

electronics

A MCGRAW-HILL PUBLICATION

**MECHANIZED
PRODUCTION**
of
Electronic Equipment

▼ *SP21*
**24-Page Special
Report on Latest
Techniques...**

- ▶ etched wiring
- ▶ component preparation
- ▶ machine assembly
- ▶ dip soldering
- ▶ automatic testing

SEPTEMBER • 1955

PRICE 75 CENTS

Also in this issue:

High Fidelity with Transistors
page 174

Latest Technical Literature
page 337

OUR 10 MILLIONTH MILITARY UNIT SHIPPED THIS YEAR

Military Components FOR EVERY APPLICATION

A HUNDRED STOCK UNITS in our catalog B... 30,000 special designs



FILTERS

UTC filters, equalizers and discriminators are produced in designs from .1 cycles to 400 mc. Carrier, air and telemetering types available in standard designs.

POWER COMPONENTS

The scope of military power components produced at UTC ranges from 500 lb. plate transformers to miniaturized 2 oz. units... hermetically sealed and encapsulated... molded types.

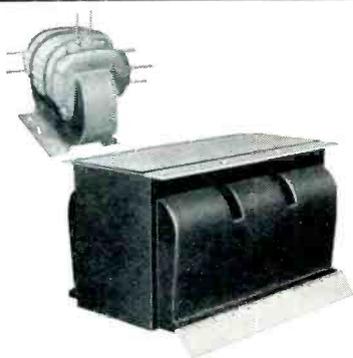


ENCAPSULATED UNITS

8 years of encapsulation experience assure maximum reliability in this class of UTC material.

MOLDED UNITS

UTC molded units range from 1/8 oz. miniatures to the 100 lb. 3 phase unit illustrated.



PULSE TRANSFORMERS

UTC pulse transformers cover the range from molded structures weighing a fraction of an ounce to high power modulator applications.



MINIATURIZED COMPONENTS

UTC H-30 series audios are the smallest hermetic types made. Class A, B, and H power components of maximum miniaturization are regular production at UTC.



AUDIO COMPONENTS

UTC military audio units range from 1 ounce subminiatures to high power modulation transformers. Standard, high fidelity, sub-audio, and super-sonic types.



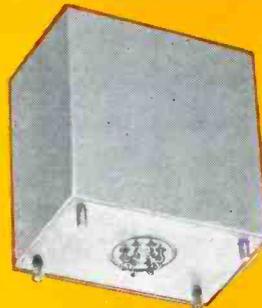
HIGH Q COILS

Unequaled stability is effected in UTC high Q coils thru special processes and materials. Toroid, mu-core, and variable inductors are available to military standards.



MAGNETIC AMPLIFIERS

In addition to a stock line of synchronous motor magnetic amplifiers, UTC manufactures a wide variety to customer specifications. Saturable reactors supplied for frequencies from cycle to 40 mc.



WRITE FOR UTC CATALOG B

...includes complete line of hermetic audios, reactors, magnetic amplifiers, filters, high Q coils, pulse transformers, etc.

UNITED TRANSFORMER CO.

150 Varick Street, New York 13, N. Y. EXPORT DIVISION: 13 E. 40th St., New York 16, N. Y. CABLES: "ARL"

H. W. MATEER, *Publisher*

W. W. MacDONALD, *Editor*

VIN ZELUFF, *Managing Editor*

JOHN MARKUS, *Associate Editor*

ALEXANDER A. McKENZIE, *Associate Editor*

JOHN M. CARROLL, *Associate Editor*

WILLIAM P. O'BRIEN, *Assistant Editor*

WILLIAM G. ARNOLD, *Assistant Editor*

DAVID A. FINDLAY, *Assistant Editor*

HAIG A. MANOOGIAN, *Assistant Editor*

EDMUND B. PALMQUIST, *Assistant Editor*

GLORIA J. FILIPPONE, *Editorial Assistant*

ARLENE SCHILP, *Editorial Assistant*

GLADYS T. MONTGOMERY, *Washington Editor*

HARRY PHILLIPS, *Art Director*

ELEANORE LUKE, *Art Assistant*

WALLACE B. BLOOD, *Manager*

R. S. QUINT, *Buyers' Guide Manager*

FRANK H. WARD, *Business Manager*

GEORGE E. POMEROY, *Classified Manager*

DONALD H. MILLER, *New York*

JAMES GIRDWOOD, *New York*

WM. S. HODGKINSON, *New England*

JAMES T. HAUPTLI, *Philadelphia*

CHARLES WARDNER, *Chicago*

BRUCE WINNER, *Chicago*

HENRY M. SHAW, *Cleveland*

T. H. CARMODY, *San Francisco*

R. C. ALCORN, *San Francisco*

CARL W. DYSINGER, *Los Angeles*

WM. D. LANIER, *Atlanta*

JAMES H. CASH, *Dallas*

KEITH HENNEY, *Consultant*

AUTOMATIC TERMINAL INSERTER—Machine built for IBM's Kingston, N. Y. plant by Berg Manufacturing and Engineering stakes up to 41 lugs in etched wiring boards for radar computer. Photo by E. J. Casazza (see p 137)
COVER

SHOPTALK 2

FIGURES OF THE MONTH 6

INDUSTRY REPORT 7

Transistor Operates At UHF.....	7	Networks Plan More Color.....	16
Electronics Aids Space Station.....	7	Industry Shows Mixed Record.....	20
Hurricanes Speed Radar Islands.....	8	Electronics Withstands Blast.....	20
Computer Firm Presses 1,000 Mark	8	More Firms Feature Electronics.....	22
Orthicon Output Gets A Boost.....	10	Educational TV Plans Big Year.....	22
Productivity Gains In Industry.....	12	Taped Music Has Sound Future.....	22
Army Buys Transistor Transceivers.	12	Commercial TV Set For Britain.....	24
Reactors Expand Electronics.....	12	Microwave Relay Business Stirs.....	24
Missiles Business Shoots Up.....	14	Infrared Scopes Go Commercial.....	24
What's Ahead For Rest Of 1955.....	14	Financial Roundup.....	26
Analog Computers Help Design.....	16	Future Meetings.....	26
Klystron Business Keeps Gaining.....	16	Industry Shorts.....	26

CROSSTALK 121

FEATURES

All-Magnetic Audio Amplifier..... 122
By J. J. Suozzi and E. T. Hooper

Transistor Modulator for Flight Trainers..... 126
By George M. Ettinger

Ultrasonic Phase Meter Measures Water Velocity..... 128
By Keefer S. Stull, Jr.

Pulsed Tones Control A-M and F-M Stations..... 132
By Herbert Michels

MECHANIZED PRODUCTION OF ELECTRONIC EQUIPMENT..... 137
By John Markus

1. Etched Wiring 138
2. Component Preparation 141
3. Machine Assembly 147
4. Dip Soldering 157
5. Automatic Testing 159

Binary-Adder Tube for High-Speed Computers..... 161
By Frederick B. Maynard

Electromagnet Removes Nonferrous Metals	164
By William Vail Lovell	
Automatic Recorder for Complex Impedances	167
By Harold M. Sharaf	
Amplifier for Fast Rise-Fall Pulses	170
By Charles R. Deming	
Notch Network Design (Reference Sheet)	172
By C. J. Savant, Jr. and C. A. Savant	

ELECTRONS AT WORK..... 174

High-Fidelity Transistor Amplifier...174	Rain Gages Send Radio Reports...186
Underwater Television Camera...176	Square-Law Circuit.....192
Weather Radar Uses C-Band...178	Aeronautical Communications...202
Transoceanic Telephone Cable...178	WOR Master Control.....204
Higher Velocity of Propagation...180	Microphonics In Transistors.....206
Radar Aids Meteorology.....182	British Color TV Tests.....206
Silicon Power Rectifier.....184	Pertinent Patents.....206
Ordering Airline Tickets.....208	

PRODUCTION TECHNIQUES..... 220

Slots Anchor Built-in TV Antenna.220	Transparencies Reduce Drafting...246
Lugs Spread on Etched Board...220	Support for 24-Inch Picture Tube..248
Hopper-Fed Automatic Lead Cutter.222	Building Potted Amplifiers.....250
Dip-Soldering Techniques.....228	Cement Fed to Both Sides of Mold.254
Sorting of Paper Capacitors.....230	Thread-Mutilating Tool.....256
Dip-Solder with Tubes in Sockets..236	Drop Test for Instruments.....258
Taps of Precision Windings.....238	Mounting I-F Transformers.....262
Electrolytics on Etched Boards...240	Packaging for Resistors.....264
Cork Tape Cutter.....244	Lead Length Gage.....266

NEW PRODUCTS..... 268

LITERATURE..... 337

PLANTS AND PEOPLE..... 352

NEW BOOKS..... 380

THUMBNAIL REVIEWS..... 385

BACKTALK..... 386

INDEX TO ADVERTISERS..... 431

SHOP

IN THIS ISSUE—Three months on special assignment, to survey the state of mechanization of the electronics industry, resulted in a multitude of experiences for associate editor Markus.

These included taking off from a cow-pasture-size airport in a DC-3 at twilight in Indiana, having a union steward threaten to strike a whole plant if "that guy" didn't stop taking pictures, getting thoroughly dusty near the ceiling of another plant while searching for the most photogenic camera angle of a long line assembly machine, riding to another plant in a photographer's Lincoln Capri with elevator seats, and finding his photographs mysteriously fuzzed in the vicinity of one most interesting gadget, yet perfectly sharp everywhere else.

At one plant, a blustering red-faced foreman dashed up screaming, "Eight rejects have come down the line since you guys started taking pictures; get out of here!"

Markus traveled over 5,000 miles. Corrospended with a hundred manufacturers of components and complete electronic equipments. Made and received enough long-distance telephone calls to go once around the world. Reports and other material fill a three-foot bookshelf.

He also acquired enough samples of "new look" components to fill a desk drawer; in fact, after filling pockets while going through one television plant, the vice president thoughtfully offered to align the

electronics

SEPTEMBER, 1955 Vol. 28, No. 9



Member ABC and ABP

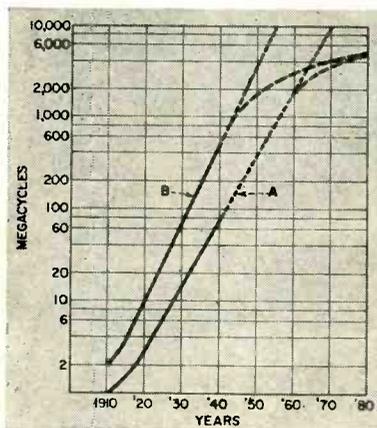
TALK

tv set after editor Markus had put it together.

OF PROPAGATION — The current flurry over so-called scatter propagation (ELECTRONICS, p 149, Mar. '55) has sent the editors digging into yearly indexes and files to answer phone calls. Among the items of interest is "Reliable VHF Signals Up to 1,250 Miles Distance", abstracted from a Bureau of Standards report by Alex McKenzie and published on page 102 of the June 1952 issue. This described ionospheric forward scatter.

Another, which has to do with "backscatter", is entitled "COZI, Communication Zone Indicator" and shows a method of measuring skip distance instantaneously. Some callers seem glad to know about the piece in EAW (p 196, May '54) that summarizes diffraction-gain transmission experiments — although this beyond-the-horizon mechanism has little in common with scatter.

One dividend of this file-combing is shown in the illustration. Until now unpublished, the graph shows a forecast of maximum frequency usage as well as actual past usage. It was compiled in 1940 by a well-known engineer (now retired) of a large electronics firm (still in business). Curve B, representing stabilized laboratory use, leads in frequency over curve A, which indicates wide commercial use. The compiler said, at the time, "... practical considerations of propagation, apparatus and service may begin to



ELECTRONICS file divulged this old graph prepared by a leading engineer in 1940. Frequency use in laboratories (B) and commercially (A) are extrapolated from 1940

limit the increase at 2 or 3 kmc and a final limit, for communication purposes, may be reached at 4, 5, 6 or 10 kmc. This possibility is shown in dashed lines."

REFLECTS INDUSTRY—Activities of readers at work certainly shows up in a comparison of our first Buyers' Guide, published in 1941, with the issue just released.

About 175 major products were listed in 1941, while today over 1,700 individual products are classified. The early issue contained 1,400 manufacturers producing for electronics; now there are over 3,000.

The first Guide was included in a regular issue and contained 65 pages. The current issue is a separate publication totaling 1,054 pages, of which 228 make up the

directory information section.

SOLVENT NEEDED—One reader who clips articles for preservation in group binders finds it easy to remove the staples but difficult to remove the glued pages from the backing. Since the magazine is made up of groups of double-pages folded in half, only the outer double page of each group is glued. But there are enough to be troublesome, if neat pages are required.

AUTHORS' NOTE — More than the usual number of engineers have contacted the editors in recent months asking questions that have to do with the mechanical details of preparing a manuscript. Such as what size paper, drawings, photographs and so on. We like that.

What puzzles us is that some of these potential authors are reticent as to the subject matter of the proposed article. They seem reluctant to tell us what is new and different about the equipment or technique and feel that the article will explain that.

But the subject is our major interest, and the reader's major interest.

When you plan to do an article, please do get in touch with us before you get involved in the mechanics of putting it together. Write, phone or stop in, with as much technical information as possible. Maybe we can help, then, in advising on the mechanics and avoid rewriting later.

Published monthly with an additional issue in June by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder, Executive Editorial and Advertising Offices; McGraw-Hill Building, 330 W. 42 St., New York 36, N. Y. Longacre 4-3900. Publication Office, 95-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Joseph H. Allen, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Circulation Director.

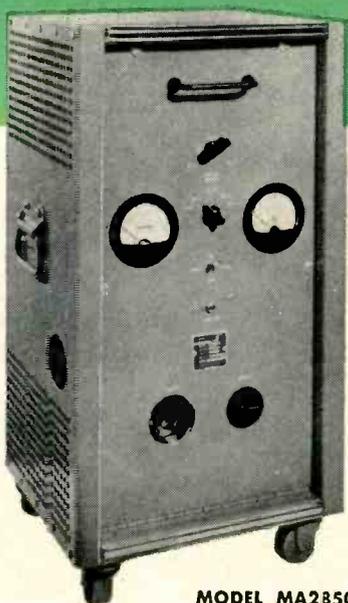
Subscriptions: Address correspondence to Electronics—Subscription Service, 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address. Subscriptions are solicited only from persons engaged in theory, research, design, production, maintenance and use of electronic and industrial control components, parts and end products. Position and company connection must be indicated on subscription orders.

Single copies 75¢ for United States and possessions, and Canada; \$1.50 for Latin America; \$2.00 for all other foreign countries. Buyers' Guide \$3.00. Subscription rates—United States and possessions, \$6.00 a year; \$9.00 for two years. Canada, \$10.00 a year; \$16.00 for two years. Other western hemisphere countries and the Philippines, \$15.00 a year; \$25 for two years. All other countries \$20.00 a year; \$30.00 for two years. Three-year rates, accepted on renewals only, are double the one-year rate. Entered as second-class matter August 29, 1936, at the Post Office at Albany, N. Y., under act of Mar. 3, 1879. Printed in U.S.A. Copyright 1955 by McGraw-Hill Publishing Co., Inc.—All Rights Reserved.

BRANCH OFFICES: 520 North Michigan Avenue, Chicago 11, Ill.; 68 Post Street, San Francisco 4; McGraw-Hill House, London, E. C. 4; Washington, D. C. 4; Philadelphia 3; Cleveland 15; Detroit 26; St. Louis 8; Boston 16; 1321 Rhoads-Haverty Bldg.; Atlanta 3, Ga.; 1111 Wilshire Blvd., Los Angeles 17; 919 Oliver Building, Pittsburgh 22. ELECTRONICS is indexed regularly in The Engineering Index.



MODEL MA640



MODEL MA2850



MODEL MA65

RUGGED • ACCURATE • TUBELESS

MAGNETIC AMPLIFIER DC SOURCES

(MA-NOBATRONS*)

Sorensen MA-NOBATRONS* have been designed for industrial applications and unattended installations where the utmost in maintenance-free service is required.

S P E C I F I C A T I O N S

	MODEL MA65	MODEL MA640	MODEL MA2850
INPUT	105-125VAC, 1Ø, 60 cycles		190-230VAC, 3Ø, 60 cycles 4-wire wye.
OUTPUT	6VDC, adj. $\pm 10\%$	4.5-7.7VDC, adj.	23-32VDC, adj.
LOAD RANGE	0-5 amperes	0-40 amperes	0-50 amperes
REGULATION	$\pm 1.0\%$ for any combination of line and load conditions		
RECOVERY TIME	0.15 seconds under worst conditions	0.2 seconds under worst conditions	0.5 seconds under worst conditions

Contact your local Sorensen representative, or write for further information. If you have special requirements in magnetic amplifier DC sources, write or call the Applications Engineering Department, and your problem will receive prompt attention.

SORENSEN & COMPANY, INC. • 375 FAIRFIELD AVE., STAMFORD, CONN.

*Reg. U.S. Pat. Off.

CONTROLLED POWER FOR



RESEARCH AND INDUSTRY

TECHNIQUE

This quarterly journal of instrument engineering
is received regularly by 20,000 engineers and technicians
including 5,000 in the U.S.A.

It is available free of charge to all scientists,
research workers, engineers, technicians and others
who are interested in scientific instruments.

why not add your name to our mailing list ?

Recent issues have contained articles on the following subjects :—

Remote indication for weighing machines

The Canadian Weatherfax System

Rolls-Royce vibration measuring installation

Muirhead resistors on Mount Everest

New time signal equipment

Recent developments in ship stabilization

Make sure that *you* receive "Technique" regularly by writing to the address below

MUIRHEAD

PRECISION ELECTRICAL INSTRUMENTS

Muirhead & Co. Limited · Beckenham · Kent · England

Sales & Service U.S.A.

Muirhead Instruments Inc. · 677 Fifth Avenue · New York 22 · N.Y.

INDUSTRY REPORT

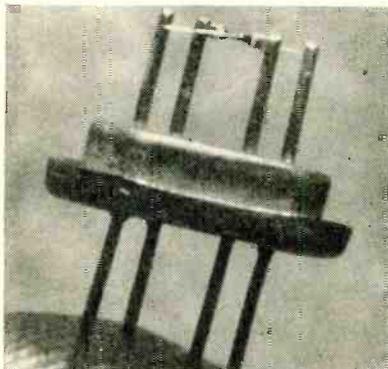
electronics—September • 1955

Transistor Tetrode Operates At UHF

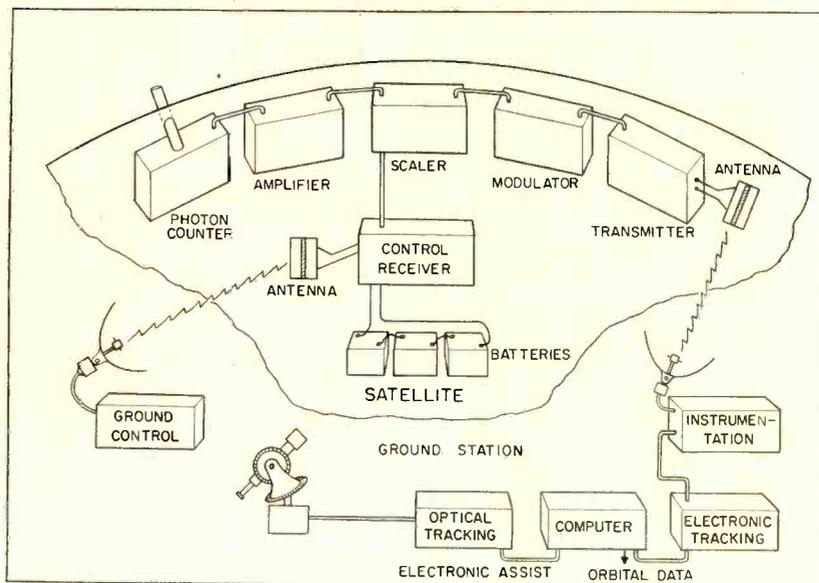
OPERATION at frequencies exceeding 1,000 mc has been reported for experimental *npn* junction tetrode transistors produced by Bell Telephone Labs. Their high-frequency operation is achieved by reducing the central *p* layer to less than 0.0002 in. wide.

► **Other Units**—At least three companies, Germanium Products, Texas Instruments and Western Electric have transistor tetrodes commercially available. These are *npn* grown-junction units that work mostly at video and low vhf frequencies.

Transistors previously announced for the vhf and uhf regions include selected point-contact units (p 10, Aug. '52) operating up to 225 mc and the *pnip* transistor (p 18, Oct. '54) which oscillated at 440 mc and was expected to attain 3,000 mc. Other candidates for high-frequency transistor operation include surface-barrier transistors (p 12, Jan. '54) and the field-effect transistor or fieldistor.



UHF tetrode transistor



Educated guess as to how the first earth satellite may utilize electronic means of tracking and data reporting on command from the ground

Electronics Aids Space Station

Ten-million dollar project will swing reporting satellite at 18,000 mph

ALTHOUGH FOLLOW-UP stories predict greater space marvels after launching of the first earth satellite, announced recently by the President, scientists are puzzling just how to spend their multimillion government windfall most effectively. Techniques are known—in most cases proved—but will require careful dovetailing for greatest effectiveness and reliability in the first orbiter.

Scientists are surer, at this point, what they will not do rather than exactly how the job will be accomplished. They believe, for ex-

ample, that dry batteries are a more reliable source of power than the solar batteries that will likely be employed in later satellites.

▲ **Why the Satellite?**—Projected as a part of the U. S. program of participation in the International Geophysical Year (1957-58), the 100-pound, basketball-like artificial satellite will be placed on orbit some 250 miles above the earth by rocket techniques. It will give unprecedented opportunities for scientific measurements of the upper atmosphere. Unlike a rocket, it will have a useful life expectancy of weeks, months or even years. The first may be limited to days or weeks. Out of approximately 90 minutes in which it will encircle

the earth, perhaps three to five will be available for experimentation.

The mass of electronic equipment used in launching and tracking the satellite, being similar to that used in military weapons, will probably remain classified information—when it is finally decided upon.

► **Educated Guessing**—Thinking aloud to an **ELECTRONICS** editor, John W. Townsend, Jr., assistant head of the Rocket Sonde Branch, Naval Research Laboratory, had a few ideas on the direction of proposed instrumentation. Some of his conclusions:

Mercury batteries and silver cells will probably power the satellite electronic equipment.

