TODAY.

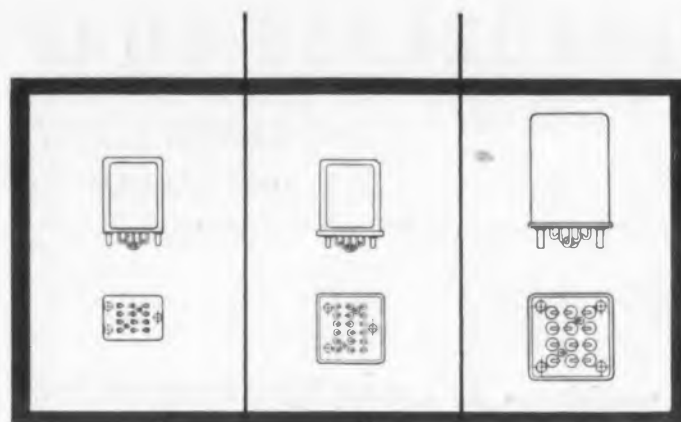
CORPORATION

LEACH RELAY DIVISION

5915 AVALON BLVD., LOS ANGELES 3, CALIFORNIA

DISTRICT OFFICES AND REPRESENTATIVES IN PRINCIPAL CITIES OF U.S. AND CANADA

CIRCLE 134 ON READER-SERVICE CARD FOR MORE INFORMATION



	9220	9226	9230
Contact arrangement	4PDT	6PDT	4PDT
Operating voltage	18-30 VDC	18-30 VDC	18-30 VDC
Contact rating at 28 VDC			
Resistive	5 amp	5 amp	10 amp
Inductive	1.5 amp	1.5 amp	7 amp
Coil resistance	250 ohms	200 ohms	150 ohms
Duty	Continuous	Continuous	Continuous
Weight	.25 lb.	.25 lb.	.5 lb.
Case dimensions, inches	1.3x1x1.7	1.5x1.5x1.7	1.7x1.7x2.6



△ 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.

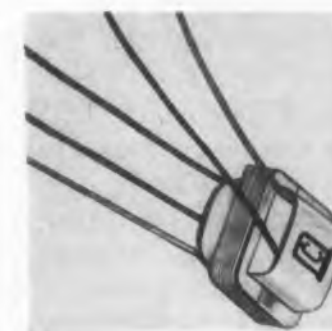
The characteristic impedance is 50 ohms for the model 230 and 46 ohms for the 230B. The slotted line is calibrated in centimeters and millimeters, with vernier reading accurately to 0.1mm. Residual VSWR is under 1.04 from 500 to 4000Mc.

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.

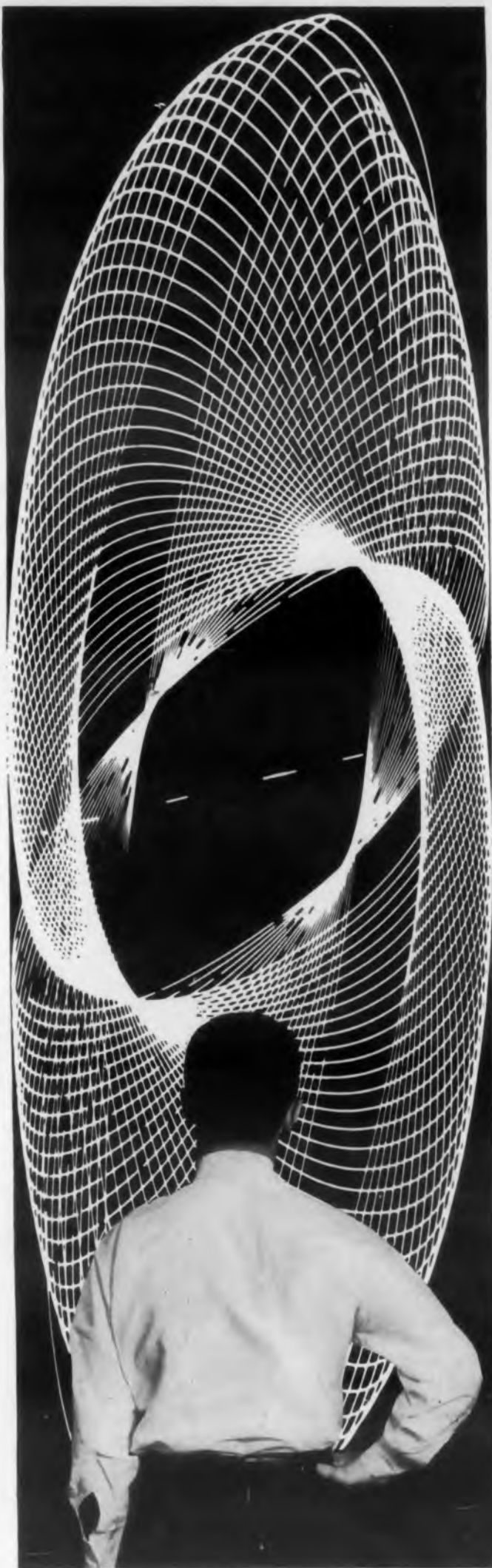
The instrument utilizes cold cathode glow transfer tubes which accomplish both counting and indication.

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



Autonetics salutes the WESTERN JOINT COMPUTER CONFERENCE August 21, 22, 23, 24 Los Angeles, California. See booths 759 & 760.

as an Autonetics

Engineer...

*you can achieve science-fact
far stranger than science-fiction*

Today at AUTONETICS there are elaborate automatic control systems actually being developed, designed and produced in quantity that make the mechanics of the wildest space fantasies look ordinary.

For example, where in the pages of science-fiction is there a robot that compares with AUTONETICS' new airborne digital computer? This 3-cubic-foot brain can solve mathematical problems in one second that would take a math whiz with pencil and paper 9 hours, or require a clothes closet full of ordinary computer equipment. It can continuously integrate 93 quantities simultaneously... through 51 removable panels of etched, transistorized circuitry.

This is only one example of AUTONETICS' far-reaching electro-mechanical technology. There are hundreds of other areas of equally advanced opportunity in missile guidance, flight control, fire control and special automatic controls. Among your tools are the latest data processing equipment, plus modern and complete environmental and flight test facilities. AUTONETICS' scientific leadership is setting the pace in this field with its unique 10-year backlog of know-how.

OPPORTUNITIES FOR:

- Computer Specialists
- Electro-Mechanical Designers
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- Instrumentation Engineers
- Fire Control Systems Engineers
- Flight Control Systems Engineers
- Electronics Research Specialists
- Computer Programmers
- Computer Application Engineers
- Automatic Controls Engineers
- Electronic Engineering Writers
- Inertial Instrument Development Engineers
- Preliminary Analysis and Design Engineers
- Also Openings for Draftsmen and Technicians

CONTACT: Mr. R. C. Smith, AUTONETICS Engineering Personnel Office, Dept. 991-20ED, P.O. Box A.N., Belleflower, California

Autonetics

A DIVISION OF NORTH AMERICAN AVIATION, INC.

AUTOMATIC CONTROLS MAN HAS NEVER BUILT BEFORE

△ **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 10³:1 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.

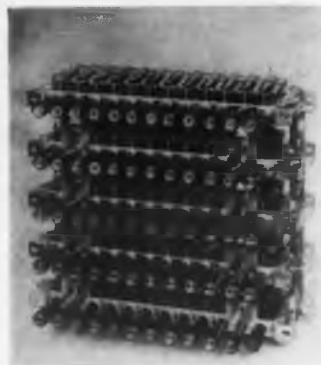
Output stage of the amplifier consists of two H-3 germanium transistors operating in class B push-pull. The amplifier assembly is encapsulated in an epoxy resin. Applications include computers, guided missiles and others where exceptionally accurate servo-mechanisms are required.

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.

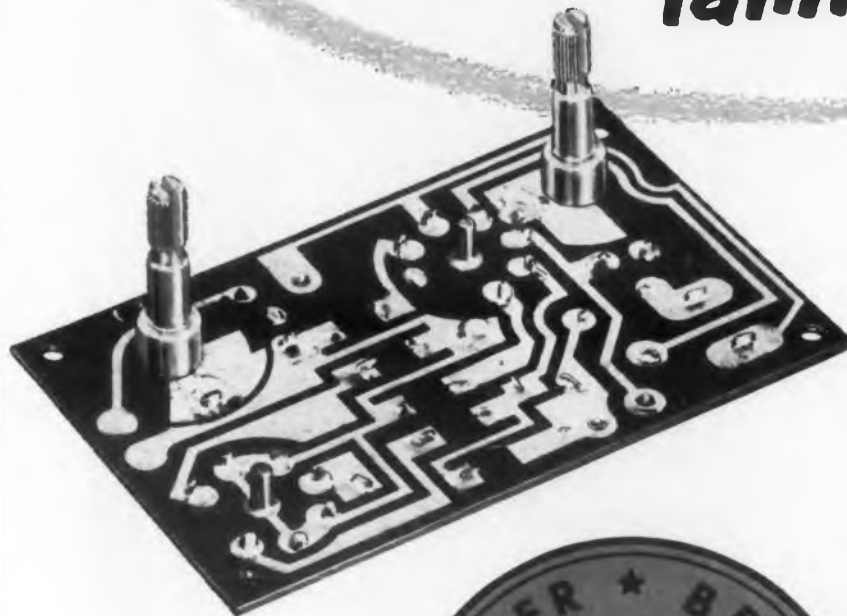
Wescon Show, Booth No. 805.

CIRCLE 143 ON READER-SERVICE CARD FOR MORE INFORMATION

Taylor Fibre Co.

says...

"Using
Revere Rolled Copper
we are able to produce
superior copper-clad
laminates!"



REVERE
COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N.Y.

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

CIRCLE 144 ON READER-SERVICE CARD FOR MORE INFORMATION

At the top of the page opposite is a section of an etched printed circuit enlarged 10 times. These particular lines are of .008 thickness, spaced .012 apart. They show the kind of printed circuits obtainable by combining Revere Rolled Printed Circuit Copper and Taylor laminates. Note the fine line etching, the close spacing and the sharp definition of the edges . . . the smoother surface (freer from pits, pinholes and imperfections) . . . the more uniform thickness with no sacrifice of conductivity. Results—consistently satisfactory etching at better production rates.

Laminators and users alike also have found that Revere Rolled Copper produces no peaks or valleys, that its smooth, hard surface of uniform density permits resist to clean off easily for there are no pores to hold resist and cause trouble when soldering.

They have noted, too, that Revere Rolled Copper is free from oxidation as it comes from the mill and is without lead inclusions. And because of its clean surface, fluxes wet readily, while in the automatic soldering operation it makes possible a uniform solder coat every time free of skips or bald spots.

Those are the very reasons why you should insist that Revere Rolled Copper be used when ordering blanks from your laminator. It is available in unlimited quantities in standard coils of 350 lbs. in widths up to 38" and in .0015 and .0027 gauges, weighing approximately 1 oz. and 2 oz. per square foot. Revere Rolled Copper exceeds requirements of standard specifications and meets ASTM B5 specification for purity with 99.9% minimum.

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.

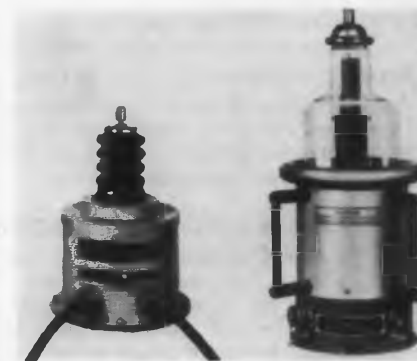
Specifications are: pull in and drop out in the range of 80-150v ($\pm 1-1/2v$); temperature, $-65^{\circ}F$ to $+250^{\circ}F$; frequency, 320cps to 480cps; contact rating, 5amp d-c @ 29v d-c, spdt.

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 $\pm 5\%$



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 μ sec 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 μ fd. Both units are low dissipation capacitance type dividers with an accuracy of $\pm 5\%$.

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...



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 minimum 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

*Clue:



*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: 1 1/4 diameter x 2 1/4 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.

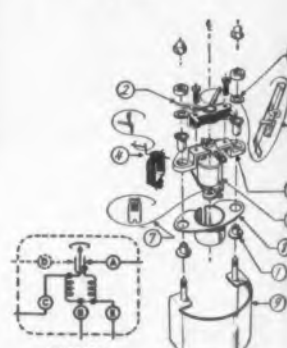
Contacts: SPST or SPDT, 5-25 Ma. D.C. Other ratings to 1/2 Amp. A.C. A locking coil gives high pressure and chatter free contact even under shock and vibration. Prices on the order of \$20-\$80. Delivery 4 to 6 weeks. Assembly Products, Inc., Chesterland 17, Ohio (West Coast: Desert Hot Springs 17, Calif.)

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



Model 266

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



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



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.

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.

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

3 Relay Types by FILTERS, INC.



NEW DPDT SUB-MINIATURE

SHOCK: 50 G
VIBRATION: 10 G at 5 to 2000 CPS
AMB. TEMP.: -65° C to +125° C
MTG. CTRS.: .875
WEIGHT: 1.3 oz.
TYPE: M26FC6

ACTUAL SIZE

NEW LATCHING

SUB-MINIATURE
Magnetically Held—Electrically Reset

2PDT, 4PDT and 6PDT
SHOCK: 50 G
VIBRATION: 10 G at 5 to 500 CPS
TYPE L26F18

Mil. Specifications:
All Made to MIL-R-5757B and MIL-R-25018 (USAF)
DRY CIRCUIT RELAYS AVAILABLE IN PRODUCTION QUANTITIES

ACTUAL SIZE

SUB-MINIATURE 4PDT

SHOCK: 50 G MTG. CTRS.: 1.406
VIBRATION: 10 G at 5 to 500 CPS
DIA.: 1" TYPE 26SR12

SEND FOR FREE CATALOG TODAY
FILTERS, INC.
30 SAGAMORE HILL DRIVE
PORT WASHINGTON, L. I., N. Y.

CANADIAN OFFICE: MJS Electronic Sales, Ltd.
P.O. Box 240, Ajax, Ontario
Tel.: EMpire 8-3806
EXPORT OFFICE: Maurice I. Parisier & Co.
1860 Broadway, N. Y. 23 Tel.: CI 5-5700
Cable Address: MIPARISIER NEW YORK

CIRCLE 157 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

How Fafnir is prepared to meet MIL-STD-206 Standards of Torque Measurement for Instrument Ball Bearings.