Telemetry and tracking equipment might be combined with tracking running continuously and instrumentation on and off.

Tracking can use low-power narrow bandwidth transmissions.

Telemetry will require full-power and wide bandwidth.

The switch between functions can be made with radio control from the ground.

Satellite instrumentation will include photon counters, Geiger counters, magnetometers, electrostatic analyzers, amplifiers and scaling circuits—about 40 pounds of gear.

The telemetry transmitter may be f-m, f-m/f-m and p-w/f-m.

Tracking and ground command equipment may be conventional (and classified).

Computers will bulk large in maintaining accurate tracking of the bird.

High-accuracy optical tracking (when weather permits) will get an electronic assist by computing tracking measurements.

Computers will also indicate slowing up of the satellite and make possible measurements of retarding forces.

► **Route of the Bird**—If, as is expected, the orbit of the satellite is chosen over the equator (rather than over the poles) countries along the route will be able to track the orbit part of each 90-minute circuit.



CONSTRUCTION work is stepped up on Air Force Texas Towers as . . .

Hurricanes Speed Radar Islands

FIRST of the U. S. Air Force's steel islands for aircraft-detecting radar launched in May at Quincy, Mass., is now in place on Georges Bank, about 100 miles east of Cape Cod. Installation work was speeded in August when hurricanes Connie and Diane threatened the New England states. Cement work was completed while construction crews worked around the clock to make the island secure. Now electronic technicians are readying radar and radio equipment.

► **Equipment**—Rising from the platform will be three rubber radomes, each the size of a greenhouse. Each station will have height finders and a search radar. The height finders, type AN/FPS-6, manufactured by GE, have also been supplied to the Air Force for the ground radar network guarding the North American continent and are produced in a mobile version, the AN/MPS-14, for movement by trucks or heavy cargo aircraft.

► **Size**—The legs of the tower, reaching down to shoals along the continental shelf, will support a platform mounted 87 feet above water level, out of the reach of waves. The steel platform alone weighs 6,000 tons. It is the first of several similar towers to be erected along the east coast of the U. S.

for the Continental Air Defense Command by the Navy's Bureau of Yards and Docks. The stations will be located approximately 100 miles off the coast and will be linked with the Continental Air Defense Command's shore-based warning network. Multichannel radio and radioteletypewriter circuits will make use of new beyond-the-horizon propagation techniques. Each station will include housing facilities for a crew of 70 Air Force, Navy, Weather and Coast Guard personnel who will be stationed at the sites for 30-day periods or more.

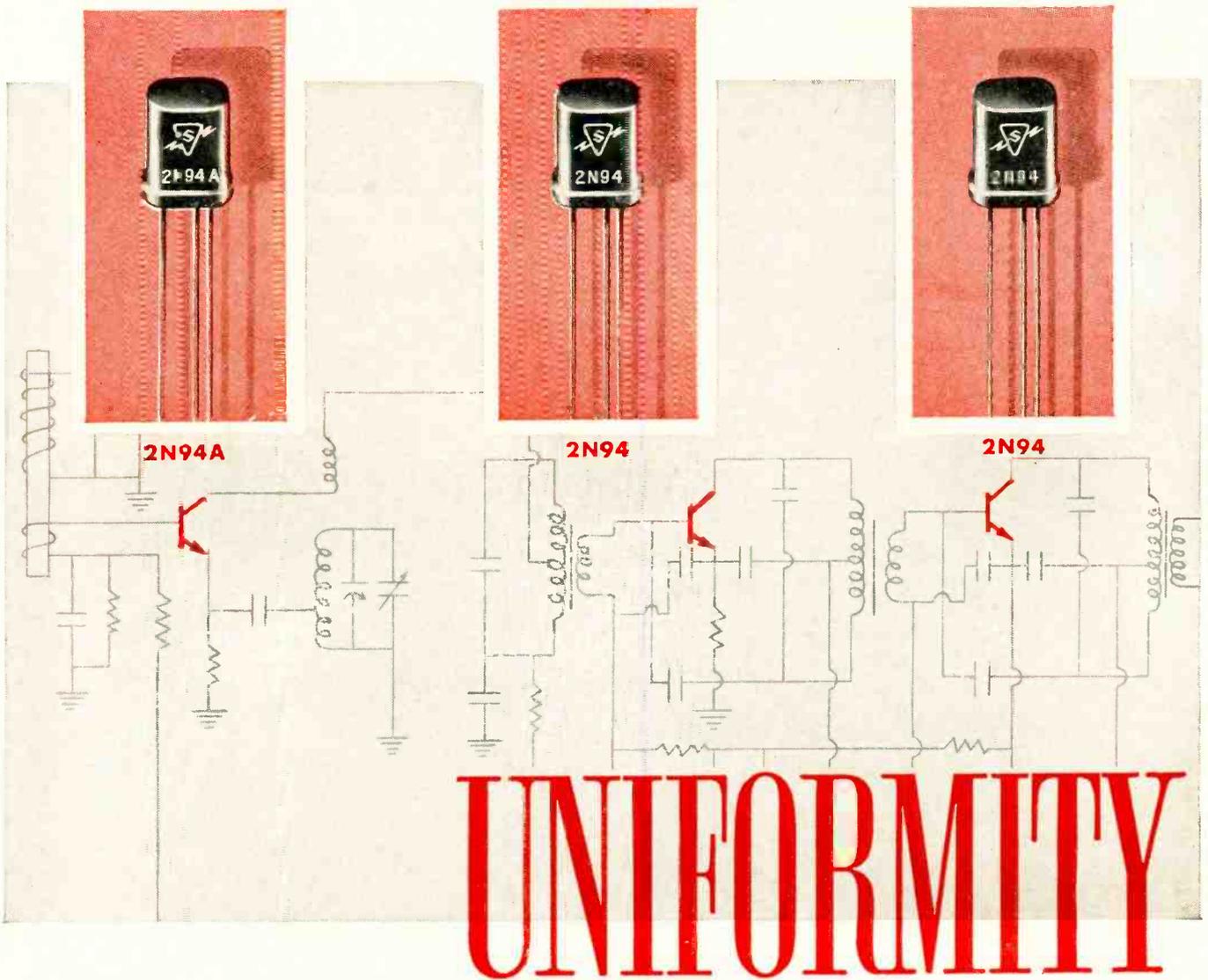
Computer Manufacturer Presses 1,000 Mark

IBM discloses sales, orders, and new developments in data processing machines

SALES for electronic data processing machines are approaching the 1,000 mark at International Business Machines Corp. The figure includes 31 machines of the one-million-dollar-plus 700 series delivered and another 150 on order as well as 80 smaller-sized model 650's installed and 700 on order.

► **Data Processing**—The term electronic data processing machine

(Continued on page 10)



...for more gain from stage to stage without preselecting

For your broadcast applications, Sylvania high frequency transistors Type 2N94 and 2N94A offer higher gain without preselection by stage. Production is simplified; performance is more stable; servicing problems are minimized.

Low collector capacitance and ease of neutralization account for this important advantage. In a typical broadcast application, the addition of a

single 10 μ f capacitor in the collector circuit of IF and RF stages provides adequate neutralization.

Uniformity is obtained through unique construction techniques permitting close production control.

In computer applications Sylvania Transistors offer quick recovery time for high speed switching and provide higher gains at higher operating currents.

High Frequency Transistors

Type 2N94 (3 mc alpha cutoff)
Type 2N94A (6 mc alpha cutoff)

- featuring
- high gain
 - high uniformity
 - low collector capacity
 - ease of neutralization

Low Frequency—High Gain

Type 2N34 (PNP)
Type 2N35 (NPN)
—for low to medium power use. Gains up to 40 db in grounded emitter circuit

High Power—Low Frequency

Type 2N68 (PNP)
Type 2N95 (NPN)
—increased power ratings—to 2.5 watts. Use for high current, low voltage applications (6—24 volt power supplies)
Type 2N101 (PNP)
Type 2N102 (NPN)
Similar to types 2N68 and 2N95 without cooling fins. Power dissipation 1 watt.

For complete information on Sylvania Transistors write to Department J20R



SYLVANIA

SYLVANIA ELECTRIC PRODUCTS INC., 1740 Broadway, New York 19, N. Y.

In Canada: Sylvania Electric (Canada) Ltd., University Tower Building, Montreal

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

(EDPM) includes only those electronic computers with sophisticated internal programming—meaning they can run off a problem in business data handling or in scientific computation from A to z without human intervention. Not included are electronic calculators—really souped-up versions of the desk calculator.

► **Big Fellows**—Nineteen model 701 computers are installed. The 701 is a large-scale computer especially designed for scientific computing. No more 701's will be produced.

This fall, six model 704 scientific computers of more advanced design will appear to replace a half dozen 701's which will then be assigned other chores. First 704 will go to the company's computation center in New York.

Twelve model 702 machines have been shipped. The 702 is a large-scale machine designed for business data processing. Users of it include Monsanto in St. Louis, IBM in New York and Poughkeepsie, General Electric in the Hanford, Wash. atomic energy works, Commonwealth Edison in Chicago, Pratt and Whitney in Hartford, Conn. and the Bank of America in San Francisco. The first 705—an advanced design business computer—is due this fall.

► **Smaller Machines**—The model 650 is a medium-sized edpm available with both punched-card and magnetic-tape input and punched-card and printed output. It handles both scientific and business computations. Several companies have more than one: Lockheed has five and GE has four.

The model 305, an edpm using the juke-box type of random-access memory, is expected to join the line this fall.

► **Other Developments**—A trend in large-scale computers is to magnetic-core memories. The models 704 and 105 use core memories for fast internal storage. Core memory is available for the 701.

Work on speeded-up input-output devices continues with a 1,000 line-per-minute printer soon to be

available for model 700 series machines.

► **Future**—Packaged programming for electronic computers is another area of development. Fortran, or formula translation, is a technique which translates engineering mathematical processes into machine language. Fortran will be available in January. Autocoder, which makes use of subroutines on magnetic tape to simplify business

data handling, will be available in March.

Trend at IBM is towards a single line of edpm. Already the 702, 704 and 705 can communicate with each other. Actually machines designed for scientific work have successfully handled business problems and vice versa. At present applications run two-to-one in favor of engineering over business but this may change on the long haul to two-to-one business.



TARGET and mesh assembly of camera tube is formed under dust and lint-free conditions at GE plant while . . .

Orthicon Output Gets A Boost

Three manufacturers now are producing the tubes for the television broadcasters

► **WITHIN** the past few months General Electric and Westinghouse have joined RCA as producers of image orthicons. Westinghouse began producing the tubes last May and GE production schedules call for shipments early this fall.

► **Volume**—Assembling the 256 parts of the tube is one of the most difficult jobs in the tube business. It requires high dust and lint control standards and calls for expert handicraft. This accounts for the high cost of the tubes. Of the two

types of image orthicons now being produced, the black-and-white studio camera tube sells for \$1,200 and the color image orthicon has a \$1,700 price tag. It is estimated that about 8,000 of the monochrome type are now in use and some 100 of the color type.

► **Output**—Difficulty of producing the orthicon is indicated by the manufacture and installation of the target and mesh assembly. It consists of a copper mesh of 500 wires to the inch spaced two thousandths of an inch from a glass membrane called the target that is between one tenth and two tenths of a thousandths of an inch thick.

(Continued on page 12)

Sprague on request will provide you with complete application engineering service for optimum results in the use of electrolytic capacitors.



Sprague

LITTL-LYTICS*

for

transistor circuitry

HERE ARE THE SMALLEST *aluminum electrolytic capacitors ever made to Sprague's rigid quality standards.* Add to that their low leakage current, high reliability, and moderate price, and you have a new series of *miniature* electrolytic capacitors ideal for use in transistorized pocket radio receivers, wireless microphones, personal-style wire recorders, and similar equipment.

Their ultra-low leakage current is particularly important for it means minimum drain and long battery life when used in filtering applications across a battery, and excellent circuit performance when used in coupling applications.

Sprague Littl-Lytics are available in a full range of capacitance ratings from 1 to 110 mf, and in standard working d-c voltages of 1, 3, 6, 10, 12, and 15. Sizes range from $\frac{3}{16}$ "D x $\frac{1}{2}$ "L to $\frac{3}{8}$ "D x $\frac{3}{4}$ "L. Maximum operating temperature of the new Type 30D capacitors is 65°C.

Performance characteristics, sizes and ratings of metal encased, hermetically sealed Littl-Lytics are all in Engineering Bulletin 320, available on letterhead request to the Technical Literature Section, Sprague Electric Company, 35 Marshall Street, North Adams, Massachusetts.

typical ratings

Cat. No.	30D6	30D16	
WVDC	6	6	
μ F	3	60	
Leakage Current (μ A Max.)	2.0	3.0	
Can Size	D"	$\frac{3}{16}$	$\frac{3}{8}$
	L"	$\frac{1}{2}$	$\frac{3}{4}$

*Trademark

world's largest capacitor manufacturer

SPRAGUE

Export for the Americas: Sprague Electric International Ltd., North Adams, Massachusetts. CABLE: SPREXINT.

Productivity Gains In U.S. Industry

ANALYSIS of government statistics by the U. S. Chamber of Commerce indicates that American industry has increased the output of goods and services almost 30 percent since the end of World War II. The study estimates that from January 1946 to January 1954 the nation's output per man hour increased about 23 percent. For 1954, industry's productivity boost is estimated at four to six percent.

► **Gains**—Since 1929 average hourly earnings of factory workers have increased 104 percent compared to an increase of 97 percent in the average output per worker.

Army Buys Transistor Transceiver

FIELD tests are being made by the Signal Corps of a quantity of developmental f-m transceivers. The set, developed by RCA, is designed for communications over a quarter-mile range. Pocket-size, it consists of a receiver-transmitter, microphone-earphone, collapsible antenna and a battery in a 15-ounce assembly.

The transceiver contains 12 transistors and one tube. It incorporates an all-transistor superheterodyne receiver and a two-transistor, one-tube transmitter. Up to ten hours operation is provided with a single battery.

Any frequency between 45 and 30 mc can be preset. The design is adaptable for fully automatic production.



Helmet holds transceiver



OUTPUT of equipment such as this designed by Phillips Petroleum for a small AEC reactor will grow when . . .

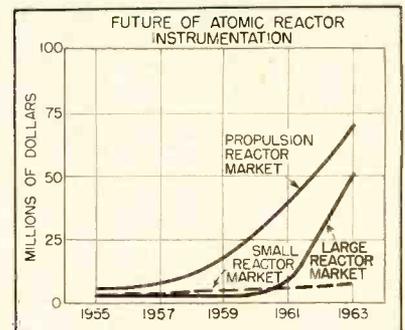
Reactors Expand Electronics

Projected growth in construction and use of power reactors bids to swell instrument volume

INCREASING use and development of atomic reactors in the U. S. in the next 9 years is forecast by the Atomic Industrial Forum. Its report shows that maximum reactor expansion may mean an annual volume of over \$125 million in reactor instrumentation.

► **Major Markets**—As is shown in the chart, three markets for reactor instrumentation will be propulsion reactors designed primarily for naval craft and aircraft, small reactors or plants which include central-station plants having an electric output of less than 25,000 kw and central-station reactors above that output rating. Instruments for reactors used by AEC for weapons-material production are not considered.

Instrumentation sales for propulsion reactors are seen reaching at least \$35 million and perhaps as much as \$70 million by 1963. For large reactors instrument sales of at least \$1 million are projected by



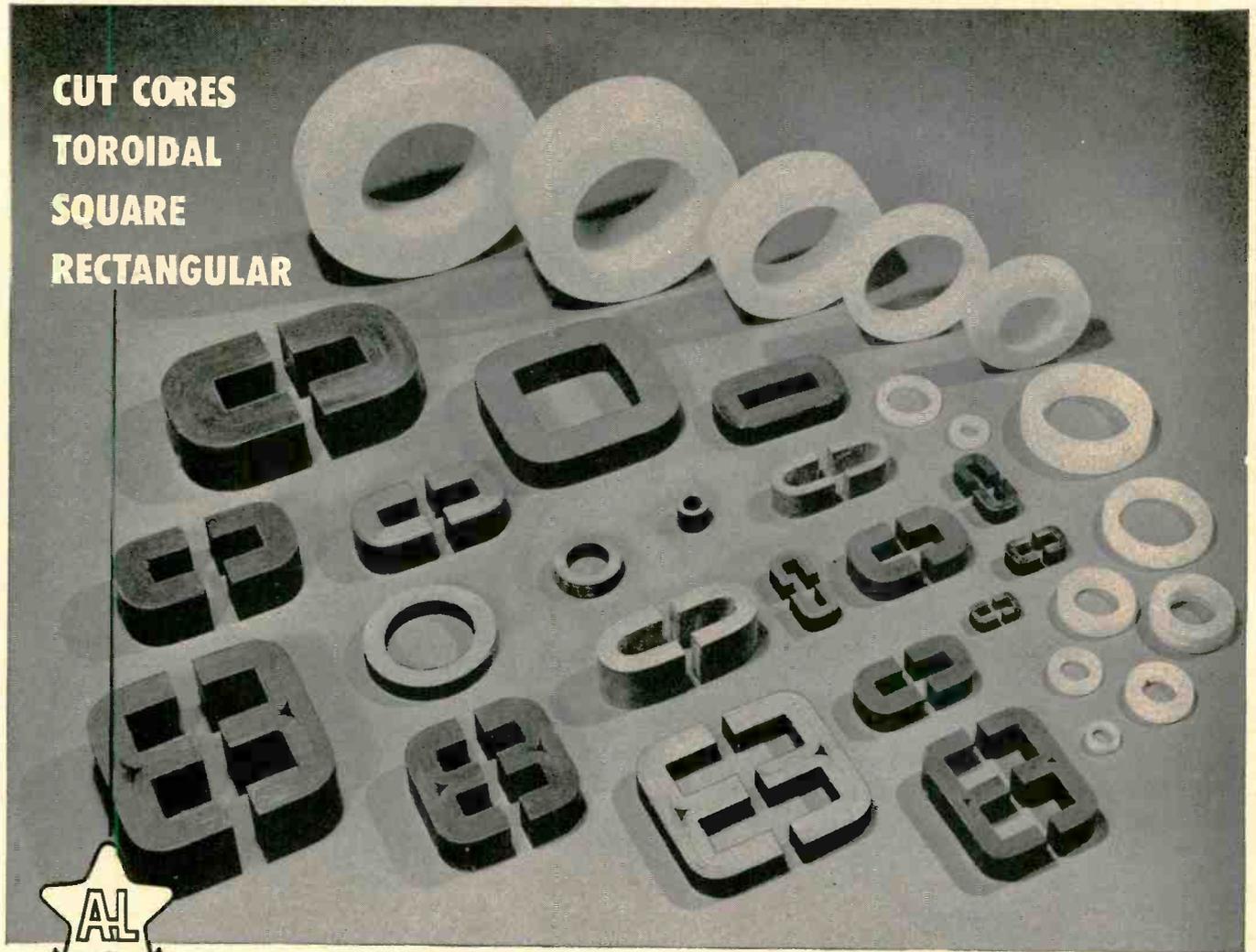
1963. However a maximum volume of \$50 million could be attained by 1963 depending on commercial development. Small reactors are seen accounting for between \$2 million and \$7 million in instrumentation sales.

► **Future**—The percentage of the total cost of a reactor plant devoted to instrumentation will be reduced to one-half its present value as these plants progress from developmental to commercial stages. In pilot and experimental plants, designs are normally over-instrumented because of safeguards incorporated.

As experience grows, instrumentation for experimental purposes

(Continued on page 14)

CUT CORES
TOROIDAL
SQUARE
RECTANGULAR



Anything You May Need in **TAPE-WOUND CORES**

RANGE OF MATERIALS

Depending upon the specific properties required by the application, Arnold Tape-Wound Cores are available made of DELTAMAX . . . 4-79 MO-PERMALLOY . . . SUPERMALLOY . . . MUMETAL . . . 4750 ELECTRICAL METAL . . . and SILECTRON.

RANGE OF SIZES

Practically any size Tape-Wound Core can be supplied, from a fraction of a gram to several hundred pounds in weight. Toroidal cores are made in twenty-seven standard sizes with protective nylon cases. Special sizes of toroidal cores—and all cut cores, square or rectangular cores—are manufactured to meet your individual requirements.

RANGE OF TYPES

In most of the magnetic materials named, Arnold Tape-Wound Cores are produced in the following standard tape thicknesses: .012", .004", .002", .001", .0005", or .00025", as required.

For complete details, write for Bulletins TC-101A and SC-107.

Applications

Let us help with your core problems for Pulse and Power Transformers, 3-Phase Transformers, Magnetic Amplifiers, Current Transformers, Wide-Band Transformers, Non-Linear Retard Coils, Reactors, etc.

ADDRESS DEPT. E-59

W&D 8465

THE ARNOLD ENGINEERING COMPANY



SUBSIDIARY OF ALLEGHENY LUDLUM STEEL CORPORATION

General Office & Plant: Marengo, Illinois

DISTRICT SALES OFFICES . . . New York: 350 Fifth Ave.

Los Angeles: 3450 Wilshire Blvd.

Boston: 200 Berkeley St.

can be eliminated, control functions combined and made automatic and designs simplified.

Manufacturers of industrial-control instruments may have to gain some of the experience of radiation-detection instrument manufacturers to deal with the effects of radio-

activity and the best means of instrumenting reactor systems. The majority of components of reactor-instrumentation systems is standard. However, some novel functions are involved and high reliability is required because of the potential hazards.

Missiles Business Shoots Up

Expenditures for procurement grow faster than for aircraft. Electronics firms get share

DESPITE conflicting reports concerning the expenditures by the government for guided missile procurement, research and development, such weapons are growing in importance to the electronics industry.

► **Makers**—Prime contractors in the development and production of guided missiles are engaged in at least 27 separate projects for the military services, according to the Aircraft Industries Association. Manufacturers of electronic equipment among 20 known prime contractors of missiles include Bendix making the Loki, Western Electric with the Nike, Raytheon with the Hawk and Sparrow, Firestone with the Corporal, Eastman Kodak with the Dove, Sperry with the Sparrow, Philco with the Sidewinder and Hughes with the Falcon.

Magnovox recently announced that it had been awarded contracts for production of a new type of guided missile that has been under development for two years. Many other electronics manufacturers are also cashing in on the guided missiles program. Farnsworth Electronics Division of IT&T has received orders in excess of \$10 million for substantial quantities of control and test equipment in connection with the government's guided missile program.

► **Status**—As shown in the chart guided missiles expenditures have outstripped spending for aircraft in rate of growth in the past five years. They have increased steadily

while aircraft expenditures have dropped back. However, in terms of overall dollar volume, aircraft expenditures are some 15 times greater.

In the field of research and development, guided missiles rank almost equally with aircraft in funds provided. For fiscal 1955, an estimated \$254.1 million was obligated for guided missile research and development by the Defense Department compared to \$263.0 million for aircraft and related products.

The Air Force is taking the lead as the largest procurer of guided missiles of the three services. In fiscal '55 it is estimated that Air Force will spend \$258.5 million on the devices compared to \$144.9 for Navy and \$115.0 for Army. In 1954 and 1953, Army lead the services in missiles procurement.

Recent appointment of D. A. Quarles, former AT&T missiles expert, as Air Force Secretary also points up the weapon's growing importance.

What's Ahead For The Remainder Of 1955

Set manufacturers are optimistic but consumers plan to buy fewer tv sets

THE remaining months of the year have, in the past, accounted for as much as 45 percent of annual tv set sales and receiver manufacturers are, in the main optimistic about prospects. Some see improved profit margins.

► **Firms**—Hoffman Electronics' forecast for the fall months is healthy volume at a better price and profit level than has been experienced in the immediate past.

Motorola estimates that some 7.5 million tv sets will be sold during the year and estimates that some 4.4 million will be sold during the last half. The radio total was forecast at 12 million sets. For 1956, sales of another 7.5 million tv sets were forecast. By 1965 the company estimates that more than 65 million tv sets will be in use, with more than half of them color sets.

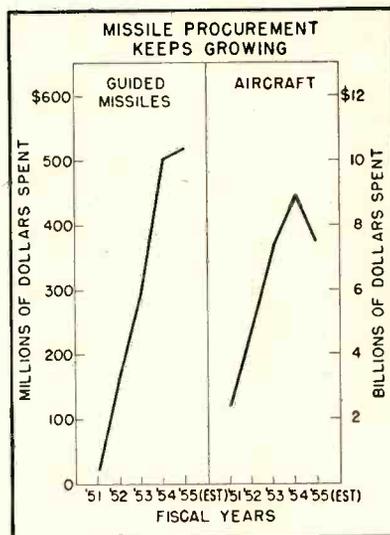
Philco looks forward to excellent tv business all during the fall season. With national income and employment at record levels, it expects consumer buying of all of its products to gain.

Sylvania estimates that this year net sales will total 7.2 million sets and may even equal last year's record of 7.3 million sets. The firm points out that in past years, strong tv sales sometimes ran counter to minor business turn-downs but that the industry has now come of age and is tied pretty tightly to the overall condition of the national economy.

Zenith expects that the normally stronger fall and winter market will permit a reversal of the trend toward lower prices and that a higher percentage of console receivers will be produced which will have the effect of substantially increasing average unit billing prices.

► **Down**—Despite the rosy outlook

(Continued on page 16)



KÄHLE

automatic machines

PRODUCE BETTER

----- **GLASS DIODES**

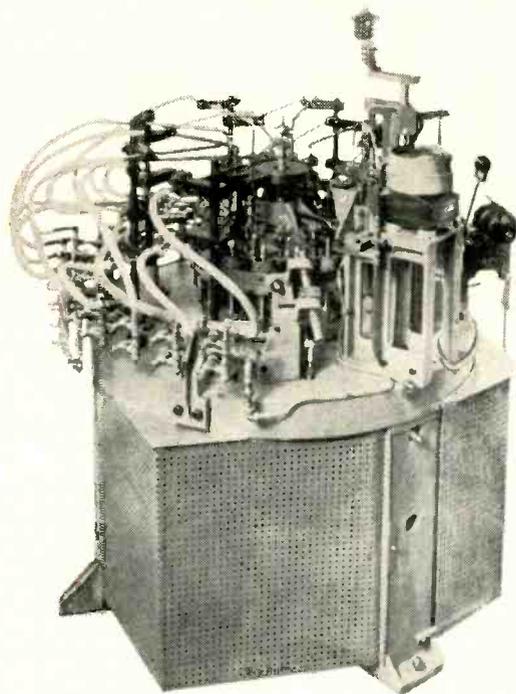
TRANSISTORS, TUBES

AND OTHER

ELECTRONIC COMPONENTS

faster,

more economically



Write *today*— tell us your requirements or problems.

Kähle ENGINEERING COMPANY
1310 SEVENTH STREET NORTH BERGEN, N. J.

Designers and builders of special automatic and semi-
automatic equipment for all industrial operations.

foreseen by some setmakers, the University of Michigan's latest survey of peoples intentions, taken in June, shows that although consumers plan to keep on buying houses, autos and appliances, planned purchases of tv sets appear to be lower than they were last year.

Analog Computers Help Design Brakes, Missiles

ONE of the largest analog computers will be installed at Wright Air Development Center, Dayton, Ohio. The million-dollar machine will be built by Reeves Instrument Corp., a subsidiary of Dynamics Corp. of America (ex Claude Neon). The computer's speed and capacity for solving differential equations will be utilized in development of weapons systems for the Air Force.

Overall design calls for an integrated computer organized in four separate sections. The computer will incorporate more than 500 operational amplifiers and will occupy 6,000 square feet. Design innovations include problem checking routines, automatic programming and visual indicators to pinpoint equipment malfunction.

► **Brakes**—A much smaller electronic analog is being used to design airplane tires in the B. F. Goodrich wheel and brake plant, Troy, Ohio. The instrument simulates the heat rise in an aircraft brake during landing. A 300,000-pound plane landing at 100 mph causes the temperature where the brake lining rubs the drum to rise to more than 2,000 F.

The analog solves problems relating to whether critical temperature ratings will be exceeded.

► **On-Line Control**—A Goodyear Electronic Differential Analyzer (GEDA) will take over automatic control of 35 steam electric generating plants for Ohio Edison Co. The equipment will be installed in 1956 at the company's central dispatching headquarters Massillon, Ohio. Carrier telephone will transmit control signals to the generators—some as far as 150 miles away.

Klystron Business Keeps Gaining

Manufacturers expand production capacity as increasing applications push sales

IT HAS been 17 years since the klystron tube was invented. In that time the tube has been responsible for millions of dollars in sales by its various manufacturers.

► **Business**—Sperry recently announced an order from the Signal Corps for 2K25 klystron tubes, totaling more than \$200,000. According to the company, latest applications of the tube now extend to automatic control systems and target simulators for beacons, gun-fire controls, missile guidance and navigation devices in airborne, ground and shipboard service.

One firm estimates that industry wide in 1954 some 105,000 klystrons were produced at a value of between \$11 million and \$12 million.

► **Plants**—Sperry has begun production of high-power klystrons at its new \$900,000 plant in Florida. Varian is constructing a new klystron plant in Canada and Marconi is also building a plant in Canada in which klystrons will be made.

► **Why**—Research and development on power-amplifier klystrons have

permitted the transmission of direct tv signal and multichannel radio-telephone conversations beyond the horizon for distances up to 200 miles.

This research found that by using larger antennas and higher power such reception could be obtained. Resulting commercial and military microwave applications are expected to create substantial demand for the power klystron in the immediate future.

More than 40 types of klystron tubes are now available.

Networks Plan More Color Programming

At least twelve hours a week will be colorcast during the last quarter of the year

SOME of the tv networks are setting new plans for color programming.

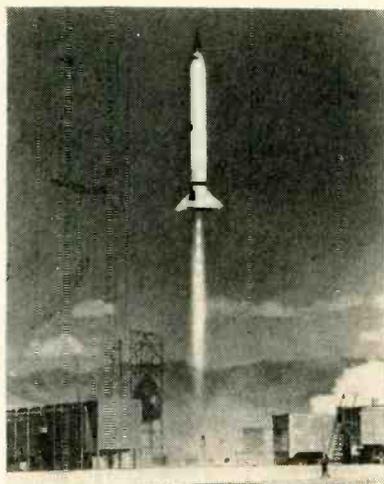
NBC plans to present nearly five times as many hours of color this fall as it carried last season. In October there will be 37 hours of live studio programming as against 7 hours last October. In November, there will be 41 hours as against 8.5 hours last year. December will have 38 hours compared to 9 hours last December. There will be outside pickups, such as the World Series and football games, mobile-unit pickups for 5 scheduled programs.

The network is expanding its color facilities with the construction of a color studio in Radio City and the installation of color equipment in another studio.

► **Plan**—CBS, which ran a rotation plan for colorcasting its black and white tv shows, completed this schedule June 9. For the fall, it plans to broadcast a minimum of two weekly programs in color on a regular basis.

The net has one theater in New York and its tv city in Cali-

(Continued on page 20)



Viking 11 rocket takes a Varian V-55 reflex klystron to a record-breaking altitude of 158 miles. The tube was recovered in operating condition

NEW!

Universal Z-Y Bridge

Measures Impedance . . .

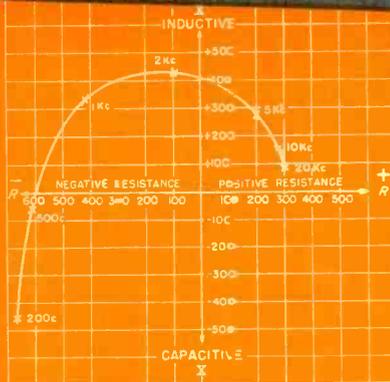
- ✓ from 0 to ∞ ohms
- ✓ balanced or grounded
- ✓ positive or negative
- ✓ at any phase angle
- ✓ over 20-cps to 20-kc range

The Type 1603-A Z-Y Bridge is the latest addition to the G-R line of precision impedance-measuring apparatus.

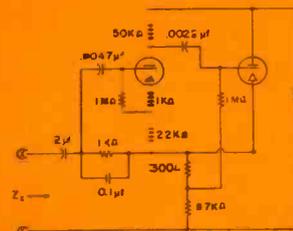
This Universal Z-Y Bridge will measure any impedance — from short circuit to open circuit, at small or large phase angle, and with a basic accuracy of 1% over most of this very wide range. Quadrature components of impedance, R & X or G & B, are measured directly at calibrated 100c, 1kc and 10kc bridge positions. Measurements at other frequencies over the 20 to 20,000 cycle range are made simply by multiplying reactance X or susceptance B readings by a factor which takes into account the difference between operating frequency and frequency setting of the Bridge selector switch.

The ability to measure impedances of any magnitude and with good accuracy with the same instrument can be an extremely valuable asset in many measurement situations. The Z-Y Bridge can be used by chemists for measuring conductivity of liquids in dielectric cells as readily as it can be used for ordinary R-L-C component measurements in the laboratory or production-test department. It will measure . . . open-and short-circuit transformer parameters . . . impedances of batteries and electrolytic capacitors . . . characteristics of audio-transmission networks . . . motional impedance of electro-acoustic transducers . . . Q and resonant frequency of chokes . . . and impedances of feedback loops, since negative real parameters are directly measured.

The Bridge also can be used to determine cable-fault locations and circular-arc plots of liquids or solids having lossy polarizations in the audio-frequency range. These are but a few of the countless applications for this unique and versatile device. *You name it — this Z-Y Bridge can probably measure it!*



Plot of Impedance Z_x of Feedback Circuit . . . illustrates ability of the Z-Y Bridge to measure any impedance; quadrature components may be positive or negative, real or imaginary.



SPECIFICATIONS

Frequency Range — 20 cycles to 20 kc

Impedance and Admittance Range —

R: ± 1000 ohms G: ± 1000 μ mhos
 X: ± 1000 ohms B: ± 1000 μ mhos

Accuracy —

R or G: $\pm(1\% + [1 \text{ ohm or } 1 \mu\text{mho}])$
 X or B: $\pm(1\% + [f_0 \text{ ohm or } f \mu\text{mho}])$

f is operating frequency, f_0 is frequency setting of panel selector switch

Impedances of less than 100 Ω (or 100 μ mhos) can be measured on "Initial Balance" dials with considerably greater accuracy —

R or G: $\pm(1\% + [0.2 f_0 \text{ ohm or } 0.2 f \mu\text{mho}])$
 X or B: $\pm(1\% + [0.2 f_0 \text{ ohm or } 0.2 f \mu\text{mho}])$

Maximum Applied Voltage — 150 volts, rms

Accessories Recommended —

Type 1210-B Unit R-C Oscillator and
 Type 1212-A Unit Null Detector

Accessories Supplied —

2 Shielded Cables for generator and
 detector

Dimensions — 12½" x 13½" x 8½"

Net Weight — 21½ lbs.

Type 1603-A Z-Y Bridge — \$335.00

GENERAL RADIO Company

275 Massachusetts Avenue, Cambridge 39, Massachusetts, U. S. A.



1915-1955

40 Years of Pioneering

in Electronics

WE SELL DIRECT
 Prices are net, FOB Cambridge
 or West Concord, Mass.

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

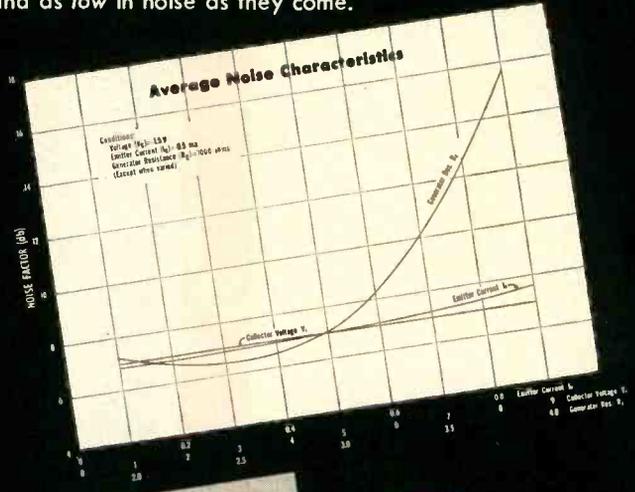
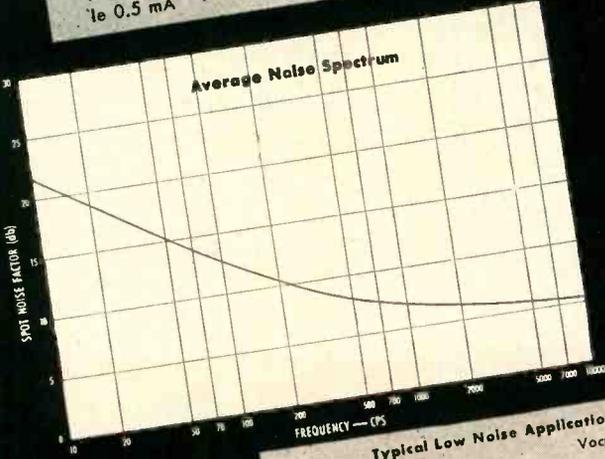
help yourself to more dollars worth of quiet
specify the new, small



2N133 low noise TRANSISTOR

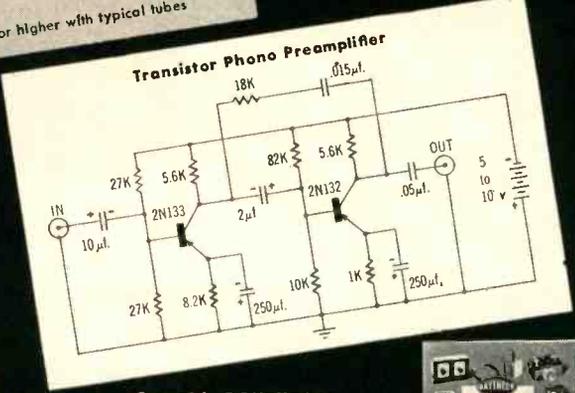
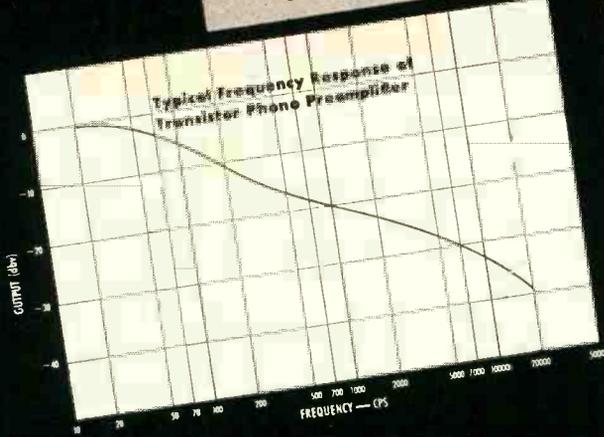
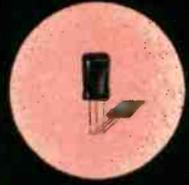
First of a new series of Raytheon hermetically sealed transistors, the 2N133 is the smallest yet — 1/3 to 1/4 the size of the CK727 it replaces — and as low in noise as they come.

Type 2N133
Important Characteristics—Grounded Emitter (30°C)
Current Amplification Factor (Ave.).....50
Power Gain* (Ave.).....38db
Noise Factor† (Ave.).....6.5db
Noise Factor‡ (Max.).....10db
*Source: 1000 ohms; Load: 20,000 ohms
†In a one-cycle band at 1000 cycles
‡Above characteristics obtained with Vc — 1.5 volts;
Ie 0.5 mA



Typical Low Noise Application PHONO PRE-AMPLIFIER

No. of Stages	Vacuum Tube	Transistor
Type of Response	2	2
Gain (IKC)	RIAA	RIAA
Tube	32db	44db
Transistors	1 65C7	1: 2N133
Signal Output†	0.4v	1: 2N132
Noise Output	100 μv ^a	1.6v
S/N	72db	200 μv
†10 millivolt signal from reluctance cartridge		78db
^a exclusive of hum which may average 500 μv or higher with typical tubes		



Get This RAYTHEON TRANSISTOR APPLICATION BOOK!
116 pages — over 50 practical circuits including timers, receivers, oscillators, etc. all using low cost Raytheon Transistors. For your copy send 50¢ to Dept. P11, Raytheon Mfg. Co., Newton 58, Mass.



RAYTHEON TRANSISTORS

more in use than all other makes combined



TWO NEW TICKETS TO better performance lower OPERATING power

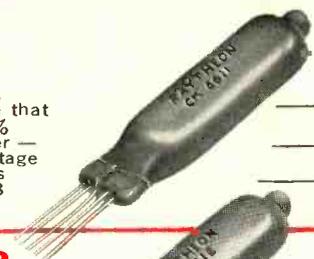
for all military and commercial portable, battery operated electronic equipment

— developed under U. S. Signal Corps contract

— backed by Raytheon's unequalled technical skill and engineering experience in the design and production of filamentary subminiature tubes

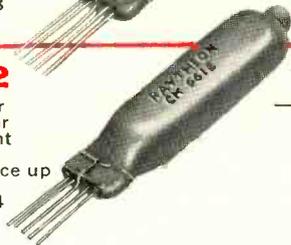
CK6611

a new IF amplifier, for 20 mc or more that requires 50 to 60% less filament power — 30% less plate voltage than present types 1AH4 and CK5678



CK6612

a new RF amplifier good for 100 mc or more, with filament power down 20%, mutual conductance up 50% compared to present type 1AD4



Type	Filament Current at 1.25V mA	Plate and Screen Volts	Mut. Cond. μ mhos	Plate mA	Grid Plate Capacity μ mf (max.)
CK6611	20	30	1000	1	0.007
1AH4	40	45	750	0.75	0.01
CK5678	50	45	820	0.8	0.01
CK6612	80	30	3000	3	0.01
1AD4	100	45	2000	3	0.01

Both these new tubes offer the following advantages:

- long life expectancy
- low filament and plate power permit smaller and lighter batteries
- mechanical ruggedness
- oxide coated tungsten filaments — a feature of all Raytheon filamentary subminiatures
- metallic shield coating over entire bulb
- better performance with less operating power
- Raytheon's flat press seal — The Seal of Reliability



Home Office: 5E Chapel St., Newton 58, Mass., Bigelow 4-7500
For application information write or call the Home Office or:
9501 Grand Ave., Franklin Park (Chicago), Ill., TUxedo 9-5400
589 Fifth Avenue, New York 17, New York, PLaza 9-3900
622 South La Brea Ave., Los Angeles 36, Calif., WEbster 8-2851



fornia equipped for color. In addition, it is refurbishing quarters in Chicago for tv studios which will be equipped for colorcasts.

► **Stake**—American Broadcasting, which is the only tv network without a stake in color set manufacturing, has no immediate color telecasting plans. According to a network spokesman, AB-PT will have color ready when there is enough set saturation. As of now, the network has no color studios in operation. However, three of its leading shows for next fall, Disneyland, Warnerland and the Mickey Mouse show for children, are being photographed in color.

Du Mont which now only has owned and operated stations in York and Washington, D. C., is planning a heavier color schedule for its New York outlet. It plans to continue the present Sunday night one-hour color show throughout the rest of the year. It will also relocate color equipment in its Telecenter so that frequent use can be made of it throughout the day especially for station breaks.

A new program series of short subjects, will show color films as they are available. It is expected that the company will also push color programming with its new Electronicam tv-film system and Vitascan equipment.

Electronics Withstands Nuclear Explosion

Equipment ranging from antenna towers to vacuum tubes holds up well

EVALUATION of damage to some 150 electronic products exposed to the nuclear explosion at Yucca Flats revealed nearly all items operable or readily repairable. Various pieces of equipment were housed in dwellings in situations approximating normal conditions and at distances of 4,700 and 10,500 feet from the blast. While the buildings were damaged by the blast, the electronic equipment showed good durability. Damage was due almost wholly to falling debris. Radiation was not a problem and thermal damage was insignificant. No broken vacuum tubes or tv picture tubes were observed.

► **Station**—A 250-watt radio transmitter, housed in a building which was heavily damaged, came through unscathed but went off the air when power lines to an outside gasoline generator were snapped by falling utility poles. The broken lines were repaired in less than 15 minutes. Power failure could have been avoided by underground wiring. Three steel antenna towers were still standing after the blast. The explosion had virtually no effect on the a-m station's antenna tower, but snapped a small one erected for a nearby mobile radio station. The stations were 4,700 feet from blast center.

► **Mobile**—The house in which one radio station was installed was demolished, and station equipment hurled from the second floor to the top of a pile of debris at ground level. However, the equipment was operable when inspection teams arrived on the scene. A radio-equipped auto parked outside the transmitter building was badly wrecked but its two-way radio remained operable. In a second car, 10, -500 feet from blastcenter, the radio was untouched.