NEW AUTOMATIC TORQUE TESTER FOR BALL BEARINGS

This Fafnir-developed torque testing equipment for instrument ball bearings automatically records in a matter of seconds a continuous series of starting torque peaks, from which maximum torque, average torque, and the frequency distribution of successive torque peaks are quickly determined. In addition, the trace distinctly reveals how torque is affected by dirt, race finish, race geometry, load, scratches, nicks, and retainer condition. By providing a multiplicity of readings in a very short span of time, inspection is simplified and chances of error minimized.

This continuous-rotation type torque tester is but one of many devices used for testing ball bearings in the Fafnir Instrument Division . . . all are operated to assure the highest standards of quality. Additional information on the manufacture of Fafnir Instrument Ball Bearings is contained in the newly-revised catalog. Write for a copy. The Fafnir Bearing Company, New Britain, Connecticut.

As a service to customers, Fafnir has been supplying the automatic torque tester. A bulletin giving concise descriptive information plus specifications is available on the torque tester upon request.



CIRCLE 160 ON READER-SERVICE CARD FOR MORE INFORMATION

**It can cost
you much more
to settle for
less than this
Clare Relay**



*This ad was all but written
by a Clare customer.*

Here is the story as he told it:

"I shopped around for relays for continuous-duty, high-speed switching service. Clare engineers recommended Type HG Mercury-Wetted Contact Relays. They said they were ideal for this application. I thought so, too; but they do cost a little more than some other relays, and I thought I couldn't afford to use them. I thought the extra cost, multiplied by the large number of relays in my machine, would run my price too high. So I built a model with cheaper relays. In just a few weeks the relays wore out. I knew that Clare Type HG relays would last for years under the same conditions, and it didn't take me long then to decide that I couldn't afford not to use them."

Ask yourself whether you, too, don't have jobs for which no other relay is good enough. Consider that the life of a Clare Mercury-Wetted Contact Relay is measured in billions of maintenance-free operations. Compare the cost per flawless operation with that of other relays: this is the crux of the matter—a vital, basic point.

The price is very reasonable, and delivery is quick—one to seven weeks, depending on the particular assembly desired and the size of the order.

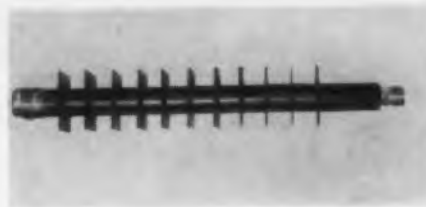
FOR COMPLETE INFORMATION on CLARE Mercury-Wetted Contact Relays for single or multiple circuits contact your nearest CLARE representative or address: C. P. Clare & Co., 3101 Pratt Blvd., Chicago 45, Illinois. In Canada: C. P. Clare & Co., 659 Bayview Avenue, Toronto 17. Cable address: CLARELAY.

Send for CLARE Sales Engineering Bulletins Nos. 120 and 122

CLARE RELAYS
FIRST IN THE INDUSTRIAL FIELD

CIRCLE 162 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.

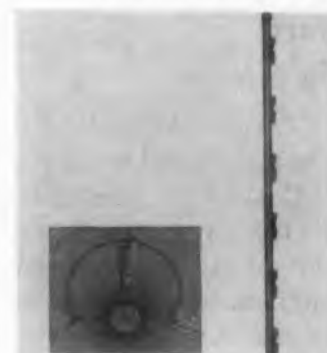
The unit is useful for terminating directional couplers and other devices in high power systems in actual operation or for test purposes. The low VSWR of the terminating element increases the effective directivity of directional couplers and facilitates more accurate VSWR measurement of all types of 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 trans-

mitter 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

NEW—self-locking UNBRAKO socket head cap screws



The Nylok* self-locking feature locks these screws securely in place, seated or unseated, wherever you stop wrenching!

They won't work loose. Can be used repeatedly. Tough, resilient nylon locking pellets permanently installed. Successfully withstand temperatures ranging from -70 to 250°F. Familiar UNBRAKO knurled heads for sure finger grip and fast assembly—accurate hex sockets for positive, nonslip internal wrenching. Heat treated alloy steel, controlled fillets, continuous grain flow lines, fully formed Class 3A threads for maximum strength and exact fit. Can be used as adjusting screws. Pellets act as liquid seals. Standard sizes from #6 to 1 in. diameter. Also available in plated finishes and in stainless steel. Write for Bulletin 2193. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 12, Pa.

*TM Reg. U.S. Pat. Off., The Nylok Corporation

UNBRAKO

SOCKET SCREW DIVISION

Unbrako Products are sold
through Industrial Distributors

STANDARD PRESSED STEEL CO.

SPS

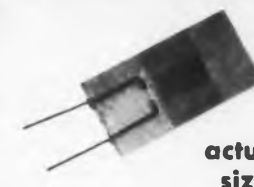
JENKINTOWN PENNSYLVANIA

CIRCLE 165 ON READER-SERVICE CARD FOR MORE INFORMATION

Send for **FREE**
T-54 Brochure
on High-Output

RdF STIKON®

**RESISTANCE
THERMOMETER
ELEMENTS**
that measure



actual
size

Surface Temperatures

NOT AMBIENT AIR!

For Precise
Temperature
Measurements

High-output, low-cost, flexible RdF Stikons measure changing temperatures quickly and accurately (to one-half a degree centigrade). Because of the thinness of the element (.005 to .010 inches), the temperature-sensitive grid becomes virtually an integral part of the measured surface. Thus the effect of ambient air temperature is practically eliminated, and temperature is measured precisely at the point desired.

When used in a bridge, an RdF Stikon may easily produce output voltages several hundred times higher than the output of the most sensitive thermocouples.

Detailed features, characteristics, and applications are contained in RdF Stikon Brochure T-54.

ARTHUR C. RUGE ASSOCIATES, INC.

733 CONCORD AVENUE
CAMBRIDGE 38, MASS

CIRCLE 166 ON READER-SERVICE CARD FOR MORE INFORMATION

U-TYPE NYLON CABLE CLAMP

Dakota's revolutionary, light weight, vibration and impact resistant U-Clamp cuts labor cost. Its quick release simplifies wiring modifications. Available in 9 sizes from 3/16" to 2 1/2".

WESCON Booth No. 1105

Write for literature and sample.



DAKOTA
ENGINEERING INC.

6641 Crenshaw Blvd., Los Angeles 43
PLeasant 8-6090

CIRCLE 168 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 ± 400 kc 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 $\pm 1.5\%$



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 $+71^{\circ}\text{C}$. Exceptionally accurate and rugged, the Model 36129

has a precision potentiometer pickoff which provides rate signals up to 70v with a linearity of $\pm 1.5\%$ or better and repeatability of $\pm 0.4\%$.

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 $\pm 15^{\circ}/\text{sec}$ to $\pm 200^{\circ}/\text{sec}$ with motor excitation by 115v or 200v 3-phase, 400cps power.

G. M. Giannini & Co., Inc., Dept. ED, 918 E. Green St., Pasadena, Calif.
Wescon Show, Booth No. 904.

CIRCLE 171 ON READER-SERVICE CARD FOR MORE INFORMATION

nonsense!

you can't mix magic
with IF transformers



but—sir— you're wrong
and here's why...

There's an element of electronic magic in the way Aladdin saves you costly, time-consuming hours of engineering. Let Aladdin worry about the design and construction of your IF transformers and IF strips. Don't spend your own valuable engineering hours doing something we have done hundreds of times. Our experience covers a wide range of special applications. If Aladdin does not already have the solution to your problem in the files, we have probably solved another one so close to it that we can be in full-scale production with almost magical efficiency.

The modern way to conjure up the genie is to rub your pencil across the coupon below. We'll send you literature that will help you tell us what you need—then get together with you at your convenience to solve your particular problem.



RADIO INDUSTRIES, INC.
Pioneers in Permeability Tuning

ALADDIN RADIO INDUSTRIES, INC.
715 Murfreesboro Road, Nashville 2, Tenn.

Send Bulletin giving technical information on Aladdin IF Strips.

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____



CIRCLE 172 ON READER-SERVICE CARD FOR MORE INFORMATION

STOP COLD JOINTS
BURNED WIRE
PRODUCTION DELAYS



ZEPHYR

Electronic

MICROBRAZER
FASTER PRECISION SOLDERING

- Electronically TIMED HEAT CYCLE
- Eliminate OVERHEATING
- SILVER Soldering TO 1250°
- ASSEMBLY LINE PRODUCTION
- Automatic OPERATION
- Perfect FOR MINIATURE SOLDERING

FREE DEMONSTRATION
in your own plant.

WRITE FOR FREE
CATALOG
NO. K-1

**ZEPHYR
MANUFACTURING CO.**
Electronic Division-Dept. E-6
201 HINDRY AVE.
INGLEWOOD
CALIFORNIA

SEE IT
AT

WESCON-AUG. 21-24
BOOTH 1130 - PAN PACIFIC AUD
LOS ANGELES, CALIF
I. S. A. SEPT. 17-21
BOOTH 231, NEW YORK COLISEUM
NEW YORK, N. Y.

CIRCLE 169 ON READER-SERVICE CARD FOR MORE INFORMATION

RF MILLIVOLTMETER

1 mV to 1 kV, 1 MC to 2.5 KMC

Fills the gap between sensitive low frequency meters

and non-sensitive high frequency meters.



WIDE CHOICE OF PROBES

HAVING CONTACT TIPS,

BINDING POSTS AND COAXIAL CONNECTORS.

The MV-18C millivoltmeter fills the important gap between highly sensitive low frequency meters (amplifier type meters) and less sensitive high frequency meters (rectifier probe type meters). The instrument uses a high impedance chopper-type DC amplifier capable of measuring the minute DC voltages developed by the instrument's RF crystal probe at signal levels as low as 1 mV. Voltage measuring range 1 mV - 1 kV, frequency range 1 MC to 200 MC without and up to 2500 MC with frequency correction chart.

The MV-18C is in extensive use today for such important purposes as monitoring the signal output of signal generators and making accurate stage gain measurements at true signal operating levels.

MILLIVAC INSTRUMENT CORP.

Box 997, Schenectady, N. Y.

CIRCLE 174 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 pre-

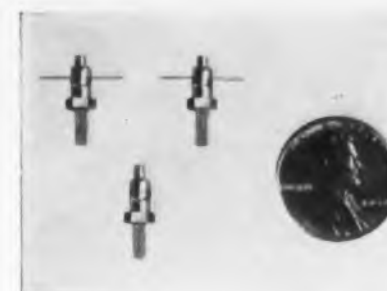
pare it for installation on a product.

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

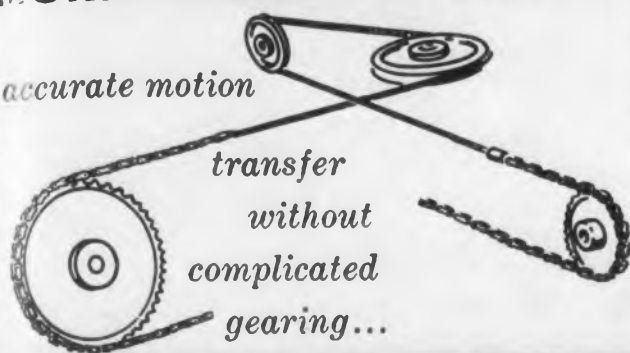
in 1956

ELECTRONIC
DESIGN

will reach
your desk
24 times

MORE DESIGN FREEDOM

accurate motion



SIERRA MINIATURE MECHANICAL CHAIN AND SPROCKETS...

Provide precise, positive motion transfer through several planes simultaneously with no cable slippage...no complicated gearing. Unlimited center-to-center selection for miniature and sub-miniature assemblies in servo systems, gyro systems, special cameras, electronic equipment, and small precision instruments. Less weight, cost, maintenance—wider tolerances. Designed to operate around minimum 7-tooth sprocket with root diameter of .250 inches. Chain pitch .1475 inches; Weight .45 oz. per lineal ft. Material: stainless steel, or other materials, including non-magnetic beryllium copper.

NEW CATALOG



Contains useful application data, specifications, tables on chain pitch and sprocket sizes, suggestions for calculating center-to-center distance. Write for yours today.

123 E. Montecito Avenue,
Sierra Madre, California



T. M. REG.

CIRCLE 180 ON READER-SERVICE CARD FOR MORE INFORMATION

HEYCO NYLON STRAIN RELIEF BUSHINGS CUT PRODUCTION COSTS AND IMPROVE PRODUCT QUALITY



With Heycos it's no longer necessary to tie wire knots or use insulating grommets. Product life is increased and product appearance is greatly enhanced.

HEYMAN MANUFACTURING COMPANY
Kenilworth 16 New Jersey



Send wire sizes for free samples and specifications.

CIRCLE 181 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 de-

rating 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

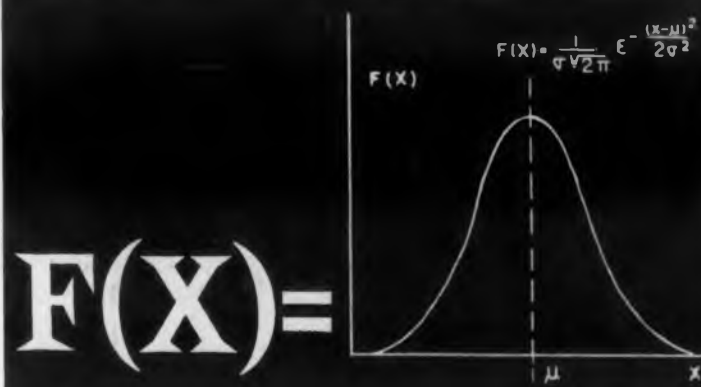
For the first time—

a random voltage or noise source
with precisely controlled power
frequency spectrum and pre-determined
amplitude probability characteristics.



MODEL G-1000

GAUSSIAN NOISE AMPLITUDE probability distribution is produced by the G-1000 Sigmatron. It is characterized by its mean value, μ and its variance, σ^2 , in the form shown in the figure below.



The G-1000 Sigmatron ultra low frequency random signal generator was created to fill the most critical analysis requirements of modern systems engineering.

A tremendous advance in instrumentation, the Sigmatron provides a powerful tool for the analysis and test of guided missile systems, servomechanisms, computers, vibration, data reduction, information theory, filter design, and quality control.