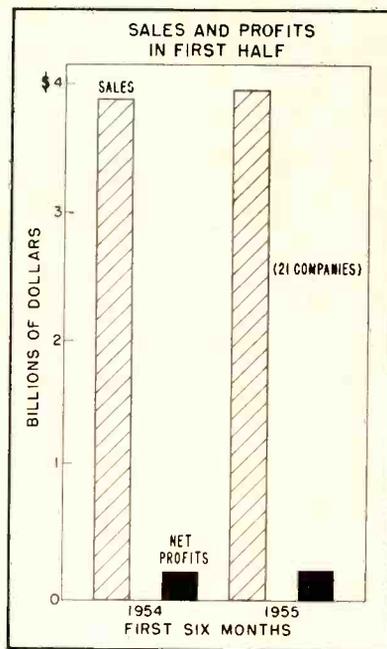
(Continued on page 22)

Industry Shows Mixed Record

Sales and profits soar for some companies but others have sharp declines

WITH television receiver production up 34 percent in the first six months of this year over the same period in 1954, and with radio output up 44 percent, companies in the radio tv end of the electronics industry would seem to be in fine shape. Many have experienced record sales and profits in the first six months of this year but a number of important companies show up poorly in first-half financial reports.

► **Bullish**—Total sales of 21 representative companies increased from \$3.8 billion to \$3.9 billion while profits increased from \$226 million to \$233. See chart.



► **Bearish**—Sales increases for individual companies were as high as \$44 million. Profit increases ranged up to \$8 million. But decreases in sales and profits of some other companies overshadowed gains. A decline of \$54 million in sales and \$16 million in net profit was experienced by one firm. Declines were attributed to lower defense volume, increased competition and lower profit margins.

► **Check**—A survey made by the First National City Bank of New

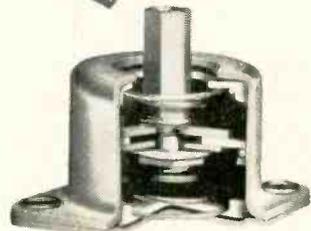
York of radio-tv electrical equipment companies also showed the financial spottiness of the industry. Despite large gains by some firms, others showed substantial declines so that the overall net change in 1955's first half was small compared to 1954. Total sales increased only 2 percent while profits showed a one-percent decline.

Sales totalled \$3.2 billion in the first half of 1954 compared to \$3.3 billion this year. Net profits were \$172 million in '54 as against \$170 million this year.

NO SHOCK MOUNT EVER HAD IT SO TOUGH

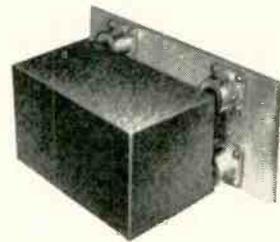


**That's why
ALL-ANGL
Barry mounts
are used in
MARTIN's
MATADOR**



Under the cumulative shock of rocket-boosted zero-length take-off, jet-fighter flight maneuvering, and on-target dive that cracks the sound barrier, the nation's first operational pilotless bomber relies on ALL-ANGL Barrymount® isolators to protect critical electronic control gear.

Equally effective in every flight attitude, ALL-ANGL mounts permit bulkhead mounting that saves vital space in this deadly weapon. And their proved performance makes Barry mounts Martin's choice for the Matador



Let us show you how Barry's new ALL-ANGL isolators can lick *your* tough mounting problems. Data sheet M-9 gives mechanical and dynamic specifications. For specific recommendations, call your nearest Barry Sales Representative.

PHOTOGRAPH COURTESY THE MARTIN COMPANY

BARRY CONTROLS
INCORPORATED

707 PLEASANT ST., WATERTOWN, MASS.

More Auto And Parts Firms Feature Electronics

Other automotive concerns diversify by adding lines of electronic products

STUDY of corporate structures of automobile and parts manufacturers reveal other firms engaged in electronics manufacturing and development in addition to the fifteen previously reported (ELECTRONICS, p 12, Aug. '55). There are probably even more companies whose lines include both electronic and automotive products.

► **Other firms**—Willys Motors, which made electronics news when it introduced the flat television tube, has three divisions engaged in electronic work.

Bendix Aviation, manufacturers of automotive and aircraft parts, makes a wide range of electronic products from computers and guided missiles systems to radio and television sets. Arvin Industries makes auto heaters, mufflers and other parts and is in the radio-tv business.

Electric Auto-Lite, which manufactures ignition systems, also produces electronic items. Sterling Precision Instruments makes radar, guided missile and fire control equipment through its Trans-America Precision Instrument Corp. Sterling, a manufacturer of gas and diesel engines has announced intention to acquire American-La France-Foamite, a fire-truck manufacturer. ACF Industries includes ACF Electronics, Avion Instrument and the Carter Carburetor Corp.

► **Tire Makers**—The Goodyear Tire and Rubber Co.'s subsidiary Goodyear Aircraft manufactures computers and military electronic products. General Tire and Rubber is in electronics through its interest in General Teleradio. B. F. Goodrich developed its own analog computer used in designing aircraft tires.

► **Diversification**—Several highly diversified companies make electronic products and automotive

products. Sperry-Rand includes the Waterbury Tool division of Vickers which makes hydraulic variable speed transmissions and Tulsa Winch whose products are used on trucks and tractors. Baldwin-Lima-

Hamilton's line includes street cleaners and earth-moving equipment as well as the SR-4 strain gage and other test and measuring equipment. Allis Chalmers' line includes tractors and ignitrons.

Educational TV Plans Big Year

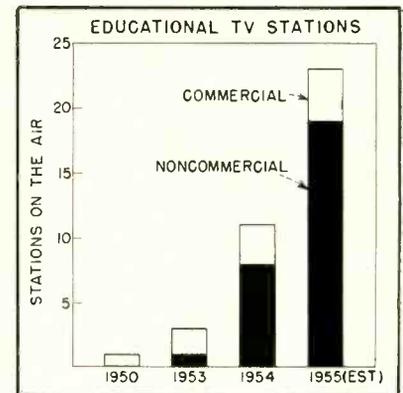
Number of stations going on the air this year will double the size of the service

SO FAR this year a total of eight new educational tv stations have gone on the air and by the end of the year the number is expected to reach a dozen. This will bring the total number of tv stations operated by educational institutions to 23.

► **Breakdown**—According to the Joint Committee On Educational Television, additional noncommercial educational tv stations that are expected to be on the air within the next few months are WAIQ, channel 2 in Andalusia, Alabama; WOSU-TV, channel 34 in Columbus, Ohio; WTTW, channel 11 in Chicago, Illinois and a station on channel 56 in Detroit, Michigan.

Of the 23 stations operated by educational institutions, 17 are operating on channels reserved for educational tv. Two stations, KWAR-TV and KUON-TV, operate noncommercially on channels not reserved for educational tv. Four tv stations, WOI-TV, KOMU-TV, WBAY-TV and WNDU-TV, are operated by educational institutions on commercial channels.

► **Cost**—The 17 educational tv stations on reserved channels have spent a total of \$5.1 million in establishing the stations. Average cost for setting up an educational station is \$305,000. However, cost varies over a wide range because of donations and other factors. For example, the lowest establishment cost for a station on the air is that of WBIQ, channel 10 in Birming-



ham, Alabama which spent only \$500. The transmitter, tower, land and building were donated by commercial station WBRC-TV for \$1.00 per year. This includes use of studios, cameras and slide/film camera units for 1.5 hours per day.

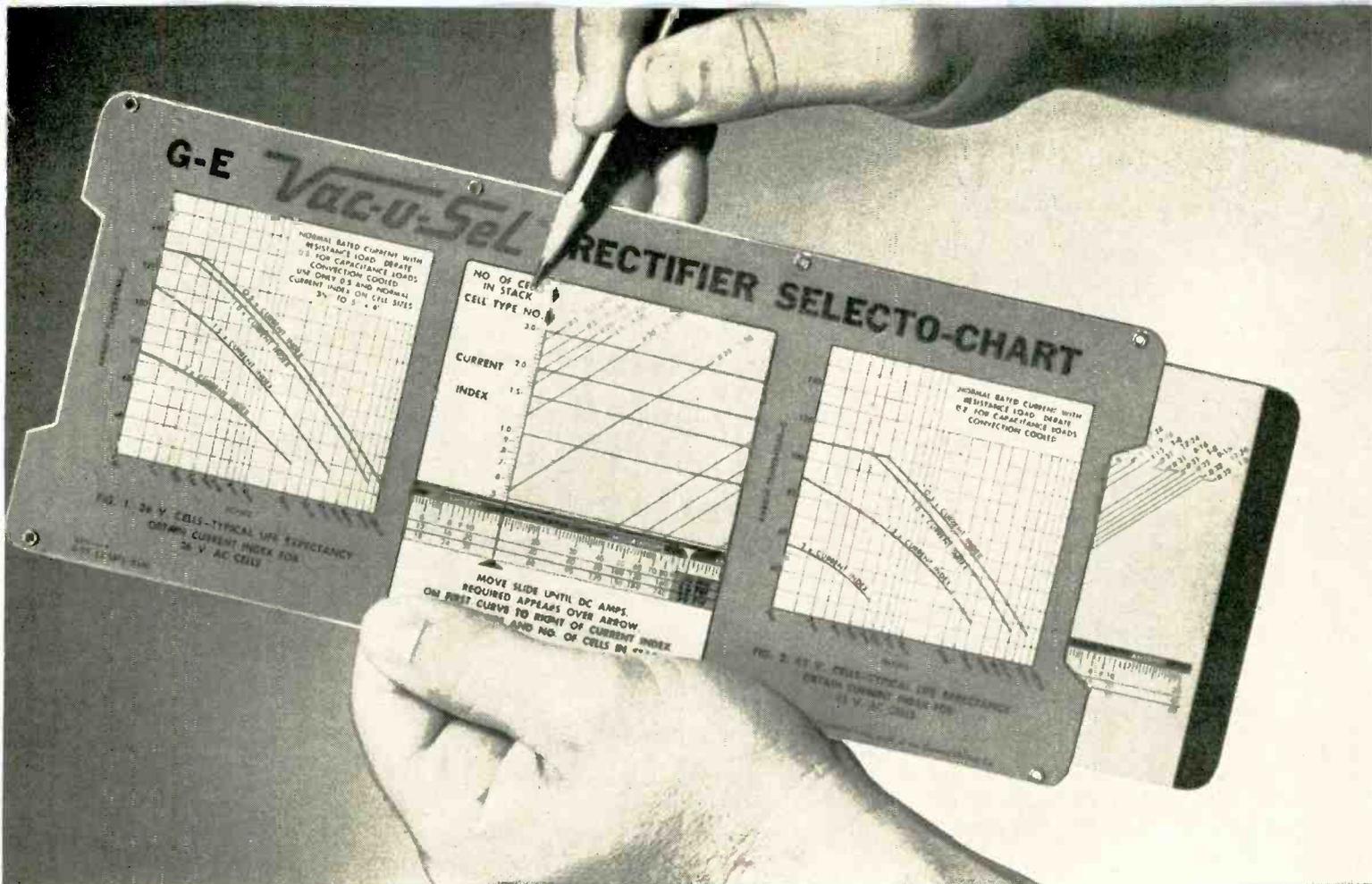
On the other hand, WUNC-TV, channel 4 in Chapel Hill, N. C., estimates its cost at \$1,020,000. Nearly all tv transmitter manufacturers have sold equipment for educational tv use.

Taped Music Has Sound Future

PRERECORDED tape, as a consumer item, has not been keeping pace with the growing use of tape recorders in the home. On the other hand, eight-hour tapes of mood music have taken over almost exclusively in the background music field.

Loading difficulties, awkwardness in handling short selections and the danger of accidental erasure are disadvantages that have

(Continued on page 24)



THIS G-E DESIGNED SELECTO-CHART, KEY TO THE NEW APPLICATION APPROACH, COMPUTES EXACT VAC-U-SEL RECTIFIER STACK YOU NEED.

NEW G-E APPLICATION APPROACH CUTS DESIGN TIME . . .

The Exact *Vac-u-Sel** Rectifier You Need Can Now Be Chosen in Minutes . . . On-the-spot

This new application approach, recently developed by General Electric, assures you of getting the correct Vac-u-Sel rectifier to meet your exact requirements. Now you are assured of getting the full advantage from the long life and outstanding technical characteristics inherent in all the many sizes and types of Vac-u-Sel rectifiers. In addition, in practically all cases, the sales engineer can give you the exact identification and price of your stack on the spot, without the inconvenient delay involved in getting data from the factory.

THIS NEW APPLICATION APPROACH brings top quality to your products by permitting complete and efficient utilization of the outstanding electrical characteristics, dependability, and predictable operation found in the many sizes, housings, finishes, and ratings of Vac-u-Sel component rectifiers.

FOR MORE INFORMATION on this new application approach, or the outstanding Vac-u-Sel line of rectifiers, contact your nearest G-E Apparatus Sales Office, or write Section 461-38, General Electric Co., Schenectady 5, N. Y.



G-E SALES ENGINEERS are able to determine, on the spot, the exact Vac-u-Sel stack to suit your particular application.

*Reg. Trade-mark of General Electric Co.

GENERAL  ELECTRIC

been listed for tape as a competitor to disks in the home music field. Another factor is the cost of base material—about 19 cents for disks compared to \$1.00 plus for tape.

Present home sales average from 300 to 800 copies of each selection, most of these going to high-fidelity enthusiasts. The saturation for the prerecorded tape market is estimated at from 3,000 to 4,000 copies per selection.

Background Music—The five largest suppliers in the background music field are using 8 to 12 hour tapes to supply music to their subscribers. The Muzak Corp. provides music service to over 20,000 subscribers from a tape library of more than 7,000 selections. Three firms, the Ampex Corp., Presto Recorder Corp., and Magnecord Inc. are producing the long-playing reproducer units used in these installations.

Commercial TV Set For Britain

Three stations will be on the air by next March. Sets are being adapted for the service

EXPERIMENTAL broadcasts have been made and on September 22 Britain's first commercial tv located at Beaulieu Heights Croydon, a suburb of London, will start transmitting programs.

By March of next year two other commercial stations will open in the Midlands and in Lancashire. The three stations will bring almost 60 percent of the total population of the United Kingdom within reach of commercial tv.

► **Sets**—About 1.2 million of Britain's 4.7 million tv receivers will be equipped to receive the new service. For the past year tv set makers in Britain have been selling receivers that can receive the new commercial stations as well as the BBC. It is estimated that about 1 million of these are now in use.

By the time the first stations go on the air this month some 200,000 one-channel sets will have been converted to receive the commercial channel. Conversion cost is estimated at 10 pounds, about \$28.

► **New Agency**—The Independent Television Authority or ITA is responsible for the new commercial service. It was set up in August of 1954 by an Act of Parliament and has a statutory life of 10 years. Its main functions are to own and operate transmitting stations. Programs will be supplied by privately financed companies which will work

under long contracts with ITA.

► **Cost**—The Authority is allowed to borrow up to \$5.6 million from the British Government within the first five years of its life but only \$2.8 million of this can be drawn during the first year. The entire amount must be repaid before the end of 1964.

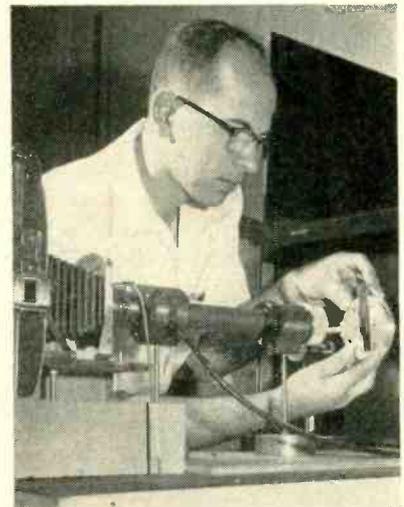
Microwave Relay Business Stirs

AFTER three years of comparative inactivity, microwave radio relay again breaks into the news albeit in a smaller way than the mammoth transcontinental systems.

► **Million Dollars**—Collins Radio will put in a million-dollar system for Continental Pipe Line Co. and Sinclair Pipe Line Co.—joint owners.

The system will link Houston, Texas and Ponca City, Okla. and will require two terminals and 25 relay stations. It is designed to carry 120 simultaneous conversations.

► **New Band**—A microwave system to use the relatively unused 2,450 to 2,700-mc band will be installed by RCA for Union Oil Co. in Los Angeles. Covering about 40 route miles, the system will link the company's control center, a pumping station and a branch office. Services provided will include voice communications, control and telemetering.



GE physicist uses modified snooperscope on silicon ingot as . . .

Infrared Scopes Go Commercial

Wartime snooperscopes and sniperscopes are moving into civilian fields

ABOUT 1,000 to 1,500 infrared viewers, commercial versions of the wartime sniperscope, are in use, according to Farnsworth Electronics division of IT&T. The number is relatively small because the instruments have only recently been made available for civilian application. The units are compact and portable, weighing approximately 10 pounds and cost \$500 to \$1,000 depending on the quality of design as well as the optics supplied.

► **Applications**—Film manufacturing and processing laboratories use the scopes to monitor film manufacturing operations in darkness. Nearly 200 are distributed among three major film firms.

The instruments are finding increasing use in security applications. Police prowler cars use them to examine suspects in darkness from the patrol car. A model is available that operates on the power from a car's cigar lighter.

In the general industrial field the devices are used in determin-

(Continued on page 26)

Exceptional
stability

Ruggedized
construction
(sectionalized)

Instrument type
tuning with
SCANSPREAD*

In communications receivers—
The Pay-Off is on Performance!

Uniformly
high sensitivity
and ultra-high
signal-to-noise
ratio



High Image
Rejection
ON ALL 6 BANDS

Continuously
calibrated
bandsread
OVER THE ENTIRE
RANGE

Frequency
readings
to
1 part in 5000

You buy a communications receiver for just one thing—dependable performance. It's performance that counts, and the *NEW* Pro-310 was designed with performance in mind. It outperforms all the other receivers in its class. Here's why—

- 3 years engineering and design time in its development (including 1½ years to iron out the 'bugs') plus 5 years production experience on its military counterpart.
- The features shown above.

Check on the *NEW* Pro-310—it's made to order for your "tough-spot" service. Write for specs and other details to The Hammarlund Manufacturing Co. Inc., 460 West 34th Street, New York 1, N.Y. Ask for Bulletin. No. E-9.



*Completely new concept in precision electro-mechanical bandsread.

HAMMARLUND

Since 1910

ing temperature distribution at heats above 250 degrees C and in warehouse surveillance.

In the identification of forgery, such as when an original signature has been mutilated or erased and written over, the instrument has proved particularly useful. This has been true especially in the identification of old oil paintings.

Medical applications include psychological and psychiatric study when it is desired to study a subject under conditions of complete surprise to stimuli.

The scopes have also been used, as has been done in the military (Nancy equipment), for signaling over long distances on land or sea. Standard sensitivity is 1 candle power at 1 mile. With a pulsed infrared light source, signals are good for ten miles day or night.

Financial Roundup

PROFIT reports made in the past month by manufacturers in the electronics field indicate the business conditions in the industry. Following are the net profits of manufacturers for the fiscal periods indicated:

Company	Net Profit	
	1955	1954
Admiral 6m	\$1,946,192	\$2,558,850
American Bosch		
Arma 6m	1,458,017	1,411,965
American Broadcasting Paramount		
Theaters 6m	3,438,000	1,850,000
Ampex 12m	365,736	25,691
Avco 6m	447,983	3,106,481
Clevite 6m	2,672,957	1,646,758
Con. Engineering		
6m	295,961	467,143
Cornell-Dubilier 6m	1,381,448	1,012,280
Du Mont 6m	*1,249,000	479,000
Fairchild Camera		
6m	638,000	757,669
General Electric		
6m	101,892,000	93,856,000
GPE 6m	2,173,654	2,541,652
Hallcrafters 9m	363,438	*1,029,935
Hoffman Electronics		
6m	419,179	818,683
IBM 6m	23,870,992	21,600,314
Int'l Resistance 6m	323,290	123,080
IT&T 3m	5,253,846	4,855,103
P. R. Mallory 6m	1,192,984	313,383
Minn. Mining 6m	15,781,268	11,453,133
Pacific Mercury		
12m	255,817	196,015
Packard Bell 9m	362,131	334,849
Philco 6m	3,575,000	1,735,000
RCA 6m	22,061,000	19,268,000
Raytheon 12m	4,531,561	3,523,316
Reliance Electric		
3m	574,828	480,577
Standard Coil 6m	*88,892	1,358,996
Stewart-Warner 6m	2,810,383	1,511,560
Sylvania 6m	6,088,019	3,522,785
Thompson Products		
6m	14,791,093	14,213,253
Tung Sol 6m	1,528,792	1,001,537
Westinghouse 6m	29,417,000	45,359,000
Zenith 6m	3,126,061	1,288,246
*loss		

FUTURE MEETINGS

AUG. 26-SEPT. 4: Great German Radio, Gramophone and TV Exhibition, Dusseldorf, Germany.

SEPT. 12-16: Tenth Annual Instrument Conference & Exhibit, ISA, Shrine Exposition Hall and Auditorium, Los Angeles, Calif.

SEPT. 14-16: 1955 Annual Meeting of the Association for Computing Machinery, University of Penn., Philadelphia.

SEPT. 14-16: Second Annual Meeting of Professional Group on Nuclear Science, IRE, Center Theater, Oak Ridge, Tenn.

SEPT. 17: Symposium on Automation, Cedar Rapids IRE, Cedar Rapids, Iowa.

SEPT. 23-24: IRE Fifth Annual Fall Symposium On Broadcast Transmission Systems, Hamilton Hotel, Washington, D. C.

SEPT. 26-27: RETMA Symposium, Electronics For Automation and Automation For Electronics, Philadelphia.

SEPT. 26-27: Sixth Annual Meeting and Conference of the IRE Professional Group on Vehicular Communications, Multnomah Hotel, Portland, Ore.

SEPT. 26-28: IRE Symposium, Aeronautical Communications—Civil and Military, Utica.

SEPT. 28-29: Industrial Electronics Conference, AIEE, Rackham Memorial Auditorium, Detroit, Mich.

SEPT. 29-30: Fall Assembly Meeting of the Radio Tech-

nical Commission for Aeronautics, Hotel Statler, Washington, D. C.