Model G-1000 has found application in many other fields such as Ultrasonics, Chemical Process Control, Applied Psychology, Geophysics and Biochemistry.

sigmatron®
ULTRA LOW FREQUENCY
RANDOM SIGNAL GENERATOR

For additional information
address inquiries to:


INTERCONTINENTAL DYNAMICS CORP.
 170 Coolidge Avenue • Englewood, N. J.

CIRCLE 185 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.



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.

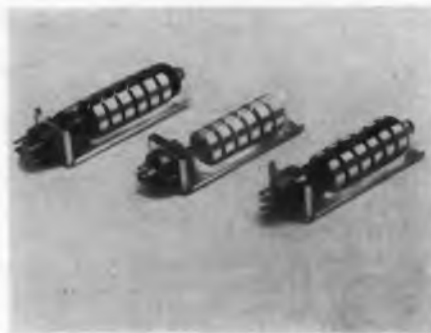
Varo Mfg. Co., Dept. ED, 2201 Walnut St., Garland, Tex.

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



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 POKETSCOPE

16 POUNDS
 7" x 6" x 12"

S-14-C

BY Waterman

The Waterman Computer POKETSCOPE 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 POKETSCOPE 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 POKETSCOPE®
 S-12-B JANIZED RAKSCOPE®
 S-12-C SYSTEMS RAKSCOPE®
 S-14-A HIGH GAIN POKETSCOPE®
 S-14-B WIDE BAND POKETSCOPE®
 S-14-C COMPUTER POKETSCOPE®
 S-15-A TWIN TUBE POKETSCOPE®
 RAYONIC® Cathode Ray Tubes
 and Other Associated Equipment
 T. M. REG.



WATERMAN PRODUCTS

CIRCLE 190 ON READER-SERVICE CARD FOR MORE INFORMATION

*An Engineer
Speaks Out...*



... about Cutting Production Costs of Electro - Mechanical Components

Once your engineers have proven out their design prototype, there's the problem of manufacturing production components to meet their design specifications. Here's one way you can eliminate the procurement problems of such parts as: couplings, shafts, gears, hangers, clutches, etc.

In addition to breadboarding pilot models, Servoboard® precision parts also serve as permanent, integral components of a system or instrument. When your engineers have mocked-up and tested their system design with Servoboard electro-mechanical assembly kits, you can place your order with us for production quantities of the same precision Servoboard parts they've tested and proven on their prototype. These components will perfectly match design specifications for the production run of the new system.

You'll find that Servoboard electro-mechanical assembly kits save your engineers considerable man-hours in design and test of open or closed loop systems. And, at the same time, you'll find that with production quantities of the proven Servoboard parts, you greatly reduce your own production problems and costs.

For full details on the Servoboard kits, a complete description of the precision parts, and prices, write directly to me: A. Eric Theis, Dept. Th-15, Servo Corporation of America, 20-20 Jericho Tpke., New Hyde Park, L. I., N. Y.

A. Eric Theis

Vice President
Manufacturing



Electro-
mechanical
Control Systems
and Components
for Industry by

SERVO
CORPORATION
OF AMERICA

SEE SERVO CORP.

- ▶ at the WESCON Show
Los Angeles • Aug. 21-24
BOOTHS 962-963
- ▶ at the I. S. A. Show
New York City • Sept. 17-21
BOOTH 1820

CIRCLE 193 ON READER-SERVICE CARD

△ 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 $\frac{3}{16}$ " rectifier pencils in service and about twelve hundred $\frac{3}{8}$ " 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 $\frac{1}{8}$ " to $\frac{1}{2}$ " 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 13, PENNSYLVANIA

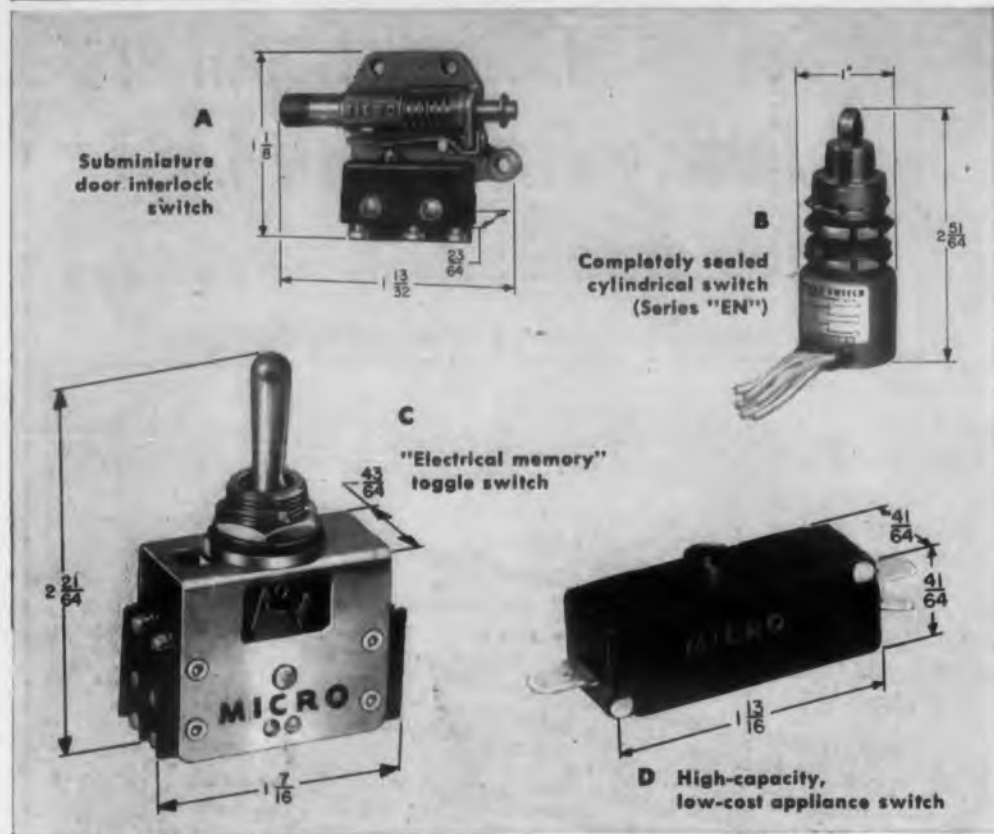
CIRCLE 196 ON READER-SERVICE CARD FOR MORE INFORMATION

MICRO

precision switches



...THEIR USE IS A PRINCIPLE OF GOOD DESIGN



A continuous flow of Precision Switch Developments anticipates Your design needs

MICRO precision switches are developed and built to meet specific requirements. Some designs call for the utmost precision, plus reliability. Other designs put long life and extreme reliability at the top of the list. Some must have all of these and more. Whatever YOUR requirement may be, MICRO SWITCH has a switch readily available or can work with you in its development.

Here are a few recent MICRO SWITCH developments to meet specific needs:

A The subminiature door interlock switch is for use where an extremely small assembly is desired to provide automatic cut-off of the power circuit when a cabinet door is opened. This switch assembly has been found extremely valuable on radio, radar, x-ray and other hazardous equipment where it is desirable to provide automatic protection to operating personnel. (Ask for Data Sheet P108).

B The MICRO SWITCH "EN" Series switches are capable of reliable, long-life performance under extreme environmental and mechanical conditions. They are completely sealed, cylindrical in shape and can be mounted wherever a through hole can be provided. Variations of the

"EN" are capable of actuation by almost any means (see right hand column). (Send for Data Sheet 105).

C This is the first of a new series of "electrical memory" toggle switches being introduced by MICRO SWITCH. They offer a completely new concept in switching remotely controlled circuits. They promise to simplify basic circuit designs of radar units, computers, aircraft control panels and similar devices. The switch indicates through a pilot light or buzzer which circuit was last actuated. (Send for Data Sheet 109).

D MICRO SWITCH now offers a new series of low cost plastic encased switches especially designed for use on domestic appliances. In addition to their small size and high electrical capacity, these switches are ruggedly constructed for hard service. They are readily adaptable for use with auxiliary actuators. (Send for Data Sheet 106).

MICRO SWITCH Engineering service is available at nearby branch offices. A call can save you time and money.

MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS

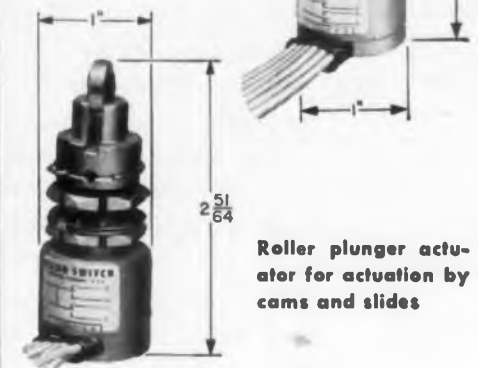


CIRCLE 198 ON READER-SERVICE CARD FOR MORE INFORMATION

See the unusual design flexibility of the new MICRO Series "EN" switches



Spring return adjustable actuator for cam or slide actuation



Roller plunger actuator for cams and slides



Positive drive adjustable actuator for linkage operation



Plunger actuator for in-line motion operation



△ 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 re-

quirements 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: 1μufd max at minimum setting at 1kc; 10μufd 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 ML-6697 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 ➤

At Last

Receiver

NOISE FIGURE

MEASURED

Automatically

and

Continuously

IN THE
LAB

ON THE
PRODUCTION
LINE

FOR
RADAR
TV

TYPE 72

AUTOMATIC
NOISE-FIGURE
INDICATOR
Price \$1490

TYPE 70A

GAS-DISCHARGE
NOISE SOURCE
200 TO 2600 MC
Price \$330

RANGE 0-20 db

ACCURACY ±0.5 db

This equipment will be demonstrated at our booth (#1326) WESCON Show



AIRBORNE
INSTRUMENTS
LABORATORY

Write

For fully descriptive literature or AIL's complete line of Noise-Figure Measuring Equipment. Ask for Series 70 brochure.



New KAY Vari-Sweep



All-Electronic Broad Band Sweeping Oscillator

Designed for continuous coverage from 2 to 220 mc with sweep width to 30 mc plus, and with high output automatically held constant over both frequency sweep and tuning range.

SPECIFICATIONS

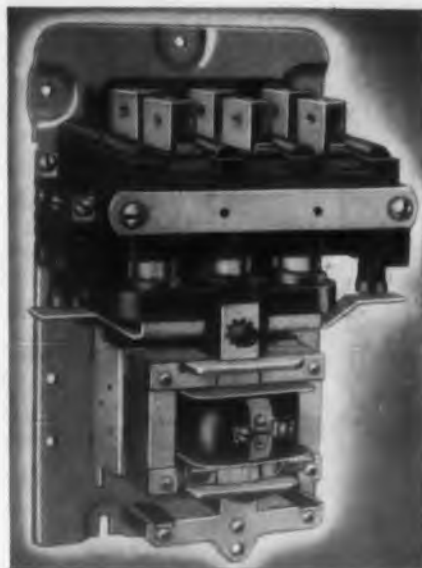
Range: Fundamental frequency 2 to 220 mc, continuously variable in ten switched overlapping bands. Direct reading frequency dial calibrated to $\pm 2\%$. RF Output: 1.0 v rms into 75 ohms, metered. Flat within ± 0.5 db. over widest sweep and over frequency band. Sweep width: Continuously variable $\pm 2\%$ to 30% of center frequency to maximum of at least 30 mc. Sweep rate: Continuously variable 10 to 60 cps. locks at line frequency. Attenuator: Switched 20,20,10,6 and 3 db plus continuously variable 6 db. Price: \$695. F.O.B. Plant.

For Complete Information and Detailed Specifications, Write Dept. ED-8

KAY ELECTRIC COMPANY

14 Maple Ave., Pine Brook, N. J.
Telephone CAldwell 6-4000

CIRCLE 206 ON READER-SERVICE CARD FOR MORE INFORMATION



1000 contactors in 1

You're looking at the most versatile solenoid contactor ever developed for building electrical controls.

This Ward Leonard Size 2 contactor is available in three basic models, six major variations, one thousand combinations.

Your savings: reduced stock, minimum panel space, lower assembly costs, less layout and drafting time. Write for Bulletin 4450 to Ward Leonard Electric Co., 77 South St., Mount Vernon, N.Y.

4.15

WARD LEONARD ELECTRIC CO.

Result-Engineered Controls Since 1892

RESISTORS • RELAYS • MOTOR CONTROLS • CHROMASTER



CIRCLE 207 ON READER-SERVICE CARD FOR MORE INFORMATION

WE NEED YOU - -

We are expanding so rapidly that we urgently need young men to join our editorial staffs of **ELECTRONIC DESIGN** and **ELECTRONIC WEEK**—our new weekly news magazine to be directed exclusively to management in the electronics field.

If you have an electrical engineering degree, some industrial experience, and an ability to write, YOU would have a fine opportunity to work on the closely knit staff of **ELECTRONIC DESIGN** and to meet and talk with top-flight engineers in the electronics field. Editors are needed for New York City as well as the Chicago and Los Angeles areas.

If you have a journalism education and training, experience in reporting and editing for some business magazine, and a working acquaintance with the electronic industries, YOU would find an excellent opportunity to grow with **ELECTRONIC WEEK**, the first management publication to the electronic industries.

If interested, please send us resume with salary requirements. Information will be treated as confidential.

Edward E. Grazda, Editor
Hayden Publishing Co., Inc.
19 East 62nd Street
New York 21, New York

△ Hermetic Variductors

Feature High Q



These hermetic variductors are extremely miniaturized (base dimensions $25/32 \times 1-1/8$) variable inductors designed to meet MIL-T-27 specifications. They provide high Q, exceptional voltage and temperature stability, and excellent shock and vi-

bration 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, air-

craft, 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: tempera-

ture 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-con-

tained audio amplifier, locates calibration points for r-f oscillators without additional equipment

★ Internal video amplifier makes available accurately-known multi-vibrator square waves, supplying timing pulses at intervals of 0.1, 1.0, 10 and 100 μ sec 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...

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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



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

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 Please have the Avery man call.

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COMPANY _____
ADDRESS _____
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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

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.

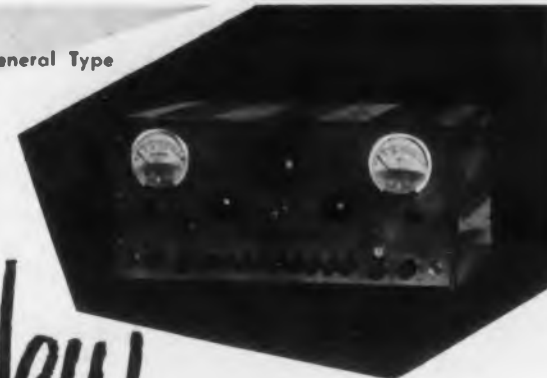
Transitron Electronic Corp., Dept. ED, Melrose 76, Mass.