OCT. 3-5: National Electronics Conference, Hotel Sherman, Chicago, Ill.

OCT. 3-7: AIEE Fall General Meeting, Morrison Hotel, Chicago, Ill.

OCT. 10-12: The Eighth International Systems Meeting, Systems & Procedures Association of America, Cadillac Hotel, Detroit, Mich.

OCT. 12-15: 1955 Convention of the Audio Engineering Society concurrent with the Audio, Fair, Hotel New Yorker, New York, N. Y.

OCT. 17-19: RETMA Radio Fall Meeting, Hotel Syracuse, Syracuse, N. Y.

OCT. 20-22: Eighth Annual Gaseous Electronics Conference, GE Research Lab., The Knolls, Schenectady, N. Y.

OCT. 24-25: First Annual Technical Meeting, IRE Professional Group On Electron Devices, Shoreham Hotel, Washington, D. C.

OCT. 25-27: International Conference on Electronic Digital Computers and Information Processing, Darmstadt, Germany.

OCT. 28-29: 1955 Symposium of Philadelphia ISA, Penn Sherwood Hotel, Philadelphia, Pa.

OCT. 21-Nov. 1: 1955 East Coast Conference on Aeronautical and Navigational Electronics, IRE, Lord Baltimore Hotel, Baltimore, Md.

Industry Shorts

► **Production** of germanium transistors was temporarily suspended by Radio Receptor because it finds that the demand for the devices has not yet reached sufficient proportions to make limited production of a low-priced, high-quality product feasible.

► **Two** all-transistor portable radios, one with six transistors and the other with seven, will be introduced by RCA during the fourth quarter. The sets will both sell for \$79.95.

► **Release** of information by ANDB on TACAN follows declassification from military confidential status.

► **Transistor** factory employing nearly 700 workers has been opened

by Philips in Nijmegen, Netherlands.

► **National** Radio and Television Week, which starts September 18, will signal the start of a two-fold campaign by the industry to promote set sales and increase radio listening and tv viewing.

► **Five-cent** credit will be given to radio and tv technicians and servicemen by Philco Corp. for each old tube it receives. Returned tubes will be destroyed as part of the firm's campaign to break racket of reselling worn-out and discarded receiving tubes.

► **Growth** in the annual unit production of transistors has been estimated by one major manufacturer as follows: 1955, 1.5 million; 1956, 6.0 million; 1957 9.4 million.

KAY

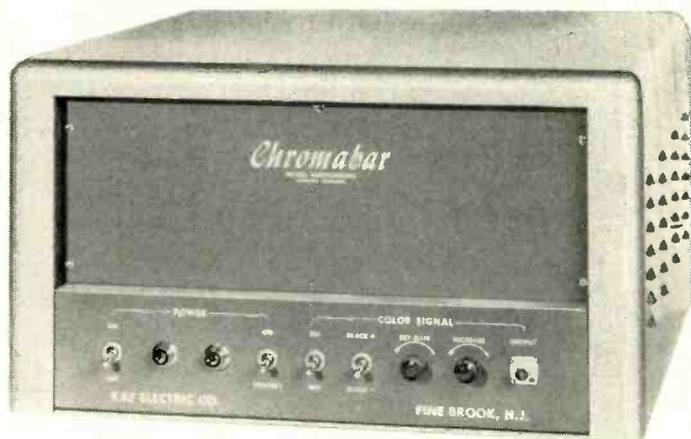
COLOR BAR GENERATORS

for

Design • Production • Service

Designed to produce black and white and standard NTSC colors—green, yellow, red, magenta, blue and cyan—for receiver alignment and servicing, the Kay CHROMABARS may be used, without auxiliary equipment, to feed black and white and the six standard colors directly into the video amplifier.

In combination with the Kay MEGA-PIX Single Channel, the CHROMABARS may be used to check overall performance of television receivers.



The *Chromabar* Model Multi-Chrome

Output Signal:

Colors: 1. Black, white and six NTSC colors
2. I, Q, R-Y, B-Y are available by switch selection.

Frequency: Video, RF output can be supplied through Mega-Pix at specified channel.

Polarity: Positive or negative.

Amplitude: Continuously variable, 0 to max. of 1.4 volts peak-to-peak across 75 ohms. Amplitude increases with impedance.

Phase Angle Accuracy: Within 3 degrees.

Repetition Rate: Continuously variable through range of $\pm 5\%$ about 15.75 kc.

Power Supply: 105-125 volts, 50-60 cps, 220 watts.
Power supply electronically regulated.

On special order, RF oscillator can be added to provide RF output.

Price: \$850.00, f.o.b. factory.

THE *Chromabar* MODEL UNI-CHROME

Output Signal:

Colors: All six NTSC standard colors available individually with black and white. Controlled by single front panel switch.

Other specifications similar to Multi-Chrome
Built-in dot generator for checking convergence and linearity.

Price: \$425.00, f.o.b. factory. (Additional colors, gray shades or I and Q, R-Y, B-Y at \$20.00 each.)

KAY

Chromadot

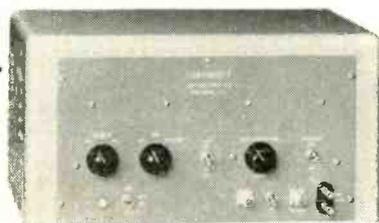
**Color Bar—Dot—
Horizontal and Vertical
Sync Generator**

The CHROMADOT is a combined color bar dot generator with vertical synchronization so that only a single connection is required to the RF antenna or video amplifier. No connections are required to receiver sync circuits.

SPECIFICATIONS

1. Ten color bars progressive every 30°.
2. Reference color burst. Constant color across each bar.
3. Single dot per line in uniform pattern for checking convergence.
4. Varying luminance signal, plus 60 cycle vertical sync pulse for checking chroma circuits.
5. Positive and negative horizontal and vertical sync provided for stationary patterns without internal connection to receiver.
Video: 0.6 volts peak to peak. 10 volts into 5000 ohms.
6. RF: 0.2 volts into 75 ohms or 300 ohms on any specified channel.
7. Sound carrier provided for tuning the receiver.

Price: \$395.00,
f.o.b. factory.



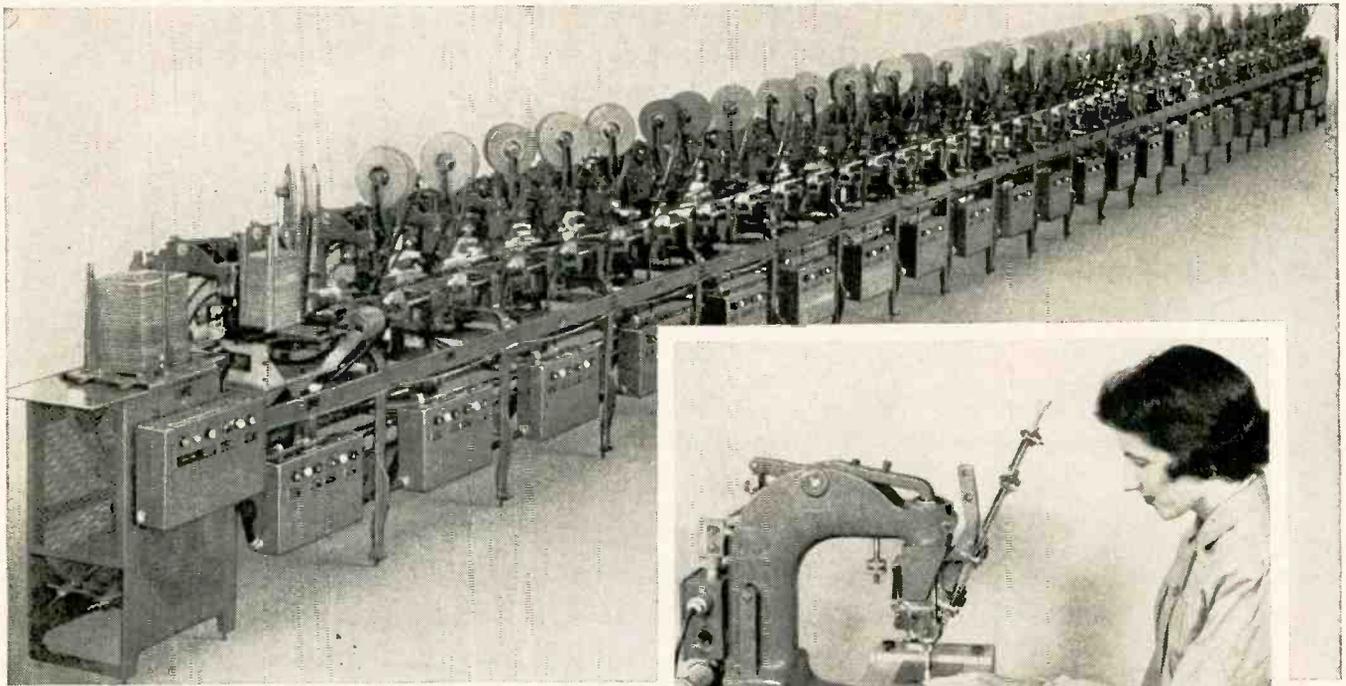
For complete details and information, write:

KAY ELECTRIC COMPANY

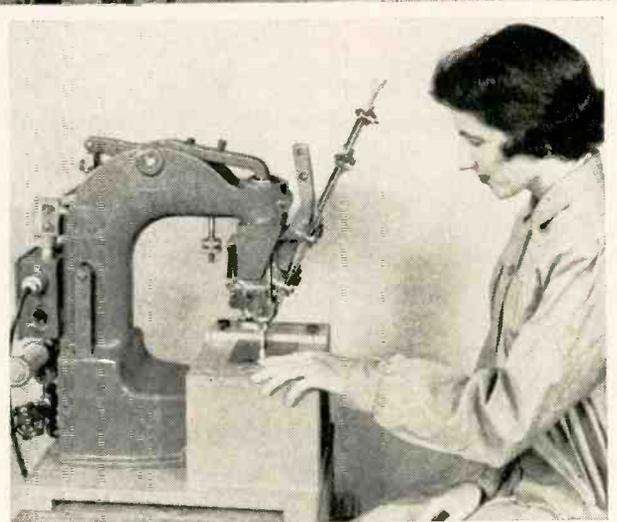
Dept. E-9

14 Maple Avenue,

Pine Brook, N. J.



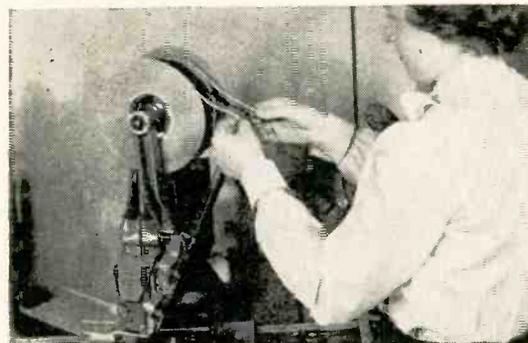
Above — Completely automatic 44 station, 75 foot long DYNASERT with printed wiring board loader. A similar United unit has been placed in operation by a large producer of TV receivers. Right — Individual inserting machines are the efficient way to insert components where volume of production does not justify the fully automatic equipment.



New United Component Inserting Machines Now in Commercial Operation



Accuracy of board location and minimum changeover time are primary advantages of United's pallet system. Multiple sets of dowel pins can be provided so that a single pallet handles a wide range of printed wiring board sizes and shapes.



Full reels of components which may be lead-taped as shown or body-taped are quickly slipped in place and spliced while United's conveyor assembler is running. Each reel holds about 1/2 day's supply.

"Dynasert" System Most Flexible for Automatic Insertion of Electronic Components

NEW, VERSATILE DYNASERT CONVEYOR, *operated automatically*, produces 9600 assemblies of electronic components per day. It is completely flexible. It will insert different components in any sequence and can handle a wide variety of printed circuits. Each station can be easily and quickly adjusted or can be readily relocated on the conveyor. Any number of stations may be added.

THE SINGLE STATION UNIT, *operated semi-automatically*, is a valuable assembly tool, increasing production, accuracy and uniformity over hand assembly while reducing operator fatigue. These advantages of DYNASERT bring new efficiencies to both small and large assembly operations. Get full details on DYNASERT — write Industrial Sales Division, United Shoe Machinery Corporation, Boston, Mass.

Brown 2-phase reversible motors

give positive positioning,
high torque

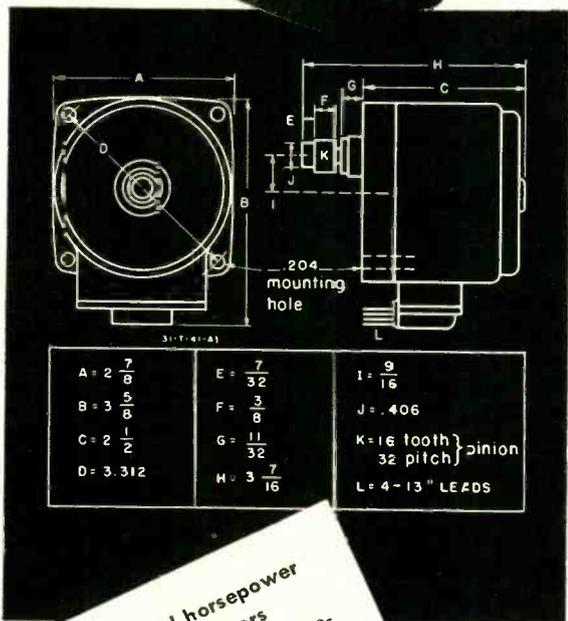
... in servomechanisms,
computers, null circuits



THIS line of low inertia 2-phase motors provides high torque at low speeds. Ideal for numerous remote positioning applications, their performance has been proved by years of use as balancing motors in Brown *ElectroniK* instruments. They are self lubricating, and are totally enclosed . . . including the reduction gear train. They operate at ambients from 20 to 175 F.

A wide range of shaft speeds is available, including a new model with no-load speed of 1620 rpm. Rotor speed for all models is 1620 rpm. Power input is 115 volts, 60 cycles. 25 cycle models are also available. Line field takes 11 watts, amplifier field 2.5 watts. Motor load impedance averages 12,000 ohms. Dimensions are shown in the diagram.

For special applications, many variations in pinion, shaft, leads and materials can be supplied. Prompt delivery available on either standard or special models.



Order Now!

Prices from **\$40.50**

(even more favorable depending on quantity)

New

No-load speed—rpm	27	54	162	333	1620
Rated torque—in. oz.	30	15	5	4	5
Max torque—in. oz.	85	43	19	11	9
rpm for max power	15	31	92	190	900

Brown fractional horsepower synchronous motors

Used for years as chart drive motors in *ElectroniK* recorders, these single-phase synchronous motors are ideal for many low-power continuous operations. External and mounting dimensions are the same as for the 2-phase balancing motors. Three different shaft speeds are available:

Nominal speed, rpm 30 60 180
Torque, in. oz. 20 10 4

MINNEAPOLIS-HONEYWELL REGULATOR Co., *Industrial Division*, 4428 Wayne Avenue, Philadelphia 44, Pa.

Honeywell
MINNEAPOLIS
BROWN INSTRUMENTS

First in Controls

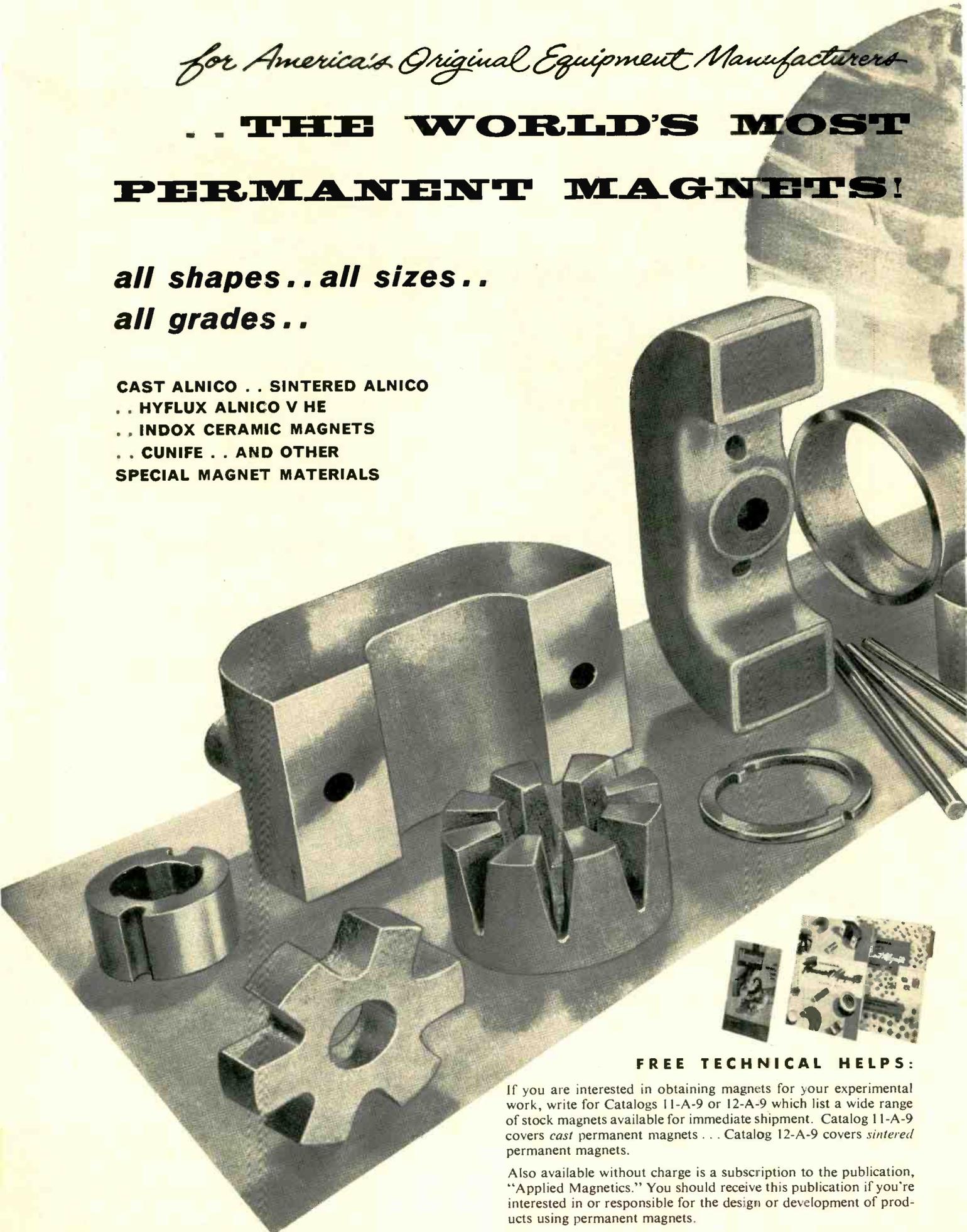


For America's Original Equipment Manufacturers

.. THE WORLD'S MOST PERMANENT MAGNETS!

***all shapes.. all sizes..
all grades..***

**CAST ALNICO . . SINTERED ALNICO
. . HYFLUX ALNICO V HE
. . INDOX CERAMIC MAGNETS
. . CUNIFE . . AND OTHER
SPECIAL MAGNET MATERIALS**



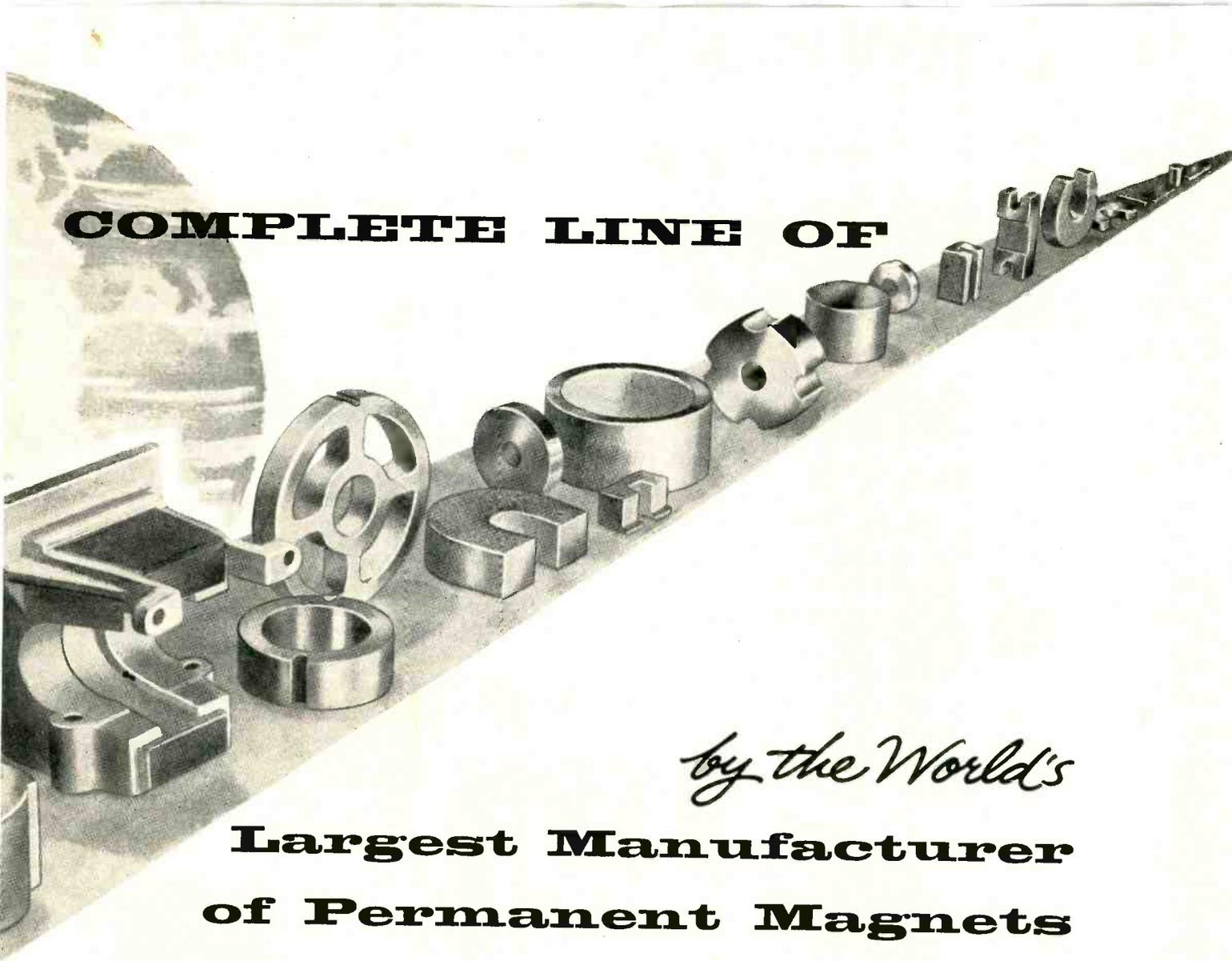
FREE TECHNICAL HELPS:

If you are interested in obtaining magnets for your experimental work, write for Catalogs 11-A-9 or 12-A-9 which list a wide range of stock magnets available for immediate shipment. Catalog 11-A-9 covers *cast* permanent magnets . . . Catalog 12-A-9 covers *sintered* permanent magnets.