Wescon Show, Booth No. 903.

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

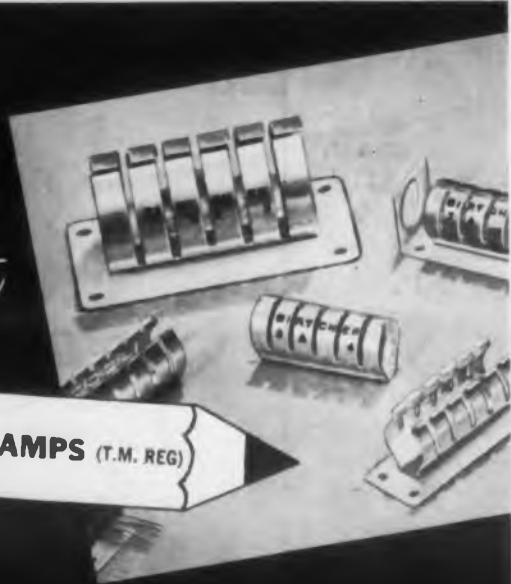


Electronic
MEASUREMENTS COMPANY INC.
EATONTOWN, NEW JERSEY

Eatontown 3-0300

CIRCLE 217 ON READER-SERVICE CARD FOR MORE INFORMATION

* build
reliability into
every circuit



Specify *BIRTCHER KOOL KLAMPS (T.M. REG)

MATERIAL

Heat treated silver alloy or Beryllium ± 25

FINISH

Silver none - beryllium copper silver plated to Navy Spec. 46P5

SIZES

Modifications available for all sub-miniature and miniature tubes and components

Excessive heat is the number one cause of tube failure. Birtcher KOOL KLAMPS, made of 99½% pure tempered silver, can reduce tube temperatures by as much as 40 C while holding them secure against shock and vibration. Available also in beryllium copper where temperature is less critical.

THE BIRTCHER CORPORATION

INDUSTRIAL DIVISION

4371 Valley Blvd., Los Angeles 32, Calif.

Write for catalog

CIRCLE 218 ON READER-SERVICE CARD FOR MORE INFORMATION

Celco

TOROIDS

... Offered in a wide range of sizes

#50 wire on .062" ID
#15 wire on 9" OD



Whether it's a complex 10 winding magnetic amplifier or a simple choke . . . at Celco each toroid is precision-made. New core materials are used in Toroidal magnetic amplifiers, reactors and transformers to achieve maximum performance.

At Celco, the proper matching of cores, winding, handling, impregnation, encapsulation and electrical history of the final assembly is carefully controlled to maintain the original design characteristics.

Submit your toroidal problems for our immediate attention . . . Call RAMSEY 9-1123 — or write today.

Celco

Constantine Engineering Laboratories Co.

MAHWAH, N. J.



Your plant is only hours away by the Celco Air Fleet

CIRCLE 219 ON READER-SERVICE CARD FOR MORE INFORMATION

**△ Metal-Ceramic Seals
For High Temperature Fields**



Among the many advantages of these custom made AlSiMag 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. & Mfgs. 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

*An Engineer
Speaks Out...*



**... about a
Servosystem Analyzer**

Seems to me that a really good servosystem analyzer must fill two important requirements. First, it must give an engineer more accurate and faster results than a home rig. And secondly, it must be able to quickly test a variety of equipment and systems.

We produce a servosystem analyzer at Servo Corp.—the Servoscope®—which meets these requirements.

The Servoscope gives you faster, more accurate results because it provides a *direct* method for measuring gain and phase shifts of any component or system in the lower frequency ranges. There's nothing complicated about using it. Just by turning the big dial, you get phase lead or lag. Signal amplitude is read directly from the associated indicator.

Servoscope is an extremely versatile test instrument. Its applications include: automatic flight and ship control design, testing computer response, checking vibration, testing response of servosystems and fire control systems.

If you'd like additional information on the Servoscope and its use, write directly to me: Tom Westover, Dept. W-12, Servo Corporation of America, 20-20 Jericho Tpke., New Hyde Park, L. I., N. Y.

Tom Westover
Chief Control Systems Engineer



*Electro-
mechanical
Control Systems
and Components
for Industry by*



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▶ at the WESCON Show
Los Angeles • Aug. 21-24
BOOTHS 962-963

▶ at the I. S. A. Show
New York City • Sept. 17-21
BOOTH 1820

CIRCLE 222 ON READER-SERVICE CARD

calculate
the
advantages
of your
future
with

Bendix
in Southern
California



W. C. Walker, Engineering Employment Mgr.
Pacific Division, Bendix Aviation Corp.
11606 Sherman Way, North Hollywood, Calif.

I am interested in this engineering field _____
I am a graduate engineer with _____ degree.
I am not a graduate engineer but have _____
years experience.

Name _____

Address _____

City _____ Zone _____ State _____

CIRCLE 224 ON READER-SERVICE CARD

△ 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

PROBLEM #4



Design a miniature audio input transformer for airborne operation. Transformer to operate in an ambient temperature of plus 85°C, and to conform to the applicable parts of MIL E-5400 and MIL T-27. Duty cycle to be continuous with a minimum life of 1000 hours. Transformer to couple a 300 ohm source to a tube grid. Step-up turns ratio to be 1:17 minimum, with the maximum possible desired. Frequency response to be flat within 0.75 db from 20 cps to 7,000 cps, and flat within 1.2 db from 15 cps to 10,000 cps. Maximum signal level to be 500 mv @ 20 cps in 300 ohm primary. Electrostatic shield required between primary and secondary. Electromagnetic shielding to be 40 db minimum. Size to be kept minimum but must not exceed 1 1/8" x 1/8" x 1 3/8" high.

SOLUTION BY PEERLESS

Audio Transformer, low level input, miniaturized.
 Construction: Grade 1, Class A, MIL T-27
 Duty Cycle: Continuous
 Life: Greater than 1,000 hours.
 Ambient Temperature: +85 C max.
 Primary: Three terminal, center-tapped winding, 300 ohms nominal impedance.
 Secondary: Two terminal winding, 125,000 ohms nominal impedance.
 Turns ratio: 1:20 1/2
 Electrostatic Shield: Between primary and secondary.
 Electromagnetic Shield: 45 db
 Frequency response: 20 cps—7,500 cps, flat within 0.5 db and
 10 cps—10,000 cps, flat within 1.0 db with
 125,000 ohm load.
 Maximum Input Voltage: 500 mv at 20 cps
 Dimensions: 1" x 11/16" x 1" high + 1/8" terminal

The Peerless engineering staff has had a long and successful history of designing transformers to unusual and difficult specifications. Knowledge of this outstanding accomplishment is one of the reasons that Peerless transformers are the first choice of engineers throughout the country. Uniform dependability is assured by the most rigid quality control and advanced custom production techniques.

Consult Peerless for the best solution to your quality transformer requirements.



PEERLESS
 Electrical Products

A DIVISION OF

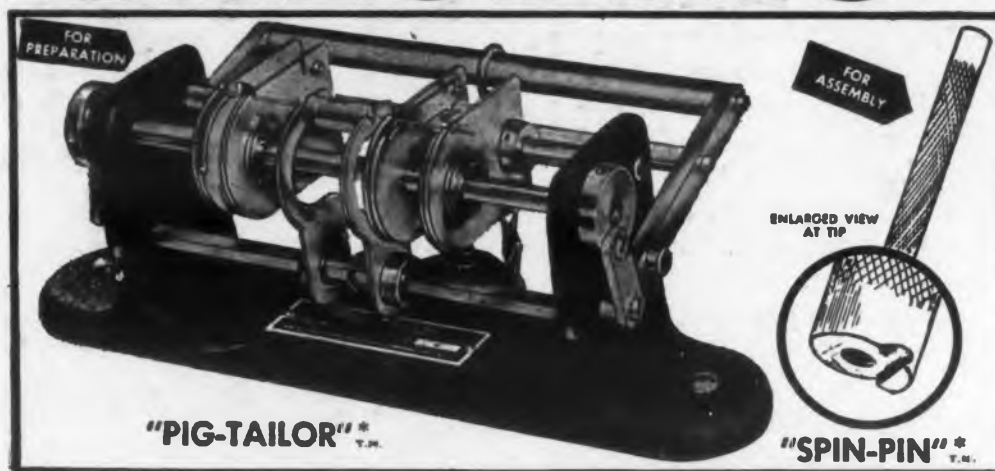


9356 Santa Monica Blvd., Beverly Hills, Calif. • 161 Sixth Avenue, New York 13, N.Y.

CIRCLE 229 ON READER-SERVICE CARD FOR MORE INFORMATION

"PIG-TAILORING"

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



The "PIG-TAILOR" plus "SPIN-PIN" — Accurately Measures, Cuts, Bends, Ejects and Assembles both leads simultaneously to individual lengths and shapes — 3 minute set-up — No accessories — Foot operated — 1 hour training time.

PIG-TAILORING provides:

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

PIG-TAILORING eliminates:

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

* PATENT PENDING

Write for illustrated, descriptive text on "PIG-TAILORING" to Dept. ED-8 P

BRUNO-NEW YORK INDUSTRIES CORPORATION

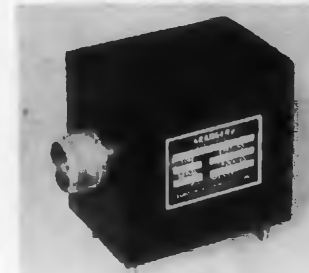
DESIGNERS AND MANUFACTURERS OF ELECTRONIC EQUIPMENT
 460 WEST 34th STREET • NEW YORK 1, N. Y.



CIRCLE 230 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.

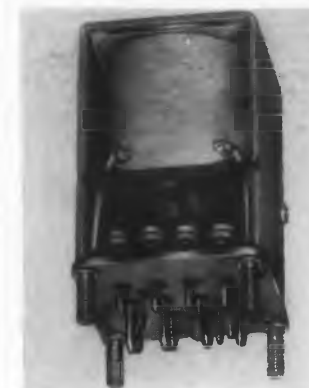
Wyco Metal Products, Dept. ED, N. Hollywood, Calif.

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 10 μ v and currents as low as 10 μ amp. 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 10 μ v.

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

ENGINEERS

ELECTRIC BOAT STEPS-UP NUCLEAR SUBMARINE PROGRAM

*offers unusual
growth opportunities
to engineers*

Two years ago, world attention centered on Electric Boat at Groton, Connecticut where scientific boldness harnessed the power of atomic energy to launch the Nautilus, which will soon be followed by its sister ship, Seawolf. Next to glide down the ways will be even more powerful versions... a third, fourth and fifth nuclear powered craft.

Now, engineers who are cognizant of the implications of the Atomic Age are concentrating their interest on Electric Boat.

The following opportunities exist for:

- a) **Naval Architects**
- b) **Mechanical and Electrical Engineers** with 3 to 5 years experience in the application of mechanical and electrical marine power plant equipment.
- c) **Electrical and/or Mechanical Engineers** for basic design using analog computers, with respect to control systems, motor control circuits, power plant, speed and voltage regulators or fluid flow and thermodynamics. Familiarity with engine room and reactor plant electrical systems and controls desirable.

At Electric Boat your professional success is spurred by company sponsored courses at the plant, advanced study at leading universities, and by attention to broader professional growth by immediate supervision.

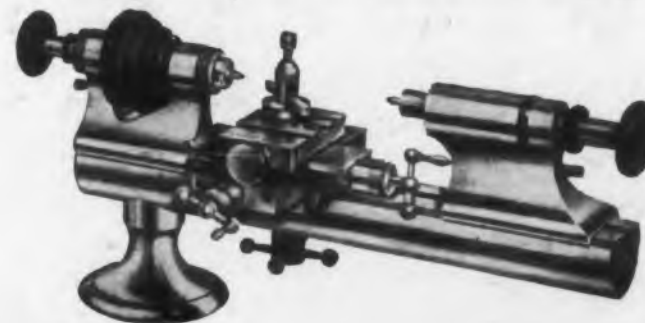
Electric Boat's location in Groton on the lovely shore of Long Island Sound makes life as pleasant as your job is stimulating. The surrounding resort area is well known for its year-round sports and recreational activities. And, you have all the advantages of nearby New York and Boston as well.

Interviews can be arranged by sending resumes to Peter Carpenter.

ELECTRIC BOAT

Division of General Dynamics Corporation
GROTON • CONNECTICUT

ARE YOU DRIVING TACKS WITH A SLEDGE HAMMER?



SMALL PARTS ARE MADE WITH GREATER ACCURACY • ECONOMY • SPEED ON *LEVIN* INSTRUMENT LATHES

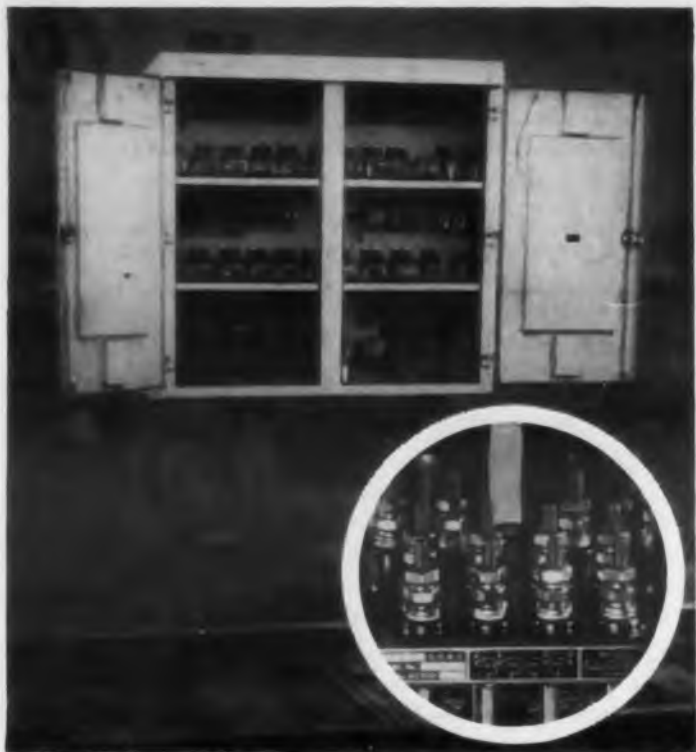
For efficiency small work should be done on a small lathe. In many cases the work done on an instrument lathe requires a degree of precision and fine finish which cannot be obtained from larger machines. LEVIN lathes are made in two collet capacities, 5/16" or 3/16", and thirty-three different models.



Send for Catalog M describing complete line of instrument lathes and accessories. Louis Levin & Son, Inc., 3610 S. Broadway, Los Angeles 7, California.



CIRCLE 236 ON READER-SERVICE CARD FOR MORE INFORMATION



Terminal bolts, nuts and springs protected by Monel alloy. Sulfur laden atmosphere, dampness, heat and cold don't affect this gear. Monel parts insure positive signal and switching response in these Transport Products Corp. relays.

That fastening failure

...maybe an Inco Nickel Alloy will prevent it

You can be sure of one thing.

Recurring failure of a metal fastening in an electrical device has a cause . . . a cause you can track down and usually design out.

Maybe it's corrosion. Or thermal shock. Or relaxation. Or metal fatigue. Or wear. Or inadequate conductivity. Or any one of dozens of hazards which ordinary metals don't overcome and Inco Nickel Alloys do.

Monel* nickel-copper alloy, for example, provides physicals comparable to steel . . . plus unique resistance to corrosive fluids and gases. Easy working qualities, too.

Then there is Inconel* nickel-chromium alloy to retain high properties at high temperatures, take thermal shock. Age-hardenable Inconel "X"* alloy goes even further . . . resists corrosion and relaxation of temper when stressed to 100,000 psi in temperatures in the 1000°F range.

Consider free-machining "R" Monel* alloy . . . with superior resistance to fatigue. Or "K" Monel* alloy . . . for extra wear resistance. Or Permanickel* . . . high-conductivity age-hardenable nickel.

It's a safe bet that these or other Inco Nickel Alloys can handle most of your tough assignments. And Inco's Technical Service Department is standing by whenever you want suggestions. Just say the word.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO Nickel Alloys

*Registered trademarks

MONEL® • "R"® MONEL • "K"® MONEL • "KR"® MONEL
"S"® MONEL • INCONEL® • INCONEL "X"® • INCONEL "W"®
INCOLOY® • NI-O-NEL • NIMONIC® Alloys • NICKEL • LOW
CARBON NICKEL • DURANICKEL®

CIRCLE 239 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 $\pm 50v$ open circuit or $\pm 45ma$ 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

Precision PAPER TUBES

any shape..size..I.D. or O.D.
..to meet your specific requirements

Round, square, oval, rectangular, triangular—spirally wound from finest dielectric kraft, fish paper, acetate, combinations or phenol impregnated.

SEND FOR
FREE
ARBOR LIST
NOW

Lists over 2000 sizes . . . all promptly available. Submit specifications for free samples.



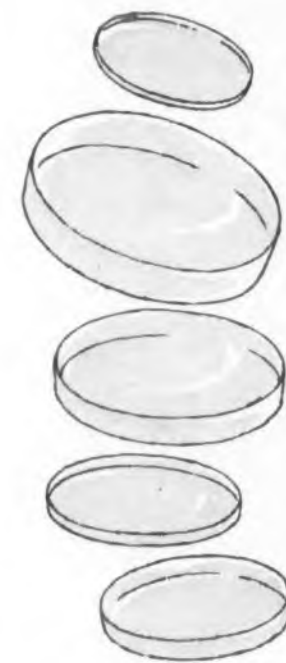
PRECISION PAPER TUBE CO.
2055 W. CHARLESTON ST. • CHICAGO 47, ILL.
Plant No. 2: 1 Flower St., Hartford, Conn.

CIRCLE 242 ON READER-SERVICE CARD FOR MORE INFORMATION

LINDE synthetic sapphire windows

Trade-Mark

hard . . . strong . . . chemically inert
excellent optical transmission



Sapphire has long been accepted as a material with excellent chemical resistance, strength at high temperatures, and transmission of ultra-violet, visible, and infra-red radiation. It is finding many new uses now that it can be produced in disks up to 2 inches in diameter. This form allows its excellent optical characteristics, along with its outstanding chemical and physical properties, to be used to advantage in many important applications.

Single-crystal sapphire windows are available in diameters from 1/2 to 2 in. and in thicknesses of 1 mm to 1/8 in. They are commonly supplied with ground finish or window glass polish. For further information, call or write your nearest LINDE office.

LINDE AIR PRODUCTS COMPANY

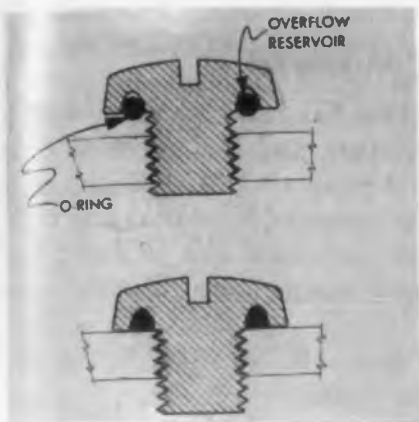
A Division of

"Linde" is a registered trade-mark of Union Carbide and Carbon Corporation.

Union Carbide and Carbon Corporation
30 East 42nd Street **UIC** New York 17, N. Y.
Offices in Other Principal Cities

CIRCLE 243 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 Seel-screws, they employ an "O-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

DO YOU NEED 400 CYCLE OR OTHER A. C. POWER?

THE BEHLMAN



INVERTRON

IS A HIGHLY ACCURATE, EXCEPTIONALLY STABLE, COMPLETELY ELECTRONIC

A. C. POWER SOURCE

The INVERTRON is available with power output ratings from milliwatts to kilowatts. Frequencies from subsonic to supersonic, fixed or variable, with accuracies to .001% for fixed frequencies and to .1% for variable frequencies. Sine wave distortion is never greater than 2%, with .5% or less available. Standard regulation from no load to full load is 1% with .5% or better obtained by adjustment of regulation control. If you are developing or testing Magnetic Amplifiers, Servo Systems, Airborne Instrumentation, Synchros, Motors, Shaker Tables, Choppers, Etc., consider the BEHLMAN INVERTRON.

MODEL 253-D-2
250 V. A. (3 Phase) 350-450 CPS OUTPUT.

WE EMPLOY MODULAR CONSTRUCTION TECHNIQUES TO PROVIDE YOU WITH CUSTOM INSTRUMENTATION AT PRODUCTION LINE PRICES.

ALSO: POWER AMPLIFIERS, OSCILLATORS, FREQUENCY STANDARDS AND CUSTOM INSTRUMENTATION.

BEHLMAN
ENGINEERING COMPANY

ELECTRONICS • MECHANICS • OPTICS
DESIGN • DEVELOPMENT • PROTOTYPE

114 SOUTH HOLLYWOOD WAY
BURBANK, CALIFORNIA

WRITE NOW FOR
FURTHER
INFORMATION

YOU ARE INVITED TO VISIT OUR BOOTH #1351 AT THE WESCON SHOW, AUGUST 21-24—PAN PACIFIC AUDITORIUM & ANNEX, LOS ANGELES, CALIF.

CIRCLE 247 ON READER-SERVICE CARD FOR MORE INFORMATION

NEY'S SMALL PARTS PLAY A BIG PART IN PRECISION INSTRUMENTS • NEY'S SMALL PARTS PLAY A BIG PART IN PRECISION
ENGINEERED CONTACTS, SLIP RINGS & ALLOYS
SUPPLIED TO YOUR SPECIFICATIONS BY ...



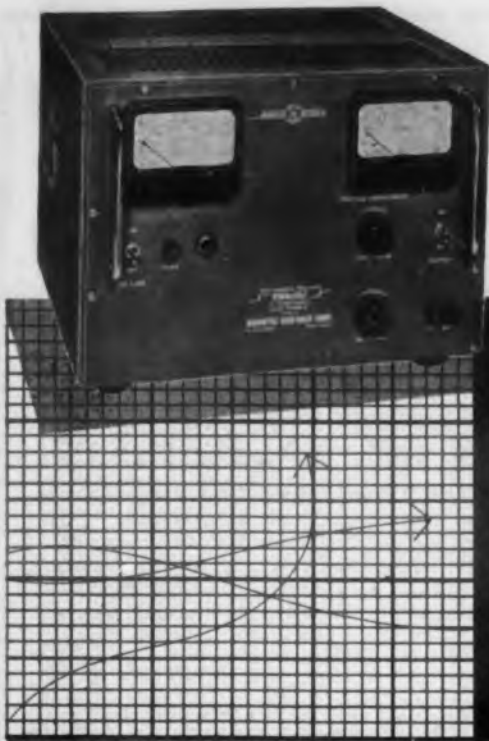
Ney offers wide experience in the development of sliding contacts, slip rings and assemblies, commutator segments and assemblies, brush and brush holder assemblies, and precious metal resistance wire. Call or write the Ney Engineering Department for consultation on any problem involving the use of precious metals to improve your products.

THE J. M. NEY COMPANY, P. O. BOX 990, DEPT. D, HARTFORD 1, CONN.

Specialists in Precious Metal Metallurgy since 1812

NEY'S SMALL PARTS PLAY A BIG PART IN PRECISION INSTRUMENTS • NEY'S SMALL PARTS PLAY A BIG PART IN PRECISION

CIRCLE 248 ON READER-SERVICE CARD FOR MORE INFORMATION



±1/4% 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:
±1/4% for 80-150V line change	less than 1% for 10% line transient
±1/2% 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.

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.

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.

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.

ENGINEERS **today** the choice is yours —
choose wisely... choose **GPL**

GPL—with its widely diversified operations in today's most active fields—offers you a lifetime of achievement, satisfaction and advancement.

Here you'll be working with men who have repeatedly broken ground on the frontiers of science, made GPL one of the country's outstanding technological leaders. You'll be part of the nationwide General Precision Equipment organization whose many companies operate in highly advanced areas.

We offer you work on challenging new projects in various stages of research and development. We offer you stimulating professional problems, top pay levels and working conditions, and ideal family living in semi-rural Westchester—just an hour from New York City.

GPL's engineers are men of skill and imagination—and we are seeking more men of their caliber. If you have the inherent capabilities and skills we need and if you are seeking a stable and rewarding career, send resume to Richard D. Hoffman, Employment Mgr. Interviews can be arranged in advance at any time, including weekends. Security limits us to considering applications of U. S. citizens only. We will pay the expenses of qualified applicants to come for an interview.

RADAR NAVIGATION AND BOMBING SYSTEMS (DOPPLER & INERTIAL)

Research . . . Development . . . Applications . . . System Analysis . . . Project Management
Field Engineering . . . Technical Writing
Computers . . . Servos . . . Microwave Techniques . . . Pulse Circuitry



GENERAL PRECISION LABORATORY
INCORPORATED

63 Bedford Road, Pleasantville, N. Y.

A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION



CIRCLE 255 ON READER-SERVICE CARD FOR MORE INFORMATION

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.

PUSH BUTTON TEST OSCILLATOR



MODEL
TO-100

- TELEMETERING MODEL FURNISHES STANDARD FM/FM FREQUENCIES FROM 400C TO 70 KC
- AUDIO MODEL FURNISHES FCC FREQUENCIES SUGGESTED FOR DISTORTION MEASUREMENTS
- SPECIAL MODELS FOR ANY 20 FREQUENCIES FROM 20 TO 100,000 CYCLES PER SECOND
- CALIBRATED DEVIATION CONTROL PERMITS $\pm 10\%$ VARIATION OF CENTER FREQUENCY



TELETRONICS LABORATORY, INC. 54 KINKEL STREET
WESTBURY, L. I., N. Y.

CIRCLE 266 ON READER-SERVICE CARD FOR MORE INFORMATION

PROBLEM:
find the ^{right} "pot"



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

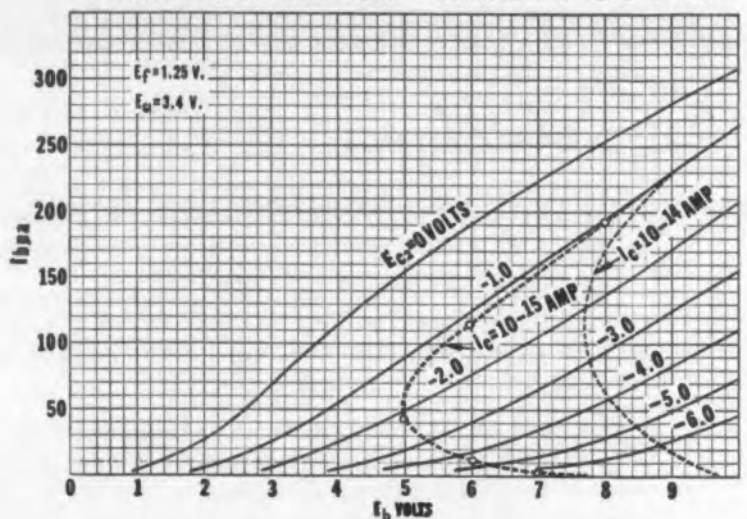
PROVIDE **EXTREME SENSITIVITY**
IN MEASURING
MINUTE CURRENTS



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 $+100^\circ$ 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 $+210^{\circ}\text{C}$, 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 turn-over and single needle phonograph cartridges recently added to the company's products.

Elgin National Watch Co., Elgin, Ill.

What is the **TOTAL COST**
of a *plastic part?*



First costs often are only part of the total cost of plastic components. Poorly designed or inaccurately produced plastic parts can mean excessive inspection and assembly costs in your plant and a high failure rate, as well. American's *precision production* saves you money by eliminating these hidden cost factors and thus keeping your *total cost* per part to the barest minimum. That is why so many exacting buyers say, "We turn to American *first* for our plastic parts—because they are precision made."

American Plastics is equipped to give you full line service—injection, compression, extrusion, multiple-shot injection, and low pressure vacuum assisted forming.

Next time you need plastic parts, try American *first*. Others have for over 50 years! Write or wire Dept. ED.



AMERICAN PLASTICS CORPORATION

Subsidiary of Hayden Chemical Corporation
Executive Offices at 342 Madison Avenue
New York N. Y.

CIRCLE 275 ON READER-SERVICE CARD FOR MORE INFORMATION

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, attenuators, 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 fire-wall, 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.

A New Technique by Wayne Kerr

Measurement of X Band power now becomes accurate and quick with the Wayne Kerr torque operated Wattmeter. Standards room and production line both benefit from its high accuracy and ease of operation.