Also available without charge is a subscription to the publication, "Applied Magnetics." You should receive this publication if you're interested in or responsible for the design or development of products using permanent magnets.

Please send requests on your company letterhead

Want more information? Use post card on last page.



COMPLETE LINE OF

by the World's

Largest Manufacturer of Permanent Magnets

Wide Range: From Valparaiso, Indiana, comes the widest range of permanent magnets in the world . . . from tiny "U" shaped 1/10 oz. sintered Alnico permanent magnets to massive cast magnets weighing 1,000 pounds, and more! Many standard sizes and shapes are available from stock . . . and quickly . . . in 24 hours!

Largest Engineering Staff: For your special permanent magnet applications, Indiana offers the World's largest engineering staff devoted solely to the design and application of permanent magnets. This staff, backed by the World's largest and most complete magnetic research and production facilities, is available to consult with your own design engineering

staff. Because Indiana makes *all* kinds of permanent magnets, you can be sure that only the magnet best suited to your product's requirements will be recommended.

Magnetic Specialists: Indiana Steel Products Co. has concentrated on manufacturing magnetic materials for almost half a century. All facilities, attention, and effort are channeled to magnetic materials . . . and *only* to magnetic materials.

Trained Sales Engineers: Indiana Permanent Magnet salesmen are trained engineers. Frequently they are in a position to give your technical men on-the-spot suggestions. More often than not, they have already encountered problems similar to yours.

.....

THE INDIANA STEEL PRODUCTS COMPANY

VALPARAISO, INDIANA

World's Largest Manufacturer of Permanent Magnets

Want more information? Use post card on last page.

**INDIANA
PERMANENT
MAGNETS**

B-H Vinyl-Sil 8000 Fiberglas Sleeving

A "BAKER'S DOZEN" IN ELECTRICAL INSULATION

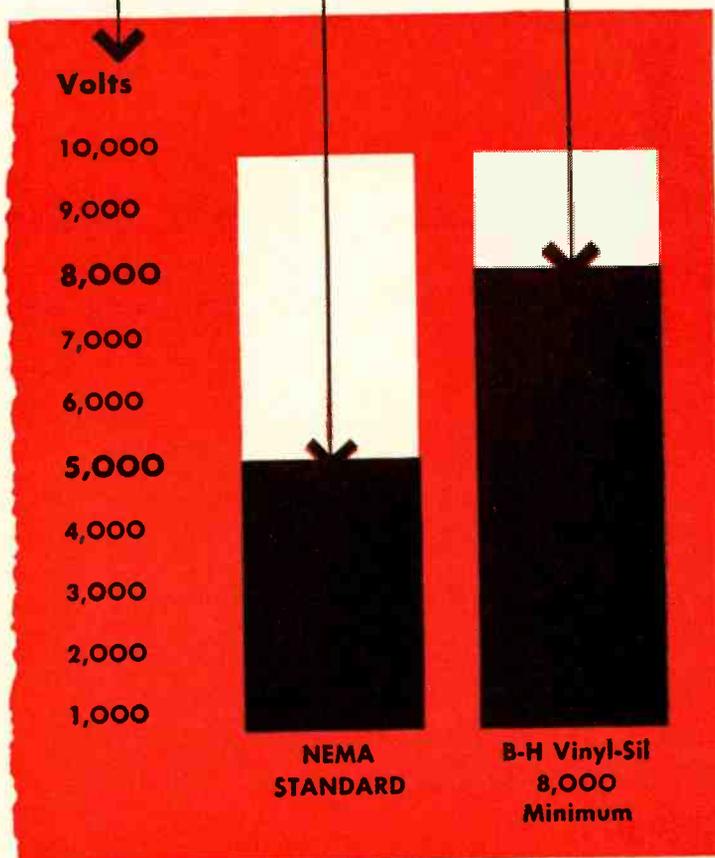
BH Vinyl-Sil 8000 is new, but behind it is 30 years' experience in the development and manufacture of high-dependability, electrical sleeveings that set new standards of insulation performance. BH Vinyl-Sil 8000 Fiberglas Sleeving for instance, offers 8,000 volts *minimum* short-time dielectric breakdown . . . 3,000 volts beyond the NEMA and ASTM requirements for Grade B-A-1.

That's one big advantage of designing with this new sleeving that combines stabilized organic resins with those of the silicone group. Here are others . . . high resistance to heat-aging, flow, oils and chemicals, abrasion and cut-thru . . . -50°F. low temperature flexibility and *no* capillary attraction to water.

BH quality is no accident. Laboratory and field checks are used as a constant control measure. There's a continuing search for new and better materials aimed toward product improvement without increase in cost. The result — maximum protection for your products.

Data sheets and samples of BH Vinyl-Sil 8000 — and others in the dependable BH family of tubings and sleeveings for electrical insulation — are yours for the asking. Tell us your insulation problem and we'll send test samples to answer your need —insulation-wise and cost-wise.

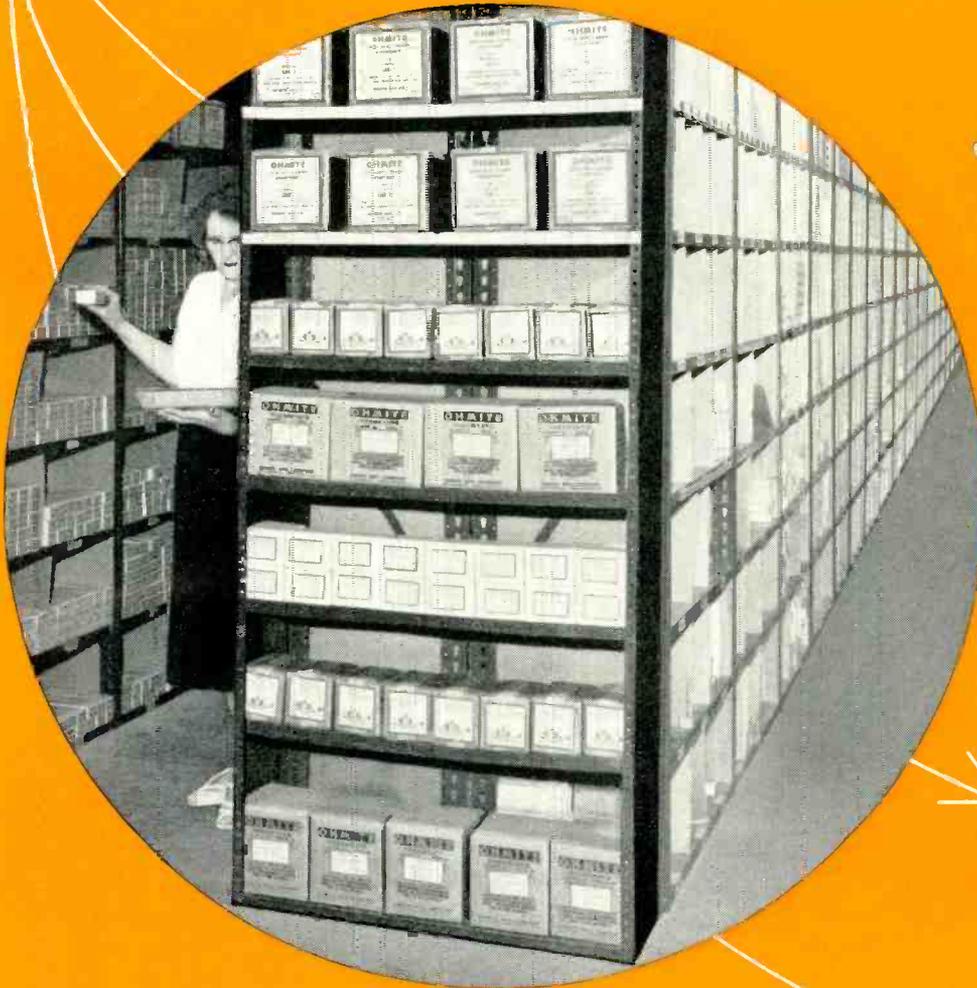
BENTLEY, HARRIS MANUFACTURING CO.
1309 Barclay Street
CONSHOHOCKEN, PENNSYLVANIA
Telephone: Conshohocken 6-0634



BENTLEY, HARRIS *Fiberglas**
SLEEVINGS

*BH Non-Fraying Fiberglas Sleeveings are made by an exclusive Bentley, Harris process (U.S. Pat. Nos. 2393530, 2647296 and 2647288). "Fiberglas" is Reg. TM of Owens-Corning Fiberglas Corp.

WORLD'S LARGEST STOCK



RESISTORS

Fixed and "Dividohm" adjustable wire-wound types, 10 to 200 watts. Also composition type.



RHEOSTATS

Ten stock sizes—25 to 1000 watts. All ceramic and metal.



TAP SWITCHES

Rotary type. Five sizes from 10 to 100 amp, with from 2 to 12 taps.

What resistance components do you need in a hurry? From a factory stock of several million resistors, rheostats, and tap switches . . . in 1,859 types, sizes, and values . . . Ohmite can make fast delivery in reasonable quantities to meet your immediate requirements.

Furthermore, by tailoring your specifications to these stock items, you can always get speedy delivery that will help you keep experimental and pilot production operations on a smooth-running schedule.

To assist engineers and purchasing agents in making their selection from this huge stock, Ohmite Stock Catalog No. 24 contains complete, up-to-date information on all Ohmite stock items. Resistance values, ratings, specifications, and other helpful information are included.

NEED RELAYS? Ohmite Amrecon Relays are available in 61 stock types. Write for Bulletin R-26.

SEND FOR STOCK CATALOG NO. 24



OHMITE®

MANUFACTURING CO.

3610 Howard St., Skokie, Ill. (Suburb of Chicago)

30th Anniversary

1925-1955

FOR HIGH CURRENT

LOW RESISTANCE APPLICATIONS . . .

OHMITE® *Power Type* RESISTORS

CORRIB®

Vitreous-Enameled,
Corrugated-Ribbon Type

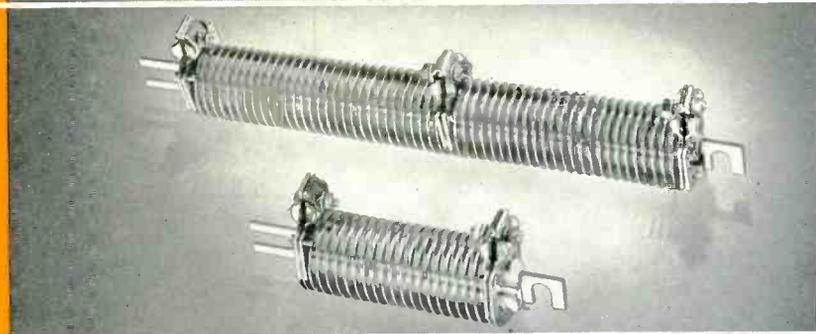
Special Ohmite vitreous enamel locks the edge-wound ribbon alloy to a sturdy ceramic core. Fixed, tapped, and adjustable types. Available in 22 sizes from 90 to 1500 watts. Resistance values range from .04 to 70 ohms.



POWR-RIB®

Edgewound-Ribbon Type

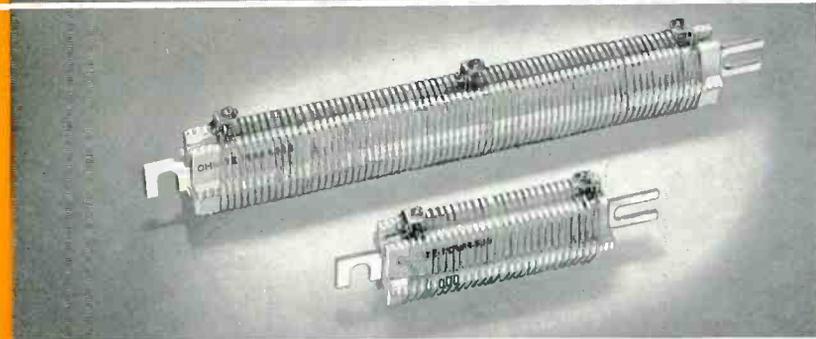
Has a heavy ribbon of resistance alloy, edge-wound on a ceramic core. Core is sectionalized for flexibility and shock resistance. Terminals and brackets are plated to prevent oxidation. Four sizes in resistances from .043 to 1.6 ohms; and from 24 to 95 amperes.



POWR-RIB®

Round-Wire Type

Similar in construction to Ribbon-Wire type shown above, but with round resistance wire. Sturdy ceramic core is made in two to five sections. Available in four sizes. Resistance values from .69 to 25 ohms. Current ratings from 5.1 to 18.4 amperes.



Write for Bulletin 144

Available in fixed or adjustable
"DIVIDOHM®" Types.

Be Right with **OHMITE®**

RHEOSTATS • RESISTORS • RELAYS • TAP SWITCHES

30th Anniversary

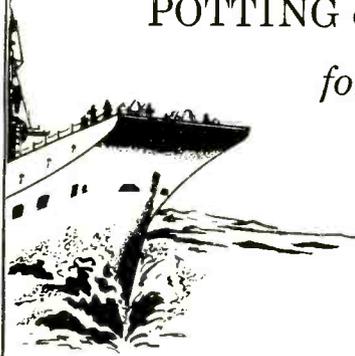
1925-1955

OHMITE MANUFACTURING COMPANY, 3610 Howard St.

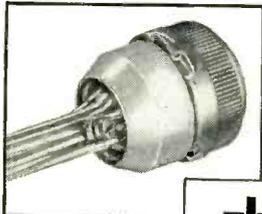
• SKOKIE, ILLINOIS
(Suburb of Chicago)

NEWEST METHOD OF SEALING AGAINST MOISTURE

POTTING of Cannon Connectors

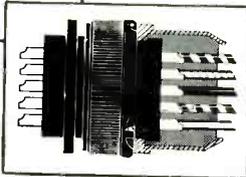


- for... 1. **Positive sealing** against moisture, dirt, and other foreign matter.
2. **Weight saving** because of elimination of end bell and cable clamp.
3. **Space saving** due to shorter overall length.
4. **Prevention of wire fatigue** under extreme vibration.
5. **Improved dielectric characteristics.**



Typical completed potted connector

Individual wires and elements are thoroughly sealed



CANNON offers these Connectors for Potting

- CAO6BS Plug • Plastic Inserts
125 to 48 Sizes
- CAO6BR Plug • Plastic Inserts
125 to 48 Sizes
- CAO6ES Plug • Resilient Inserts
85 to 36 Sizes
- CAO6ER Plug • Resilient Inserts
85 to 36 Sizes
- CA3106BS Plug • Plastic Inserts
125 to 48 Sizes*
- CA3106BR Plug • Plastic Inserts
125 to 48 Sizes*
- CA3106ES Plug • Resilient Inserts
85 to 36 Sizes*
- CA3106ER Plug • Resilient Inserts
85 to 36 Sizes*

*less grounding means

Receptacles also available for potting.

Plugs and receptacles available with either pin or socket assemblies.

Please Note: Many other connectors may be potted by devising proper potting techniques.

CANNON Potting Molds



Nylon potting cup



Aluminum end bell

How It's Done...

Potting is a newly developed method of obtaining complete protection, covering, and sealing around the solder cups and wires at the rear of electric connectors by means of a sealing compound applied at the time the connectors are wired into their assemblies. The terminal area enclosed by the plug or receptacle end bell is filled or potted with a free flowing high solids synthetic rubber compound. This cures at room temperature to form a firm, resilient, moisture and vibration resistant rubber seal.

Clean the Connector...

The connector should be free of grease, oil and wax in order to insure good adhesion. Do not expose insulating materials to the cleaning solvent beyond the time necessary for adequate cleaning. See the new Cannon Manual on Potting for complete information.

Mixing the Compound...

Compounds are usually furnished as a basic sealant compound and an accelerator. Mixing must be done carefully, either by hand or with power equipment. This subject is covered fully in new Cannon Manual on Potting.

Applying the Sealant...

Application of the sealant can be made with a small paddle-shaped tool, spatula, putty knife

or a flow gun. However, the flow gun is the preferred method where larger quantities of the plugs are to be sealed. Methods are discussed fully in the new Cannon Manual on Potting.

Potting Machines...

Large quantity runs can be handled economically by potting machines. Typical equipment of this nature is illustrated here.



Potting machine in use



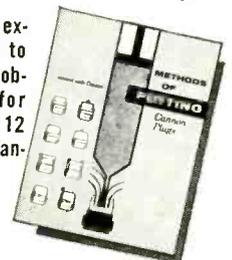
Potting by hand

Curing Time...

Curing time and the methods used are very important. The length of time that it takes for the sealant to harden and cure varies with the material used. Generally, the length of cure time depends upon the work life of the compound. A longer work life increases and short work life decreases the cure period. See the new Cannon Potting Manual for complete details.

MIL-S-8516 (Aer) is basic specification on sealing compounds for electric connectors and electric systems. BuAer Bulletin Aer-EL-35 covers electric connector sealing to prevent contamination, improve reliability.

Cannon's engineering experience is available to you on your potting problems. Write TODAY for assistance and for new 12 page, 2-color, Potting Manual No. PM-1.

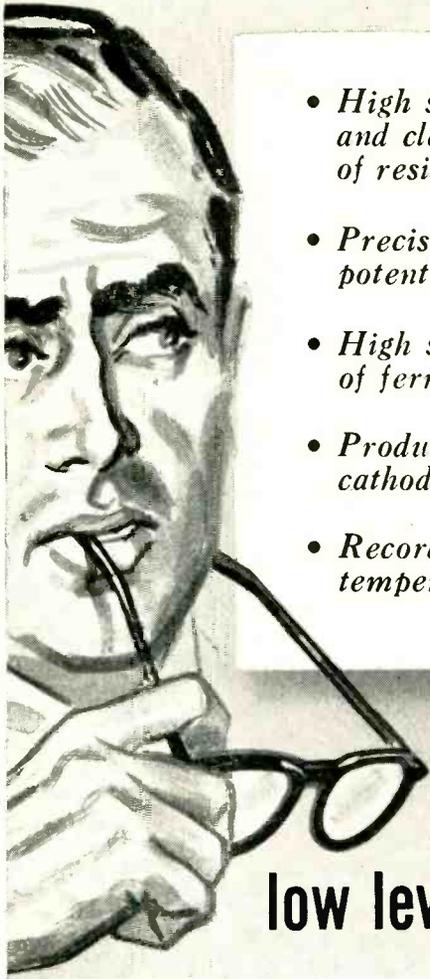


Please mention this magazine or Dept. 120

CANNON PLUGS

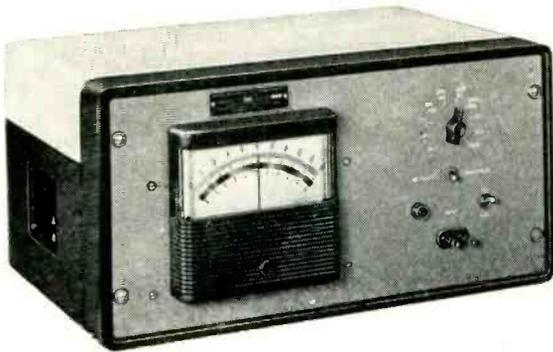
CANNON ELECTRIC CO., 3209 Humboldt St., Los Angeles 31, California. Factories in Los Angeles; East Haven; Toronto, Canada; London, England; Melbourne, Australia. Manufacturing licensees in Paris, France; Tokyo, Japan. Representatives in all principal cities.

These or similar problems puzzling you?



- *High speed inspection and classification of resistive elements*
- *Precision control of minute potentials and currents*
- *High speed inspection of ferromagnetic materials*
- *Production testing of cathode ray tube brightness*
- *Recording extremely low temperature differentials.*
- *Continuously recording rate of temperature change in jet engine test stands*
- *R.M.S. regulation of a-c oscillators and generators*
- *Multiplication of two a-c or d-c signals to provide a precision product*
- *Precision low power factor measurements for production inspection of transformers and motors*

The INDUCTRONIC[®] SYSTEM of low level MEASUREMENT and CONTROL



Model 1475 Multi-Range Inductronic D-C Amplifier provides amplification of a complete span of direct current and voltage ranges of either polarity with no sacrifice in fundamental accuracy or speed. Has seven current ranges, from 10 to 1,000 microamperes — and ten voltage ranges, from 1 to 1,000 millivolts. All ranges immediately available by the turning of a switch; and an additional seventeen ranges become available by a knob adjustment which changes the instrument from zero left to zero center. Accuracy 1%. Accessories such as recorders and additional indicators can be inserted in the output to a total of 5,000 ohms without affecting accuracy or calibration.

Practical solutions to the above, and many other problems of low-level measurement and control have been supplied by the WESTON Inductronic System . . . an entirely *different* method of d-c amplification. Utilizing the deflection of a permanent magnet moving coil system, it converts extremely low-level d-c to a proportionate a-c signal and amplifies it to a *usable degree* . . . then reconverts to a d-c level. The system operates at a frequency of 200 KC, and provides a high order of sensitivity, accuracy and speed. And because of circuit simplicity, the system is stable and virtually maintenance free. To learn how you can apply the Inductronic System in research or production, call your nearest Weston representative, or write direct for bulletin B-36-B.

WESTON *Instruments*

WESTON ELECTRICAL INSTRUMENT CORPORATION, 614 Frelinghuysen Avenue, Newark 5, New Jersey

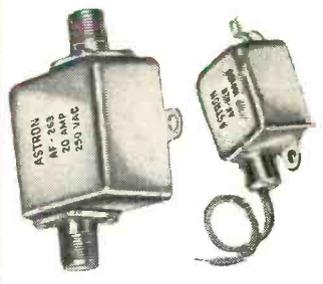
New HEIGHTS OF PERFORMANCE
Achieved by
advance-design
ASTRON CAPACITORS AND R.F. FILTERS

Today's design requirements foreshadow tomorrow's revolutionary applications ... imposing critical new areas of performance on electronic components.