SUPERIOR TO CALORIMETERS

because:

- Easy to operate
- Absorbs negligible power
- Needs no warming up or pre-calibration
- Extremely accurate. Calibration is stable
- Suitable for rapid production measurements

Watch for further
announcements by



Specialists in
RF Measurement

Exclusive Sales & Service in U.S.A.

MARCONI Instruments • 44 NEW STREET • NEW YORK 4, N. Y.

CIRCLE 284 ON READER-SERVICE CARD FOR MORE INFORMATION



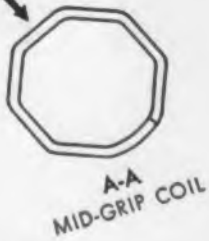
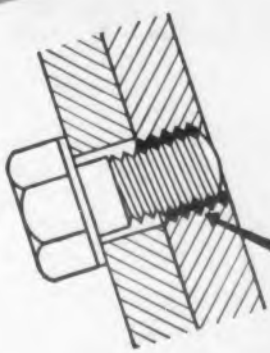
BRIEF SPECIFICATION:

Frequency range: 8690-9840 Mc
VSWR: better than 1.1:1
Insertion loss: 0.1 db
Power range: 10-200 watts, mean.
Accuracy: $\pm 2\%$

PRICE \$1450.

Immediate Delivery

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-Call,” case history periodical.

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Company _____

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City _____ Zone _____ State _____

3534

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

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“.....and pick up
the man from
PHILLIPS”

AMERICAN
LINES



Time flies . . . so does your Phillips man. That's part of the *Phillips Plan* to help meet those project deadlines. If your relay requirements are special, ask about the *Phillips Plan*—a combination of engineering skill* and personal service that is unique in the industry. Contact the Phillips office nearest you.

***FOR EXAMPLE:**

Phillips Engineered Relays are meeting the extremely specialized requirements of guided missile applications.



20410 TYPE 2 — Hermetically-sealed multi-contact relay. Flange mounting, maximum 14 pin, solder terminals. O.D. 2-1/2" W x 2-1/2" L x 5" H.



TYPE 1AC — Multi-contact AC relay. Fast operating. O.D. 1-15/32" W x 4" L.



TYPE 15QA — Miniature relay, single pole. Nominal sensitivity .200 watts, available with solder terminals or printed circuit terminals, single hole mounting. Coil available to 60 volts DC.

MULTI-CONTACT. POWER. HERMETICALLY SEALED RELAYS • ACTUATORS

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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.

RIFLE MAKER SAVES 86%

with **GRC**
DIE CASTING

Illustrated rifle part die cast in one piece by Gries not only costs 86% less than former 3-piece assembly, but is actually superior—more precise, better looking, with no assembled parts to loosen. By die casting in one piece, and in one automatic operation, substantial savings in time and money are realized. Designs can be simplified to reduce or eliminate machining and assembly. Quick deliveries on quantities of 100,000 to many millions.

NO MINIMUM SIZE!

Maximum length: 1 3/4"

Maximum weight 1/2 oz.

Send today for samples and bulletin.

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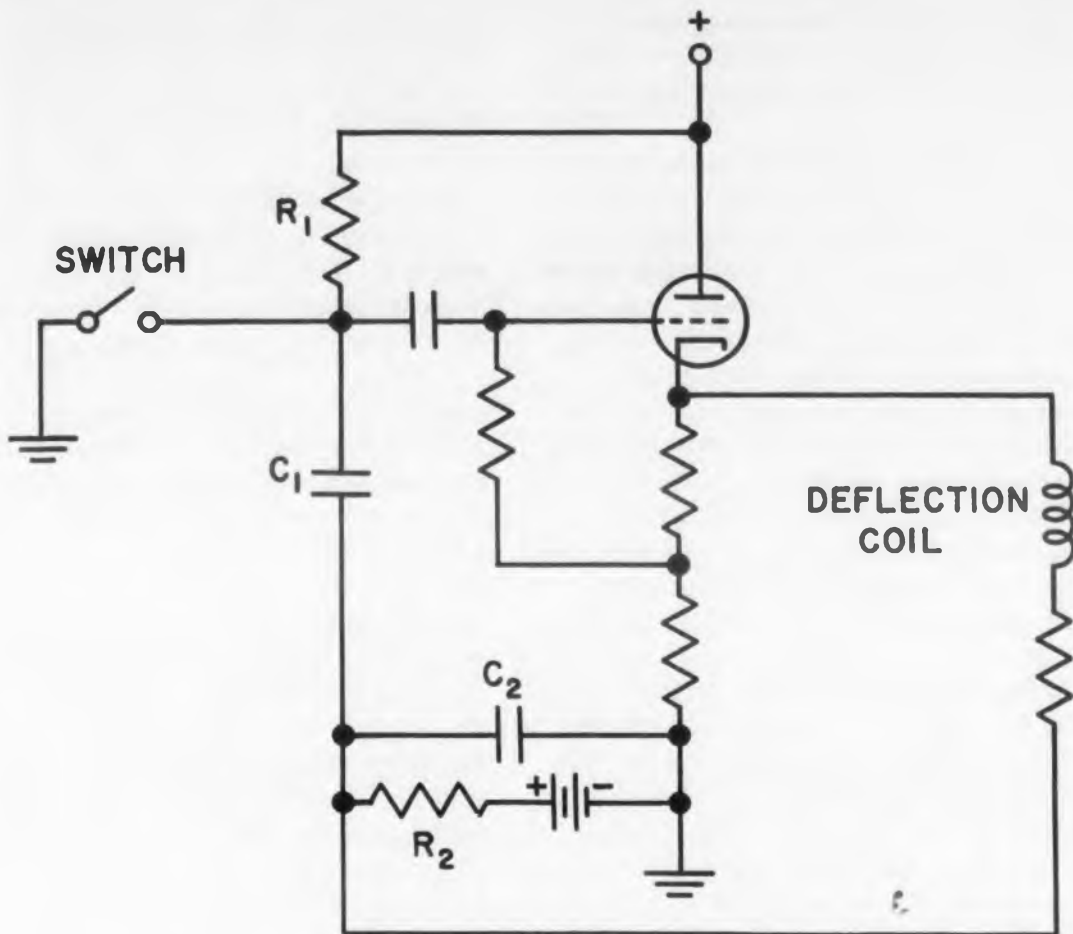
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PRODUCER OF SMALL
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Brand New!



SWITCHCRAFT
INC.

"TELEVER SWITCH"
SERIES 16000

**Featuring
Single-Hole
Mounting**

All the engineering features and outstanding workmanship of the 6000 Series "Telever Switch" are retained in this new switch.

Single hole mounting provided by 15/32" threaded bushing 3/8" long; slotted bushing and a special washer provide a convenient non-turn device.

2-position and 3-position types; locking and non-locking. A unique feature is that conversion from a non-locking action to a locking action can be made by removing a simple stamping supported by 2 screws.

Write for details and price.

SWITCHCRAFT
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See these and other
New Components
BOOTH No. 805
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Canadian Representative:
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Toronto, Canada

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PLUG-IN

PLUG-IN COMPUTING COMPONENTS WITH DONNER MODEL 30 ANALOG COMPUTER

Detachable problem boards and plug-in components make this the easiest to use of all general-purpose analog computers. Model 30 only
\$995, FOB factory.

DONNER SCIENTIFIC
COMPANY

2829 Seventh St.
Berkeley, Calif.
Complete data
on request.

AT 733 AIRBORNE AVE., N.Y. - IRE SHOW
Booths 855-856 at the Wescon Show

CIRCLE 293 ON READER-SERVICE CARD FOR MORE INFORMATION

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

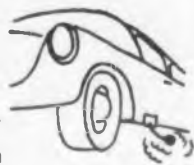
This phenomenon probably began long before recorded time and, at present, gives every indication that it is here to stay. First recognition is almost universally credited to the Cro-Magnon man who attempted to describe the combined sound and tingling sensation in his palms after he had laid asunder an 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 — "Boingg!"



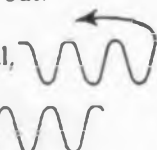
Scholarly minds since then, at odd intervals, have added to the body of scientific knowledge concerning "Boingg!". A Mr. Newton, in fact, added a rather loud, squashy one just prior to the evolving of The L. of G. (An identical, and somewhat more familiar observation, was made by the operatic team of W. Tell & Son.) It is interesting to note that "Boingg!" 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 "Boingg!"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 "Boingg!" 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	2 amp., (28VDC. 100,000 operations resistive)	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 "Boingg!" 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 Ricoverbrigrational Pingschaft 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.

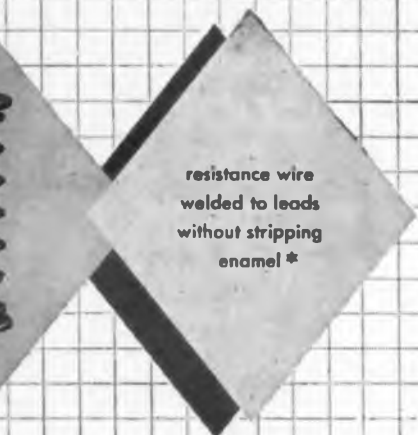
Record Controlled Machine . . . Patent No. 2,738,874. Lawrence A. Wilson, Benjamin M. Durfee. (Assigned to International Business Machines Corp., New York, N.Y.)

A machine for sorting IBM cards, or other data storage records, according 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.

TERMINATE PRECISION RESISTORS WITH SPEED AND RELIABILITY



precision stored-energy welding

WELDMATIC MODEL 1012 TWEezer TYPE WELDER welds fine wire to leads or tabs while resistor is on winder. Enamel stripping and flux contamination eliminated, with production time halved. Welded connection is very positive, stable, and rugged.

*Made by Ircal Industries
a subsidiary, I.R.C.

**Unitek
WELDMATIC**

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260 Halstead Avenue • Pasadena 8, California
Write for Complete Technical Information
on Stored Energy Welding

Visit our Booths #1223 & 1224 Wescon Show
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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 deflection 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.

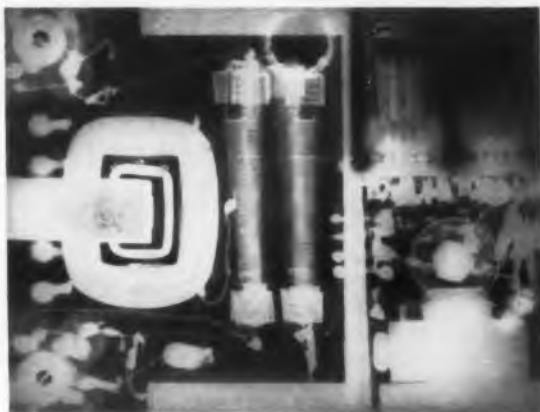
Clipping Amplifiers . . . Patent No. 2,739,191. Thomas C. Wisenbaker, Martin R. Richmond, Benjamin R. Cole. (Assigned to Raytheon Manufacturing Co., Newton, Mass.)

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.

how to get more volts per pound at high altitudes



PROBLEM: Design a regulated high-voltage dc power supply for operation at high altitudes. Specifications:

- Input voltage—400 cps \pm 10%
- Output—dual: 4 KV at 2.5 ma; 8 KV at .3 ma
- Regulation—no load to full load within 1%
- 105 cubic inches maximum
- Light as possible.

SOLUTION: We designed a vacuum tube regulator circuit, with the regulator tubes kept at low voltage. Result: The tubes could be mounted externally—for easy replacement.

For compactness and to protect high-voltage components against the hazards of moisture or rarefied air, we cast the rest of the unit in epoxy resin.

The assembly weighs only 6 $\frac{3}{4}$ lbs., occupies 96 cu. in., plus terminals.

This sort of engineering can be at your service too. When you need electronic assemblies—by hundreds or thousands—straightforward or special design—make use of our production and design experience and facilities.

CALEDONIA ELECTRONICS AND TRANSFORMER CORP.

Dept. ED-8, CALEDONIA, NEW YORK

In Canada: Hackbusch Electronics, Ltd., 23 Primrose Ave., Toronto 4

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is your problem here...



designed and perfected by
PANORAMIC
... the leader:

- Adjacent channel interference
- Relative side band level measurements
- RF cross modulation
- Keying transients
- Band occupancy studies
- Single size band investigations

solve it **faster** with

PANORAMIC PANALYZOR

SB-12 type T-100



featuring **10 cps resolution**

Provides lightning-fast solutions to all problems requiring extremely high resolution. Automatic frequency control on narrow sweeps. Designed by Panoramic, this highly versatile, highly accurate instrument assures complete accuracy and speed for limitless laboratory and production test uses.

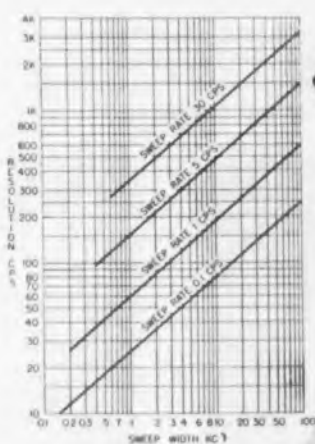
SPECIFICATIONS

- Dynamic range: 40 db
- 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

Write for complete details

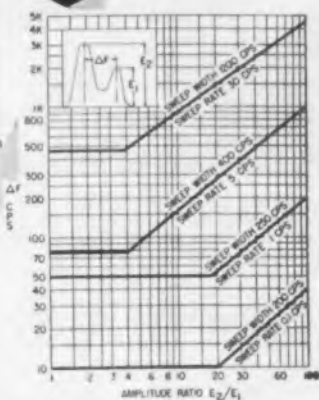
Panoramic—for proven performance in plants and laboratories

See us at WESCON:
Booth 1261



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

Minimum frequency separation ΔF required to measure amplitude ratios E_2/E_1



15 South Second Avenue, Mount Vernon, N.Y.
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cables: Panoramic, Mount Vernon, N.Y. State

CIRCLE 297 ON READER-SERVICE CARD FOR MORE INFORMATION



New

X-500 Sub-Miniature ACEPOT* rated to 150° C.

ACEPOT* - ACETRIM* sub-miniature, precision wire-wound potentiometers and trimmers are shooting to new highs!

X-500 "Hotpot" operates from -55° C. to 150° C.
1/2" size
up to 250K
± .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 \sim to 250K \pm 2%	10 \sim to 150K \pm 3%
Size	1/2 x 1/2"	1/2 x 1/2"
Linearity	\pm .3%	\pm .3%
Resolution	extremely high	excellent
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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

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random 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 non-stationary 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 Gomburg, the well-known authority in this field. Also of unusual interest is treatment of industrial operations research, by A. W. Swan, who is associated 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.