The vexing problem of efficient capacitor and R. F. filter operation under these ultra-severe conditions of extreme heat, cold, moisture and vibration challenges the imagination of the component manufacturer ... truly he must create "something completely new under the sun"!

A foremost pioneer in the exciting development of advance-design components, to cope with these requirements, is Astron ... leader in miniaturization, manufacturer of industry's widest variety of types, whose experience, ability and creative far-reaching point of view produces like significant, highly-engineered designs pictured here ... proof of a dedication to progress.

The types and styles illustrated are but a few of the many available ... for complete technical and application information on all Astron products, please request catalog AC-4.



R. F. Noise Suppression Filters.
Complete noise suppression
"Packaged" service—Definition of requirements • Engineering analysis • Efficient solutions • Advance-type components • Quality production.

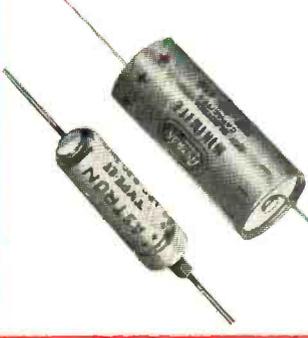
Attention: West Coast Buyers
Astron now maintains a complete West Coast Stock of all standard items ... see your local Astron distributor.



Blue • Point® Molded Plastic Paper Capacitors



Comet* Molded Plastic Metallized Paper Capacitors



Safety Margin "SM"* Miniature Electrolytic Capacitors



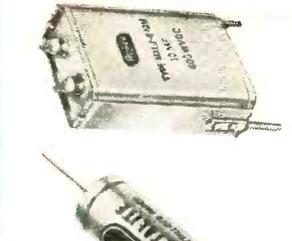
Meteor® High Temperature Miniaturized Capacitors



Metalite® and Hy-Met* Sub-Miniature Metallized Paper Capacitors



Mylar† - Plus Capacitors
Series "X"***



MIL-Type Hermetically Sealed Paper-Capacitors



Safety Margin "SM"* Twist-Prong and Cardboard Cased Electrolytic Capacitors



ASTRON
CORPORATION
255 GRANT AVENUE
EAST NEWARK, N. J.



versatile

Multi-channel --
telegraph A1 or
telephone A3.

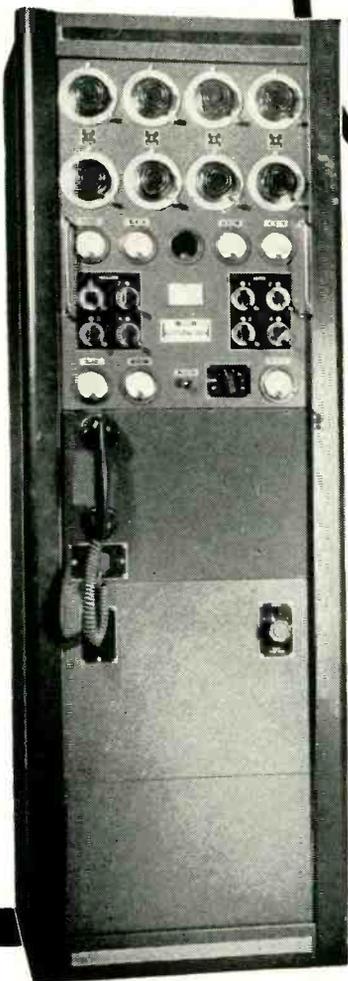
FROM GROUND TO AIR OR POINT TO POINT

STABLE

High stability (.003%) under
normal operating
conditions.

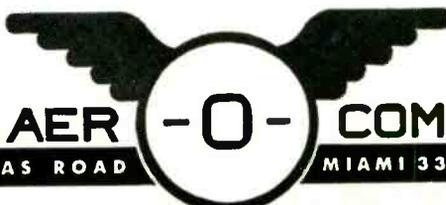
RUGGED

**Components
conservatively
rated. Completely
tropicalized.**



Model 446 transmitter operates on 4 crystal-controlled frequencies (plus 2 closely spaced frequencies) in the band 2.5-24.0 Mcs (1.6-2.5 Mcs available). Operates on one frequency at a time; channeling time 2 seconds. Carrier power 350 watts, A1 or A3. Stability .003%. Operates in ambient -35° to 45°C. Nominal 220 volt, 50/60 cycle supply. Conservatively rated, sturdily constructed. Complete technical data on request.

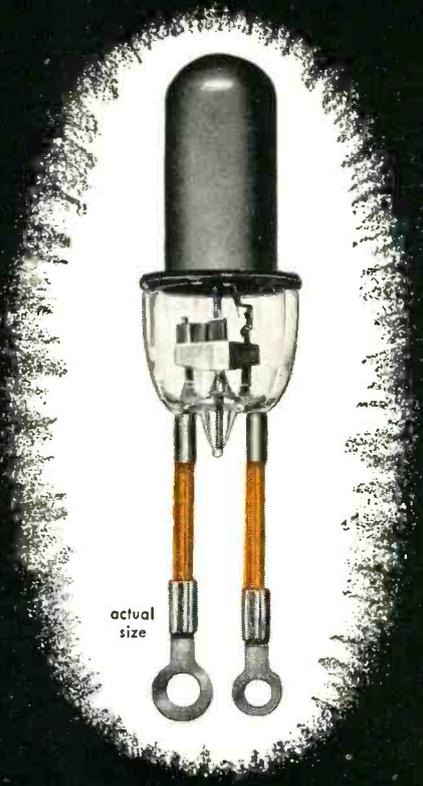
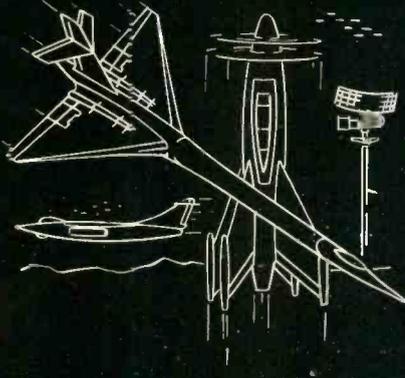
Here's the ideal general-purpose high-frequency transmitter! Model 446... 4-channel, 6-frequency, medium power, high stability. Suitable for point-to-point or ground-to-air communication. Can be remotely located from operating position. Co-axial fitting to accept frequency shift signals.



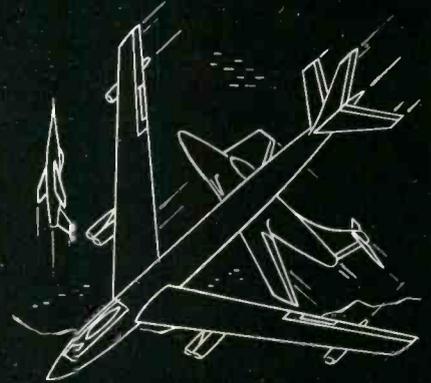
3090 DOUGLAS ROAD

MIAMI 33, FLA.

DESIGN IS OUR BUSINESS



actual size



ANNOUNCING **UNITED** TYPE 589 CLIPPER-DIODE RECTIFIER

Ever so small, and light for its power capabilities, our new type 589 electron tube will help immeasurably in concluding many electronic design problems, especially for aircraft and missile environment.

This new external anode tube weighs only a little over $\frac{3}{4}$ of an ounce, is less than 2 inches long, yet is rated as a clipper diode for 10,000 volts epx, and for peak plate current of 8 amperes.

For oil emersed rectifier operation rated epx is 16,000 volts and average plate current rating is 65 mAdc.

For convection cooled rectifier operation rated epx is 16,000 volts and average plate current rating is 30 mAdc.

Shock rating is 300 g.

MECHANICAL DATA

Nominal Overall Dimensions:	
Length (Less lead).....	1.9 inches
Lead Length.....	1.5 inches
Diameter.....	.9 inches
Anode Dimensions:	
Length (for contact).....	.8 inches
Diameter.....	.6 inches
Bulb.....	Per illustrations
Mounting and Anode Contact.....	Per illustrations
Filament Terminals.....	Per illustrations

Type of Cooling.....	Liquid
Net Weight.....	0.8 oz.
Shock Rating.....	300 g.
Vibration Rating at 500 cps.....	10 g.

ELECTRICAL DATA

General:	
Heater Voltage.....	6.3 Vac.
Heater Current.....	1.6 Aac.
Cathode.....	Coated Unipotential
Maximum Rectifier Ratings (Liquid Cooled):	
Peak Inverse Voltage.....	16.0 kv.

Peak Plate Current.....	250 ma.
Average Plate Current.....	65 mAdc.
Maximum Coolant Temperature Range	-65° C to +165° C
Maximum Rectifier Ratings (Radiation Cooled):	
Peak Inverse Voltage.....	16.0 kv.
Peak Plate Current.....	120 ma.
Average Plate Current.....	30 ma.
Maximum Clipper Diode Ratings (Liquid Cooled):	
Peak Inverse Voltage.....	10.0 kv.
Peak Current.....	8 a.
Average Plate Current.....	20 ma.

UNITED  **ELECTRONICS, 42 Spring Street, Newark 2, N. J.**



TAILOR-MADE

...at "store-bought" prices!

OVER NINETY PERCENT of the GLOBAR®

Resistors available today have been engineered in the correct sizes, shapes, resistance values—and characteristics—to solve *specific* circuit problems completely and economically...including *yours!*

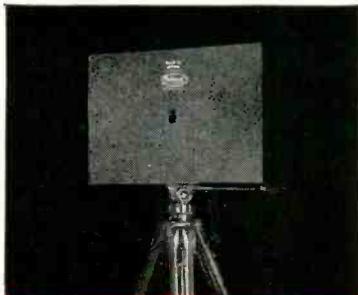
Why shop around for "stock" items when GLOBAR® Resistors cost no more? Let us convince you.

Always Specify

GLOBAR®

Ceramic Resistors

A NEW LINE OF BROADBAND MICROWAVE COMPONENTS

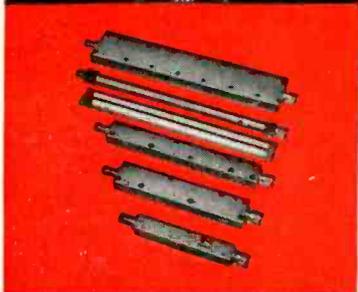


MICROWAVE TEST ANTENNAS

Covering 1,000 to 26,600 mc. Rugged, portable units built especially for field intensity measurements, antenna pattern recording, leakage measurements and other communications use. Supplied complete with tripod mount, adjustable pan head, and convenient carrying case.

Each of these Polarad test antennas is highly directional with excellent front to back ratio, and is supplied with flexible waveguide or coax couplings.

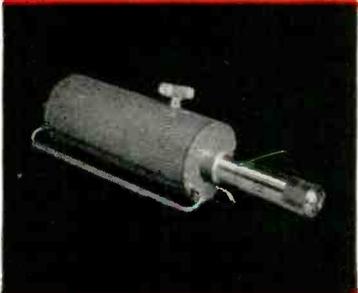
MODEL No.	FREQUENCY RANGE	MAX. VSWR
A-L	1,000 to 2,300 mc	3:1
A-S	2,150 to 4,600 mc	2:5
A-R	4,450 to 8,000 mc	2:5
A-X	7,850 to 12,400 mc	2:7
A-KU	12,400 to 18,000 mc	1.5:1
A-K	18,000 to 26,000 mc	1.5:1



BROADBAND-PASS FILTERS

Covering 650 to 13,000 mc. These Polarad Broadband-Pass filters are the first of their kind commercially available. They feature sharp skirt selectivity and low pass band insertion using standard 50 ohm co-axial connections. Curves showing typical bandpass characteristics are available on request.

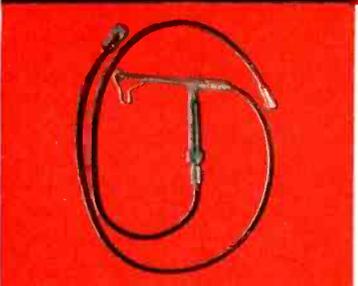
MODEL No.	FREQUENCY RANGE
F 650	650 — 1,300 mc
F 1100	1,100 — 2,200 mc
F 1800	1,800 — 3,600 mc
F 3500	3,500 — 7,400 mc
F 6100	6,100 — 13,000 mc



MICROWAVE WAVEMETERS

Covering 500 to 4000 mc. Precision, adjustable, cavity-type meters designed for measuring frequency with $\pm 0.2\%$ accuracy over the range 500 to 4000 mc. Each meter in the series has a 2:1 frequency range. Specific frequency metering is accomplished by adjustment of micrometer head until a dip of at least 20% in output occurs when input or output impedance is nominal 50 ohms. Micrometer head readings are easily converted to frequency by using calibration chart furnished with each instrument. Utilizes Type "N" coax connectors.

MODEL	FREQUENCY RANGE
FR	500 — 1,000 mc
FL	1,000 — 2,000 mc
FS	2,000 — 4,000 mc



MICROWAVE ATTENUATOR—Model SIJ

Covering 4,000 to 12,400 mc. A continuously variable, stub-tuned, mutual inductance attenuator (waveguide beyond cut-off) designed for external use in making microwave measurements with spectrum analyzers, signal sources, receivers and for power measurements. The Model SIJ can be used as a standard calibrated attenuator; for circuit protection; or for monitoring and measuring. It will insure RF circuit isolation. It may be used to convert signal source or laboratory oscillator into a signal generator.

SPECIFICATIONS:	
Frequency Range:	4 to 12.4 kmc
Impedance:	50 ohms
Attenuation Range:	130 db
Minimum Insertion Loss:	Approximately 10 db depending on frequency.

AVAILABLE ON EQUIPMENT LEASE PLAN

**FIELD MAINTENANCE SERVICE AVAILABLE
THROUGHOUT THE COUNTRY**



ELECTRONICS CORPORATION

43-20 34th STREET • LONG ISLAND CITY 1, N. Y.

REPRESENTATIVES: • Albuquerque • Atlanta • Baltimore • Bayonne • Bridgeport • Buffalo • Chicago • Dayton • Fort Worth • Los Angeles • New York
Newton • Philadelphia • San Francisco • Syracuse • Washington, D. C. • Westbury • Winston-Salem • Canada, Arnprior, Toronto—Export: Rocke International Corporation

Announcing

A-M-P®

MINIATURE TAPER PINS

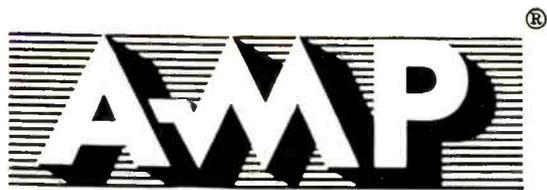
FOR MINIATURIZED COMPONENTS!



Send today for your copy of "A-M-P's Creative Approach to Better Wiring"

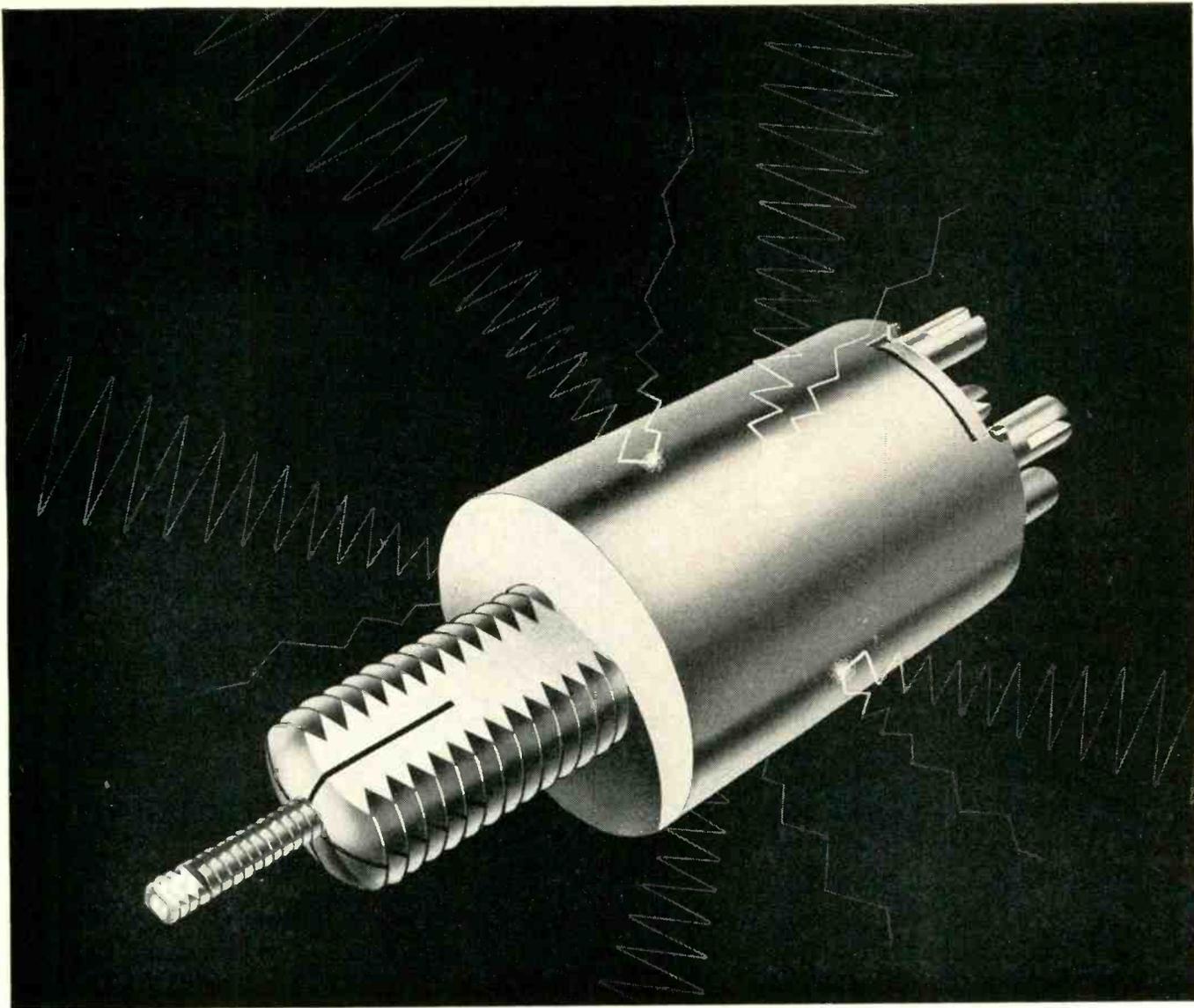


A-MP's new Miniature Taper Pins, shown here actual size, provide the same uniformly reliable wire connections for your miniature components, as the larger, widely used and accepted A-MP Taper Pins. Miniature Taper Pins are applied to wire with A-MP Automatic Machines at speeds up to 4000 per hour. They are then inserted into components quickly and easily with A-MP CERTI-LOK Insertion Tools. Miniature Taper Pins are available for wire sizes #26 to #20.



©A-MP

AIRCRAFT-MARINE PRODUCTS, INC., 2100 Paxton Street, Harrisburg, Pa.
In Canada: AIRCRAFT-MARINE PRODUCTS OF CANADA, LTD., 1764 Avenue Road, Toronto 12, Ontario, Canada



Built for close "combat" in tight spots

Into the construction of this coil form goes C.T.C.'s rigid *quality control* to highest production standards.

The result is another C.T.C. *first* — a miniaturized coil form ($\frac{1}{16}$ " diameter by $\frac{1}{2}$ " high when mounted) that is shock-resistant and exceptionally rugged — shielded against radiation, electrically, and therefore ideal for "close quarter" use in I.F. strips and numerous designs where adjacent mounting is necessary.

C.T.C.'s policy of continuous step-by-step quality control in the manufacture of every component means guaranteed performance. Already certified materials are doubly checked before manufacture.

Whatever your component need — let C.T.C. solve your problem — with either custom or standard designs of *quality-controlled, guaranteed* components — including insulated terminals, coil forms, coils, swagers, terminal boards, diode clips, capacitors and a wide variety of hardware items.

Put your component problem up to

C.T.C. now. For samples, specifications and prices — write today to Sales Engineering Dept., Cambridge Thermionic Corporation, 437 Concord Ave., Cambridge, Mass. On West Coast, contact E. V. Roberts, 5068 West Washington Blvd., Los Angeles 16 or 988 Market St., San Francisco, California.

Coil Form Data: C.T.C.'s LS-9 coil form has a brass shell enclosing a powdered-iron cup-core, tuning slug, phenolic coil form and silicone fibreglas terminal board. Three terminal boards are available with choice of two, three or four terminal layout. Forms, unassembled, may be had *without windings . . . or wound and assembled to your specifications.*



Capacitor: New CST-50 variable ceramic capacitor surpasses range of capacitors many times its size. Stands only $\frac{1}{32}$ " high when mounted, is less than $\frac{1}{4}$ " in diameter and has an 8-32 thread mounting stud. A tunable element of unusual design practically eliminates losses due to air dielectric giving large minimum to maximum capacity range (1.5 to 12MMFD).

CTC

CAMBRIDGE THERMIONIC CORPORATION

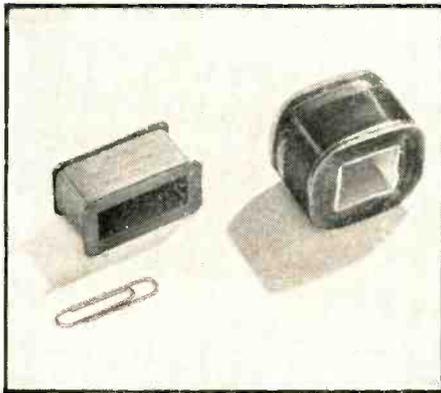
*makers of guaranteed electronic components,
custom or standard*



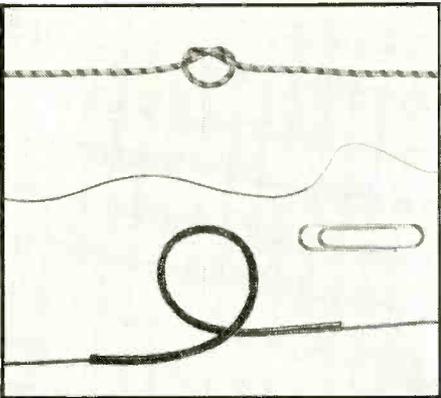


Better Things For Better Living
Through Chemistry

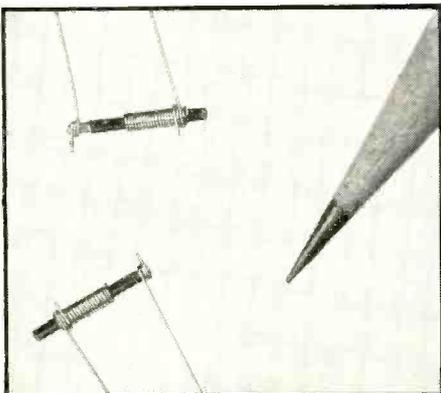
Miniaturized Components Utilize Unique Insulating Properties of TEFLON®



The paper clip indicates the small size of these coils. The insulation of "Teflon" is one important reason why they can be miniaturized.