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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 filter. 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 it 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.

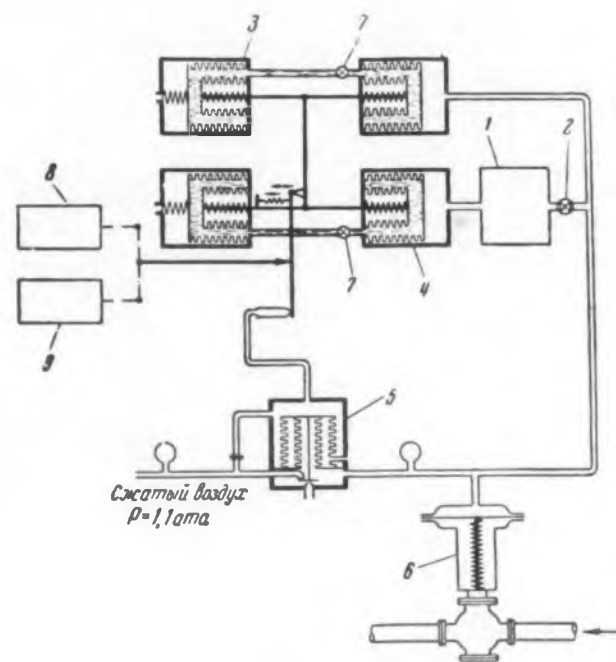


Fig. 1

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.

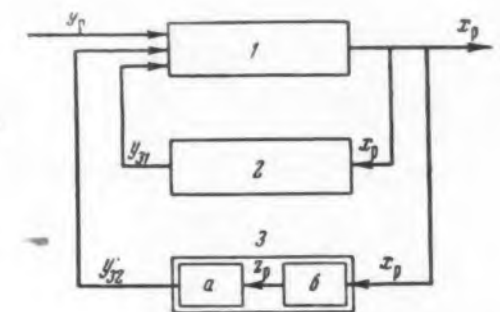


Fig. 2

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.

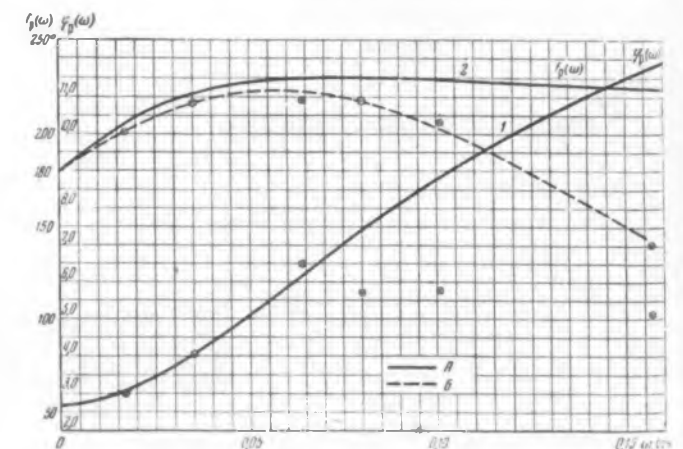


Fig. 3

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.)

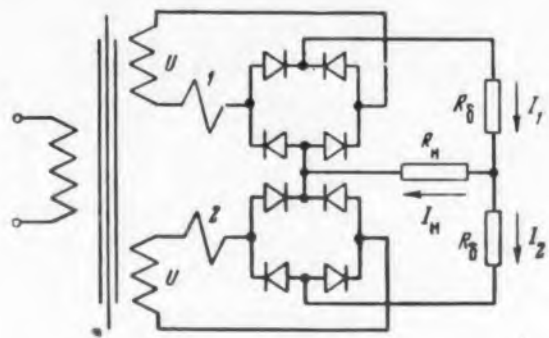


Fig. 1

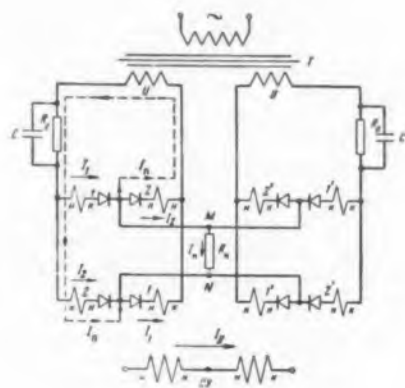


Fig. 2

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.

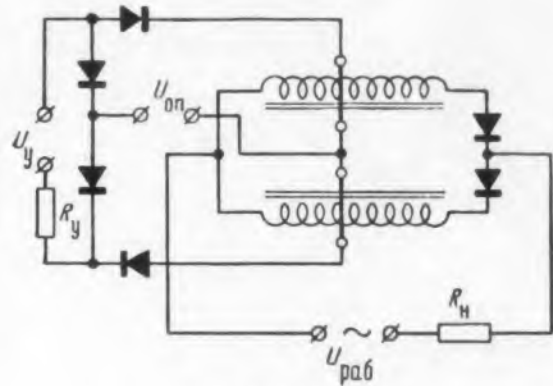


Fig. 1

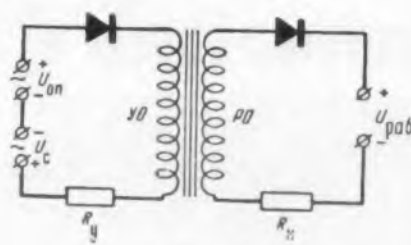


Fig. 2

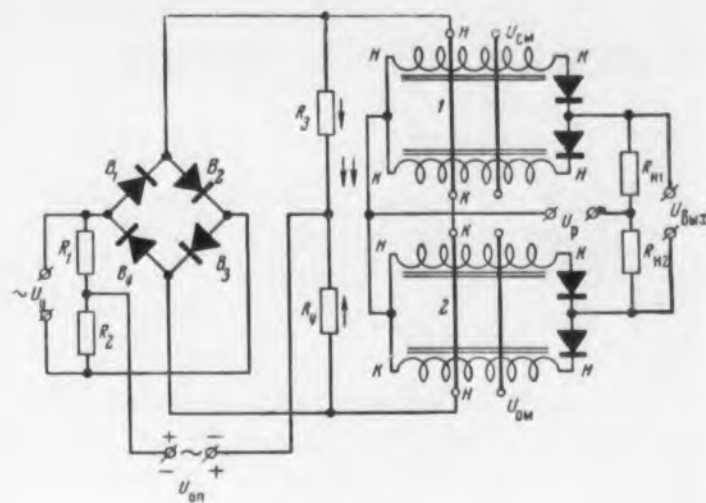


Fig. 3

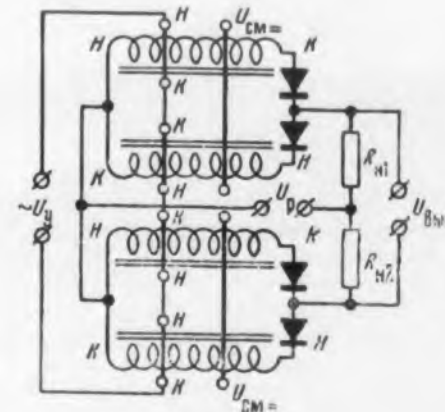


Fig. 4

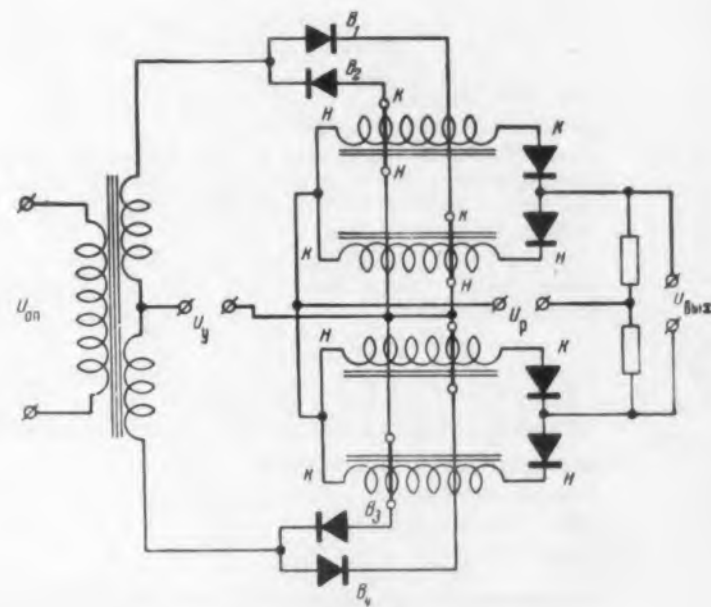


Fig. 5

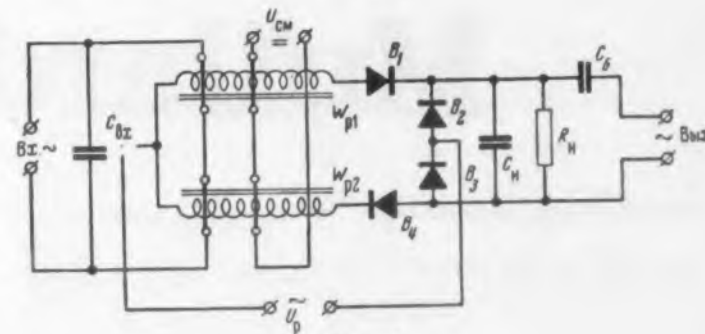


Fig. 6



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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

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.

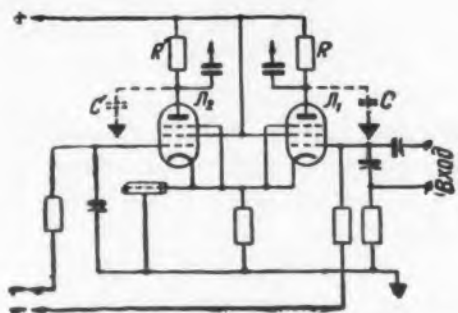


Рис. 1

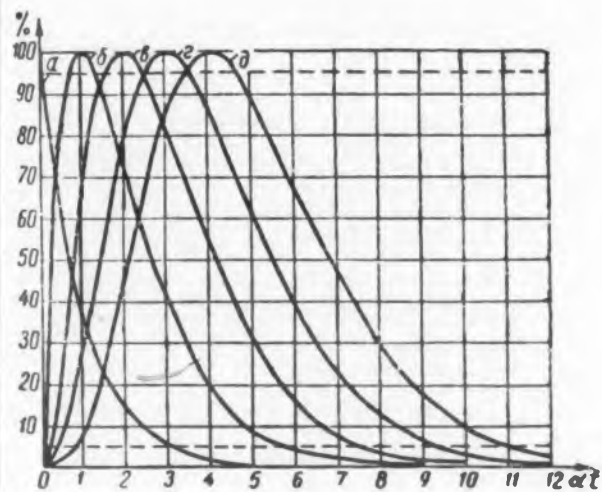


Рис. 2

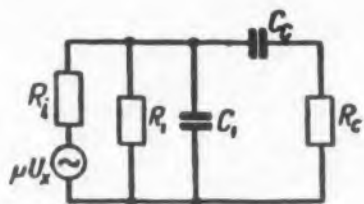


Рис. 3



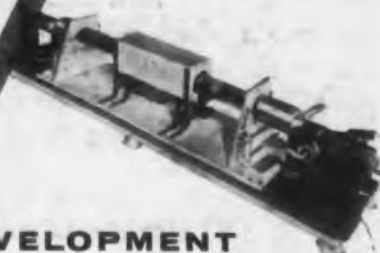
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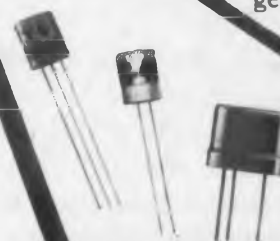
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CIRCLE 303 ON READER-SERVICE CARD FOR MORE INFORMATION

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.

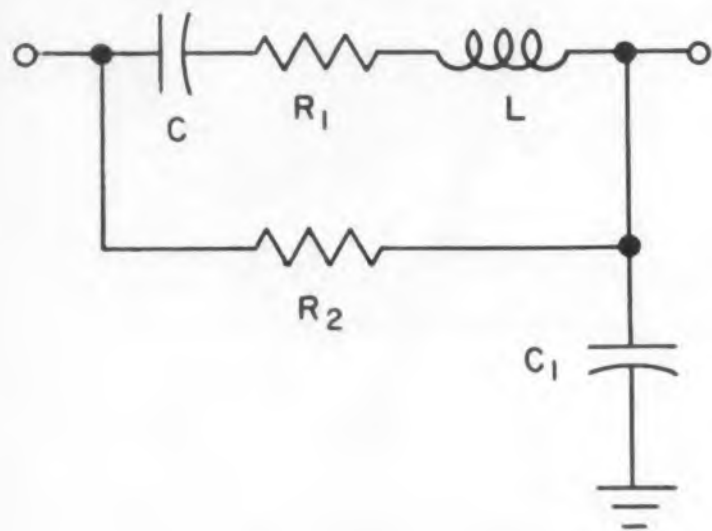
Electrical Properties

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



The equivalent circuit of a capacitor

Abstract

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.

Capacitors

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

our 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 μf), 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.



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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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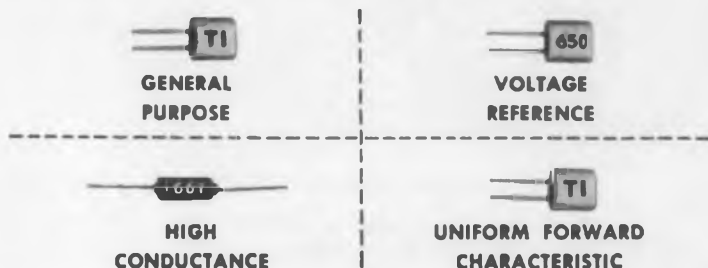
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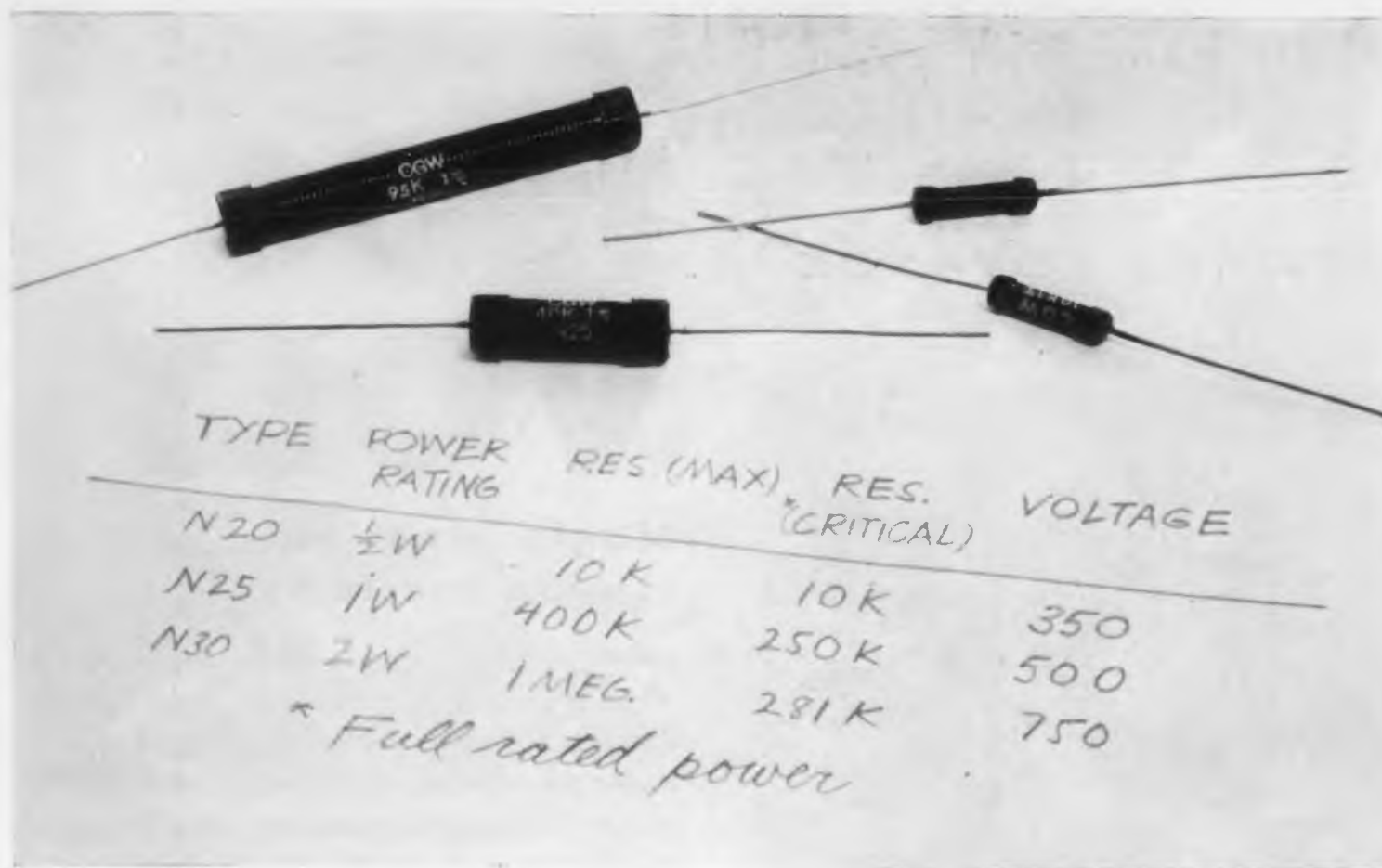


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Standards and Specs

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 discussion 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, pre-fabricated, 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-WIRE-WOUND (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 $\pm 5\%$, 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 obtained 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:

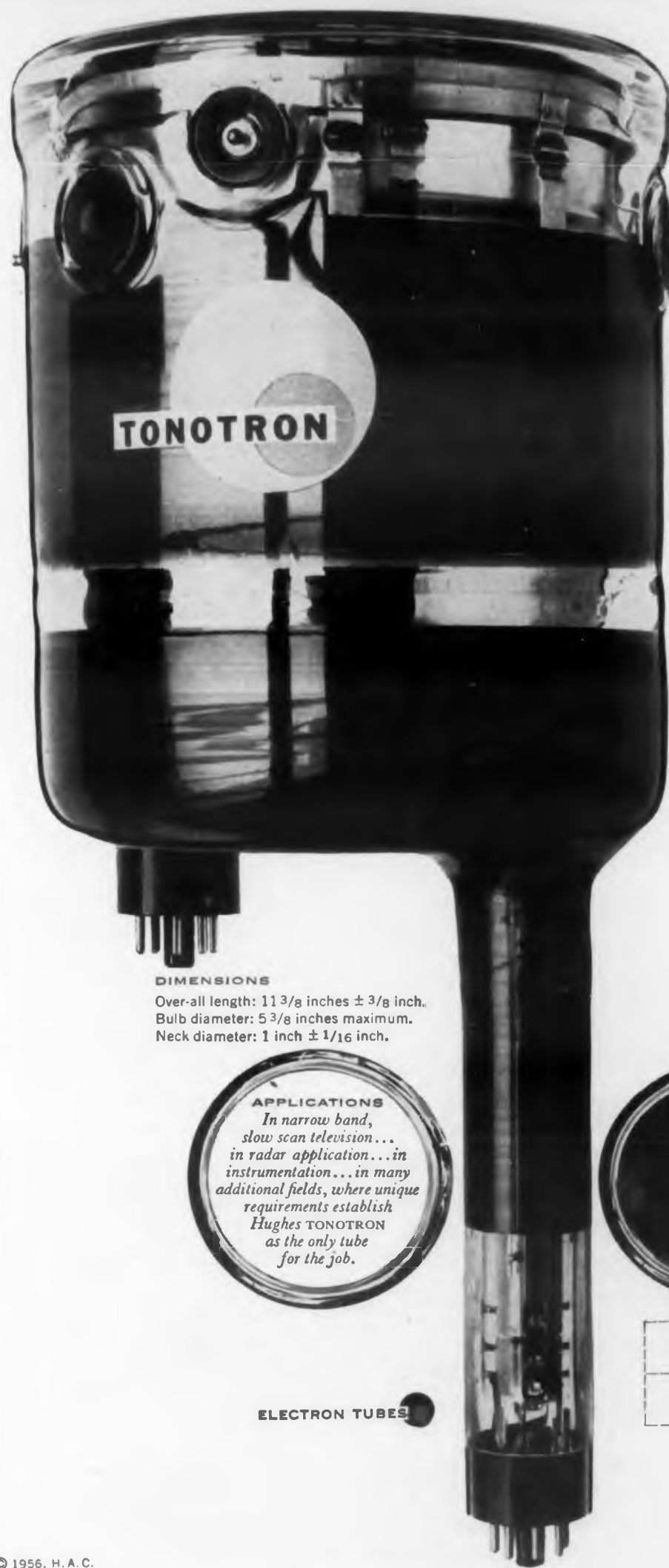
Z24.17-1955, Specification for the Design, Construction and Operation of Class HI (High-Impact) Shock-Testing Machine for Lightweight Equipment.

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. ASEA 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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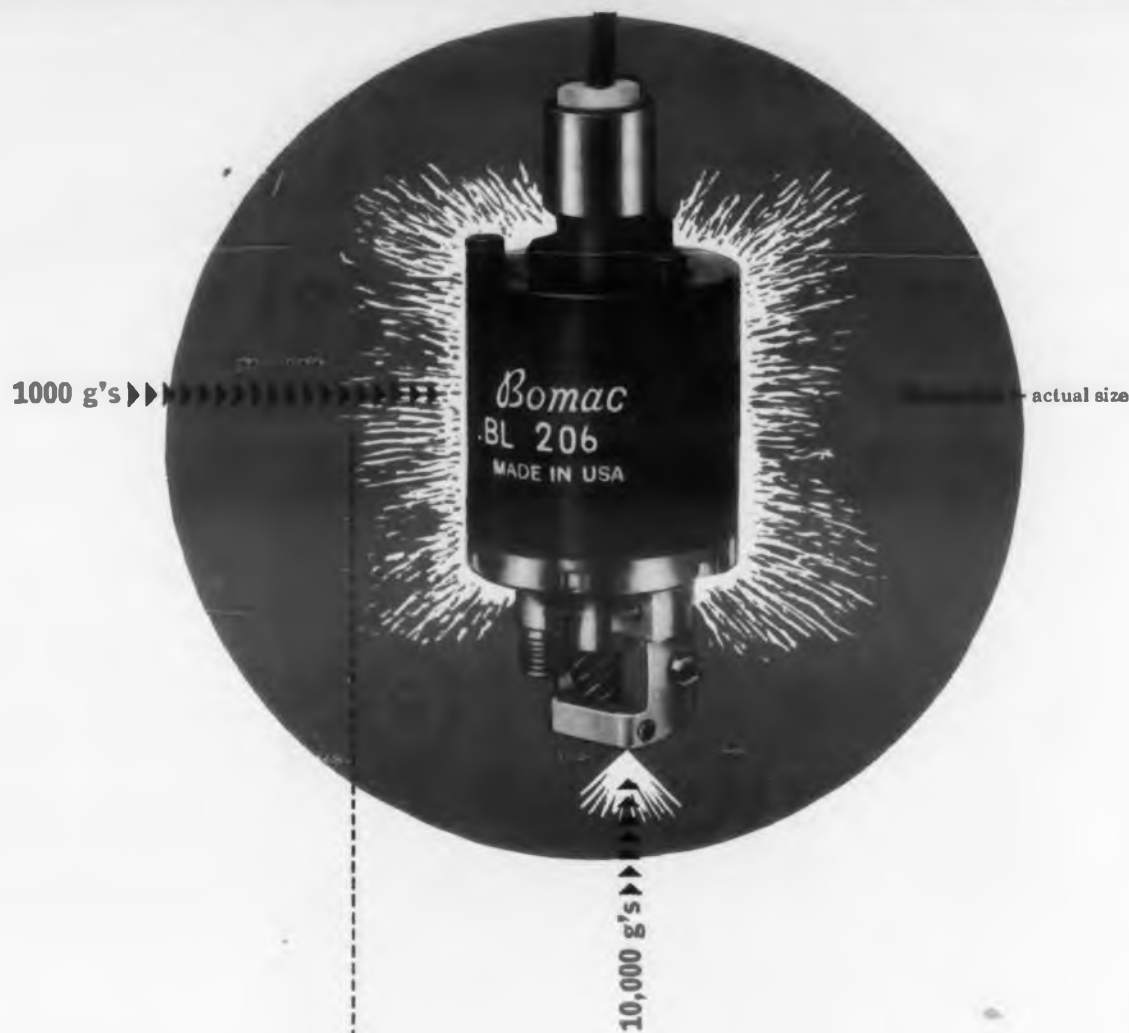
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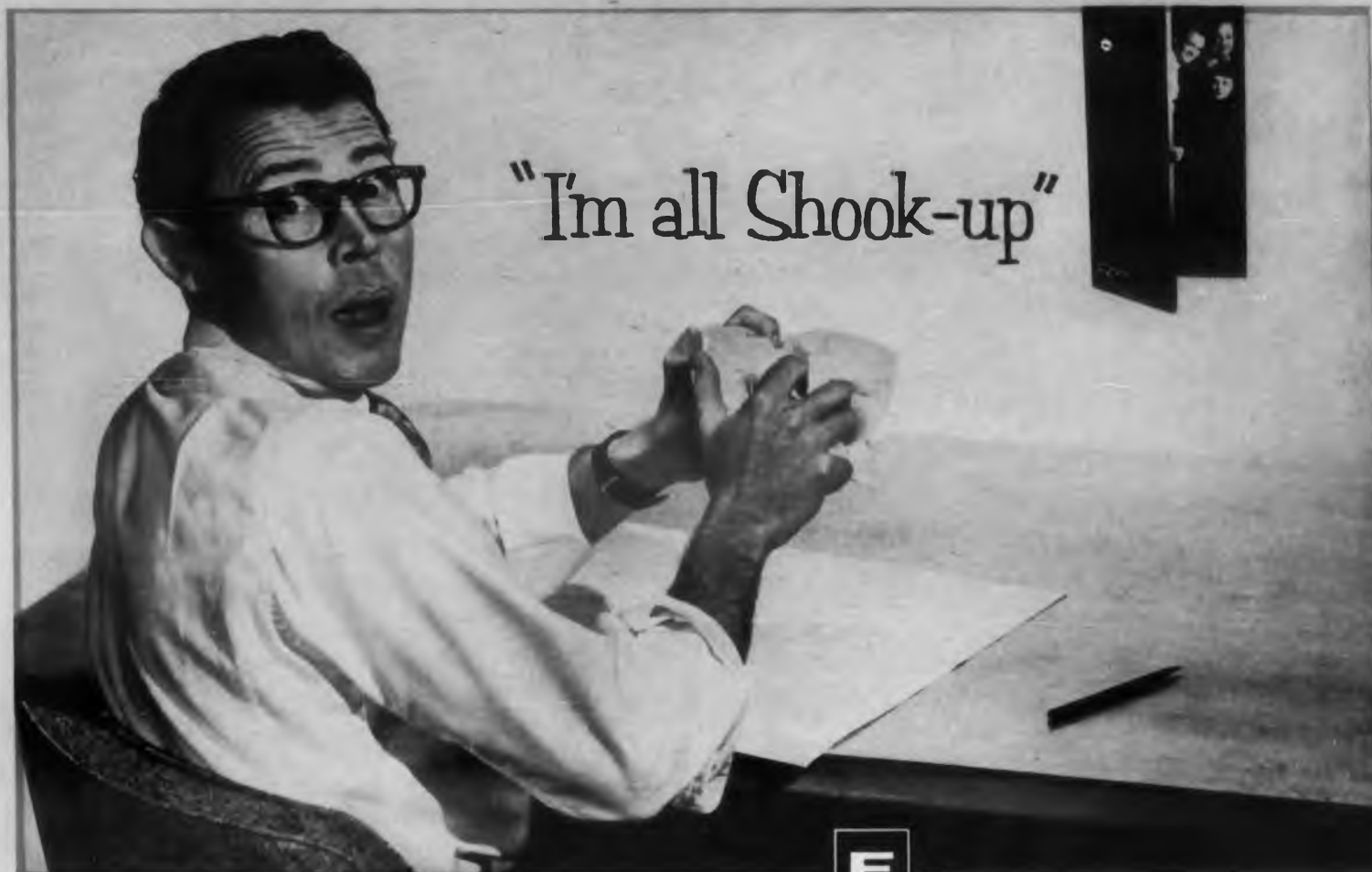
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