Here are shown (top) a striped, wrapped lead wire and (bottom) two samples of miniaturized flexible sleeves—all insulated with "Teflon."



These small capacitors use "Teflon" as the dielectric. Their degree of miniaturization is shown by comparison with end of lead pencil.

Working temperature range of Du Pont "Teflon": -450°F. to +500°F.

Miniaturization of electronic components is possible with a unique engineering material: Du Pont "Teflon" tetrafluoroethylene resin.

"Teflon" has a low loss factor, low dielectric constant, and high volume resistivity. It is nonflammable, and unaffected by moisture. "Teflon" is the only insulating material available today that is inert to every commercially used solvent and chemical, excepting only molten alkali metals and fluorine at high temperatures and pressures.

Use of "Teflon" helps cut production costs, too. In soldering operations, the iron will not burn or melt insulation of "Teflon." This important fact can save time, labor, and materials.

The three photographs on this page show some current uses for insulation of "Teflon." The wire is manufactured by Hitemp Wires, Inc., Mineola, New York. Other typical applications by Hitemp which utilize Du Pont "Teflon" are listed below.

The six products listed, insulated with "Teflon" and used in a wide variety of applications, illustrate the application of this material in current electronic designs:

MAGNET WIRE. Such wire, coated with "Teflon," is widely used on high-temperature components for aircraft and guided missiles: transformers, relays and various types of motors.

HOOKUP WIRE AND LEAD WIRE. Insulation of "Teflon" on hookup and lead wire proves advantageous on transformers, motors, and harness assemblies for high-temperature applications. The chemical resistance of "Teflon" is particularly valuable in gyros and other hermetically sealed components.

COAXIAL CABLE. Used as the dielectric medium of coaxial cable, "Teflon" permits the design of miniature constructions which are the equivalent of coaxial cables using much thicker insulation of other materials.

TUBING. Insulation of "Teflon" provides excellent protection for tubing used as bus wire and jumpers.

RESISTANCE WIRE. Insulation of "Teflon" on small resistance wire facilitates miniaturization of heating equipment.

FIBER-GLASS PRODUCTS. Insulation of "Teflon" is being applied currently to such fiber-glass products as lacing, tape and sewing thread. "Teflon" provides excellent temperature resistance, and withstands cutting action of glass fibers.

NEED MORE INFORMATION?

CLIP THE COUPON . . .

If you would like further information about the properties and uses of "Teflon" as an electronic design material, fill out and mail the coupon.

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department
Room 229, Du Pont Building, Wilmington 98, Delaware
In Canada: Du Pont Company of Canada Limited,
P. O. Box 660, Montreal, Quebec

Please send me more information on the Du Pont engineering materials checked: "Teflon"* tetrafluoroethylene resin; "Alathon"* polyethylene resin; "Zytel"* nylon resin; "Lucite"* acrylic resin. I am interested in evaluating these

materials for _____

NAME _____

POSITION _____

COMPANY _____

STREET _____

CITY _____ STATE _____

TYPE OF BUSINESS _____

* "Teflon," "Alathon," "Zytel" and "Lucite" are registered trademarks of E. I. du Pont de Nemours & Co. (Inc.)

Phelps Dodge modern fits new



First for Lasting Quality—from Mine to Market!

enamel wire

exacting coil designs!

*New processes and controls
assure uniform quality:*

1

Uniform over-all size — for uniform windings.

2

**Uniform softness with high tensile strength
for tighter windings, reduced breakage.**

3

**Uniform spooling, larger packages for lower-
cost windings.**

4

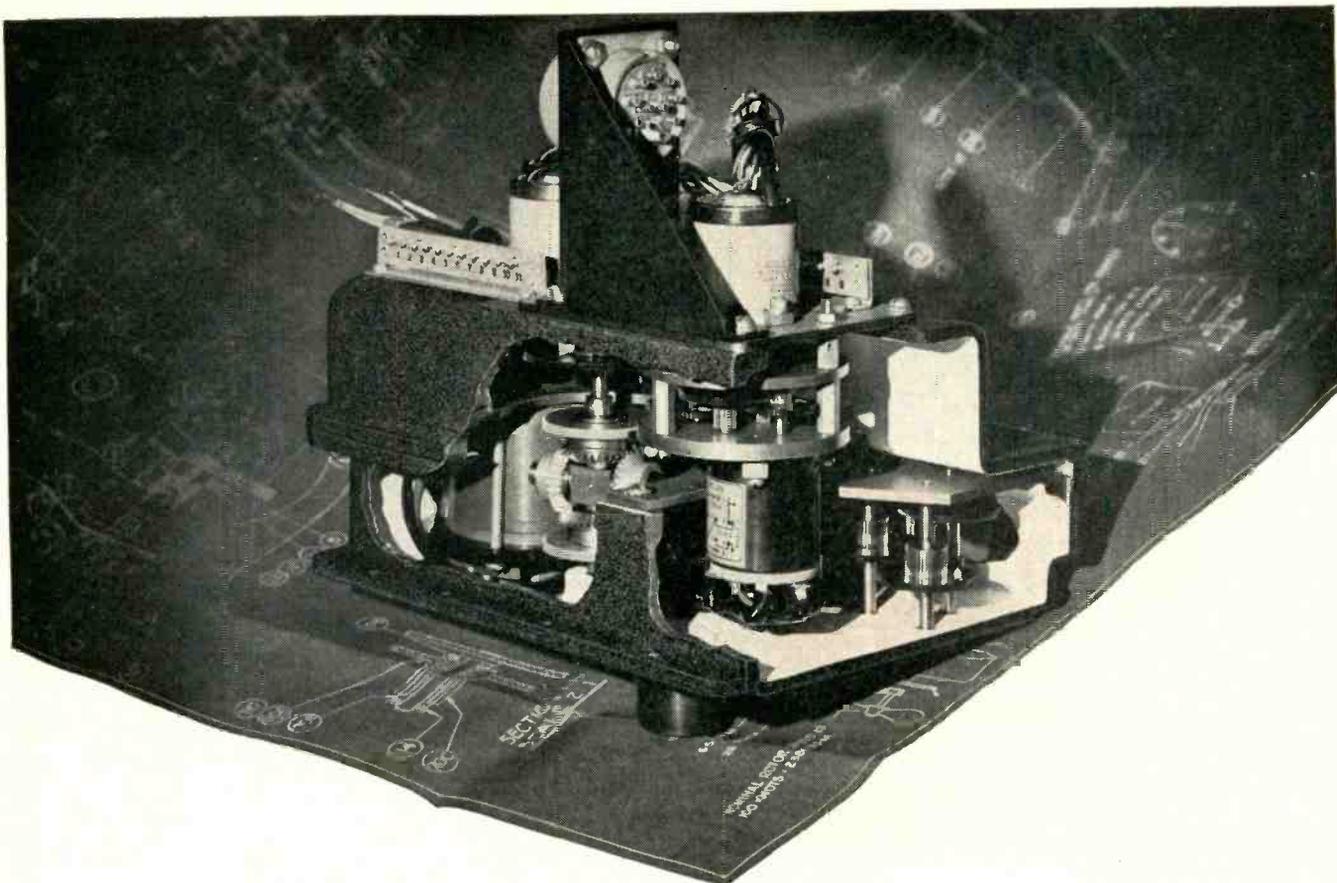
**Uniform property balance for good flexibility,
solvent resistance and dielectric strength.**

*Any time magnet wire is your problem,
consult Phelps Dodge for the quickest, easiest answer!*



PHELPS DODGE COPPER PRODUCTS
CORPORATION

INCA MANUFACTURING DIVISION
FORT WAYNE, INDIANA



Creative Engineering

OF ELECTRO-MECHANICAL ASSEMBLIES . . .

FROM "PILOT STAGE" TO PRODUCTION EFFICIENCY

Here's how Atlas helps you develop new assemblies and components for radar and sonar systems, computers, and other electro mechanical devices.

You bring your designs to us. Atlas experienced production and methods engineers layout the job using new cost-cutting methods, improved processing techniques. Atlas toolmakers build dies and fixtures to implement these plans. Atlas skilled mechanics and assemblers produce prototypes to your exact speci-

fications. Atlas metallurgical and electronic technicians test your product. Your next step is when your plant or Atlas takes over for volume production.

Atlas furnishes the practical engineering step between idea and production line. We've been "precision-eering" on a contract basis for many years. May we work with you? Write for booklet "Precision-eering Electro Mechanical Equipment." ATLAS Precision Products Co., Phila. 24, Pa. (Division of Prudential Industries).

"From Drawing Board . . . to Production Line"

ENGINEERING



• PRODUCTION



• ASSEMBLY



ATLAS

Precision Products

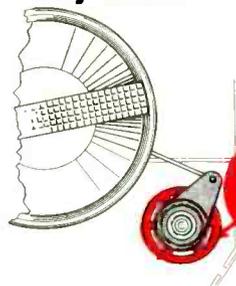


5 Waldes Truarc Rings simplify assembly, eliminate parts, bring big over-all savings to new design low-cost camera

Anscoflex II Camera



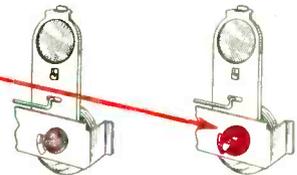
Key Shaft



Parts originally designed for self-locking Truarc ring (series 5105). Some cameras in the past had brass cup staked to the body. At times staking operation cracked the plastic, resulting in loss of expensive part.

Portrait and Filter Lens Knob Assemblies

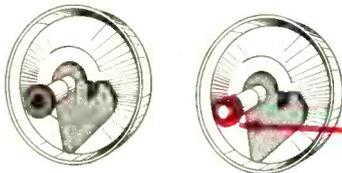
Old way: Knob with plastic shaft used washer and heat forming operation that flattened the plastic pin and locked the pivot in position.



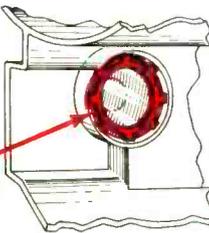
Truarc way: Molded plastic knob with pin is easily and quickly held by a Truarc self-locking ring (series 5105). No groove is necessary. Washer is eliminated and it is possible to remove ring if necessary without damage to knob.

Winding Knob

Old way: With screw and washer design, it was necessary to disassemble entire camera to remove screw which secured winding knob. Self-topping screw sometimes failed to secure knob, produced excessive end play.



Truarc way: Truarc "E" ring (series 5133) allows removal of winding knob without major disassembly of camera, reducing repair time. Use of stacked rings and Truarc applicator saved \$10.40 per M on labor. Material saving: \$2.29 per M.

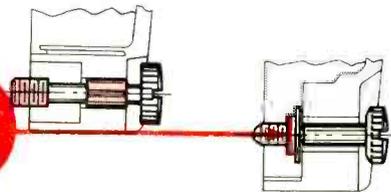


Rear Lens

Parts originally designed for self-locking Truarc ring (series 5005) Some cameras in the past had glass element secured by heat forming tabs from plastic body. Loose or chipped elements resulted in loss of both parts.

Flash-Gun Case Assembly

Old way: In the original design a sleeve was wrapped around neck of screw and pressed into hole of plastic cover. Close working areas made assembly difficult and required extra operation to lock ring into place.



Truarc way: Series 5133 E-Ring snaps onto un-threaded shank of screw quickly, needs no special groove. Labor saving \$7.06/M.

AnSCO, Binghamton, N. Y., uses the latest technical advances in construction to produce an economical, easy-to-use reflex camera. 5 Waldes Truarc Rings are used in this new design to save material and labor costs, eliminate parts, simplify assembly and reduce rejects.

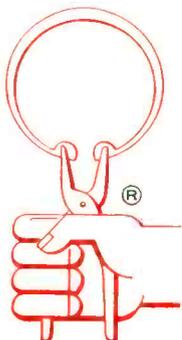
Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product... to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

controlled from raw material to finished ring.

36 functionally different types... as many as 97 different sizes within a type... 5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

More than 30 engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today... let our Truarc engineers help you solve design, assembly and production problems... without obligation.

For precision internal grooving and undercutting...Waldes Truarc Grooving Tool!



Send for new catalog supplement

WALDES
TRUARC[®]
RETAINING RINGS

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.
Please send the new supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.
(Please print)

Name _____
Title _____
Company _____
Business Address _____
City _____ Zone _____ State _____

F097

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.



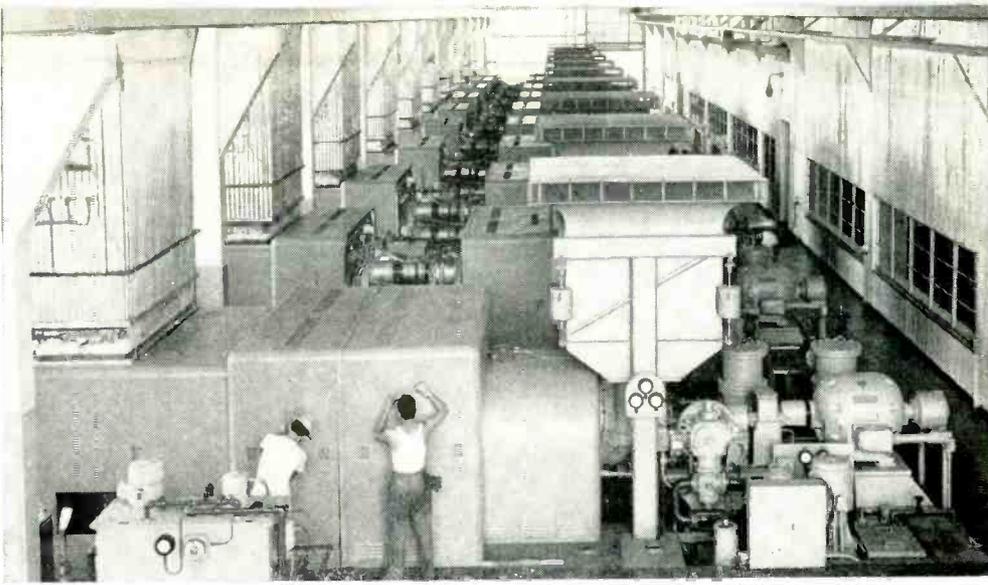
CELESTIAL NAVIGATION—Link Aviation's high-speed, high altitude celestial navigation trainer; only such trainer capable of simulating trans-Polar flight. Trains navigators in techniques of guiding planes by the stars.

Vital Controls

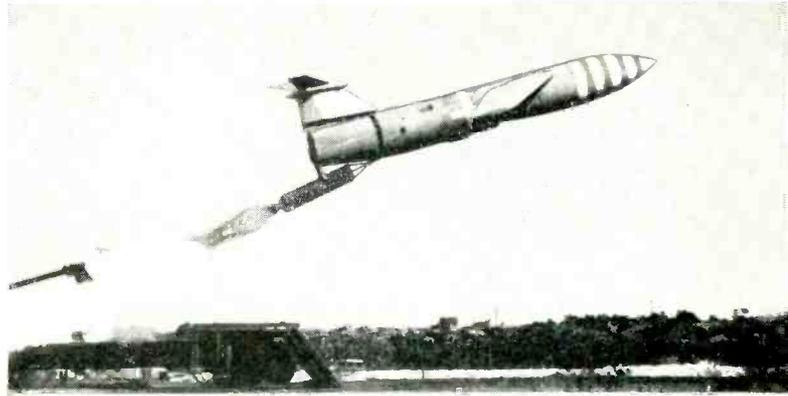
The controls on the world's fastest submarine; the most advanced airborne navigation system known to exist; other similarly advanced military systems and equally advanced industrial equipment and control systems are outstanding examples of the work of the producing companies of General Precision Equipment Corporation. More than a dozen major industries are served by instrumentation and systems designed, developed and produced by GPE Companies.

Ten of the companies in the GPE Group—notably Askania, Kearfott, Librascope and Link Aviation—devote substantial resources to the development and manufacture of instruments, servos and controls. These are used in equipment and systems developed by these companies

PROCESS CONTROL—Askania controls regulate speed of the ten turbines which develop compression to maintain gas suction pressure in Creole Petroleum Corporation's giant, pile-supported oil drilling operation on Lake Maracaibo, Venezuela.



SUBMARINE OPERATION—Controls developed and produced by Askania Regulator Company are utilized to govern operation of U. S. Navy's modern Guppy type submarines.



MISSILE GUIDANCE—One of the many guided missiles equipped with Kearfott basic gyro reference systems, the B-61 Matador—U. S. Air Force's first successful ground-to-ground tactical weapon.

GPE CAPACITIES

	● Manufacturing	●● Manufacturing and product development	●●● Manufacturing, product development and research	◐ Pilot manufacturing, product development and research	
KEARFOTT COMPANY, INC.	●●●				PRECISION MECHANICS, OPTICAL DEVICES, CERAMICS
INTERNATIONAL CORPORATION	●●●				ELECTRICAL EQUIPMENT and COMPONENTS
BLLDORTH WILSON DIVISION	●●●				ELECTRONICS
GENERAL PRECISION LABORATORY INCORPORATED	●●●				HYDRAULICS, LIQUIDS PROCESSING, HEAT EXCHANGE
THE GRIECON RUSSELL COMPANY	●●●				TELEVISION Studio, Theatre, Educational, Business, Industrial
LINK AVIATION, INC.	●●●				INSTRUMENTS, SERVOS, CONTROLS Hydraulic, Pneumatic, Magnetic, Electronic
THE HERBER ELECTRIC COMPANY	●●●				AIRCRAFT and MISSILE GUIDANCE, CONTROL, SIMULATION
THE STRONG ELECTRIC CORPORATION	●●●				AUTOMATIC COMPUTERS and COMPONENTS
J. E. MAULEY MFG. CO.	●●●				RADAR, MICROWAVE, ULTRASONICS
ASKANIA REGULATOR COMPANY	●●●				MOTION PICTURE and AUDIO EQUIPMENT
AMPRO CORPORATION	●●●				NUCLEAR POWER COMPONENTS and CONTROLS
LIBRASCOP, INCORPORATED	●●●				SYSTEMS ENGINEERING Aeronautical, Naval, Industrial

themselves, as well as in systems and equipment developed and produced by other manufacturers of advanced technological equipment.

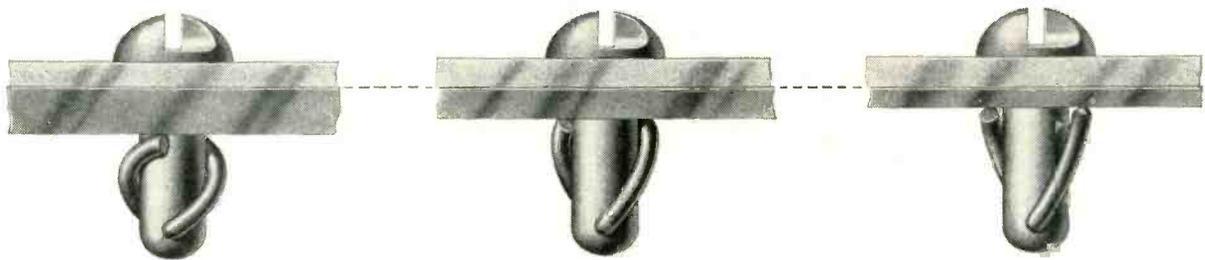
All GPE Producing Companies work in the advanced areas of highly specialized fields and are engaged in the design, development, manufacture and sale of equipment which is closely related from a technical point of view. It is all precision equipment; it derives from similar fields of technical competence; it saves labor, increases productivity or achieves results which cannot be achieved with even limited use of on-the-spot manpower. The chart here shows the specialized fields in which the key GPE Producing Companies work.

In addition to specialization in its particular products

and fields of technical competence, each of these companies has at its command, as required, the facilities and specialized techniques of the other GPE Companies in their respective fields. Interrelation of their resources is achieved through GPE's basic operating policy, GPE Coordinated Precision Technology. In all areas in which GPE Companies work, this coordination has been responsible for a wide variety of precision equipment of superior design and performance, embodying new, advanced principles.

A brochure relative to the work of the GPE Companies and GPE Coordinated Precision Technology is available. Address your request, or specific inquiries, to: GENERAL PRECISION EQUIPMENT CORPORATION — 92 Gold Street, New York 38, N. Y.

This fastener works through thick and thin!



Spring-Lock—the easy-to-use removable fastener for modern designs—works whether panel thicknesses run over or under specifications! Spring wire deflects automatically to handle greater or lesser thicknesses. Spring-Lock's design flexibility makes it more than a fastener: it can be adapted as a shelf support, door strike, knob or any similar panel-mounted device. Many standard shapes and sizes of Simmons Spring-Locks are available from stock.

SIMMONS FASTENER CORPORATION

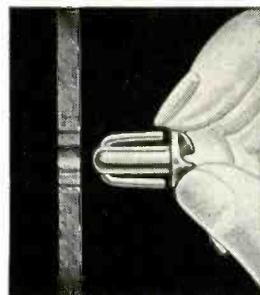
1750 North Broadway, Albany 1, New York

Simmons

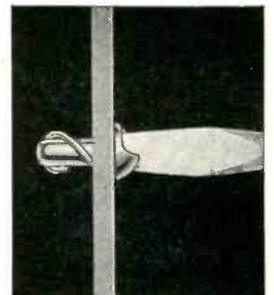
QUICK-LOCK
 SPRING-LOCK
 ROTO-LOCK
 LINK-LOCK
 DUAL-LOCK

JUST OUT!
 NEW 36-PAGE CATALOG WITH APPLICATIONS
 SEND FOR IT!

HERE'S HOW SPRING-LOCK WORKS



1. Insert fastener.



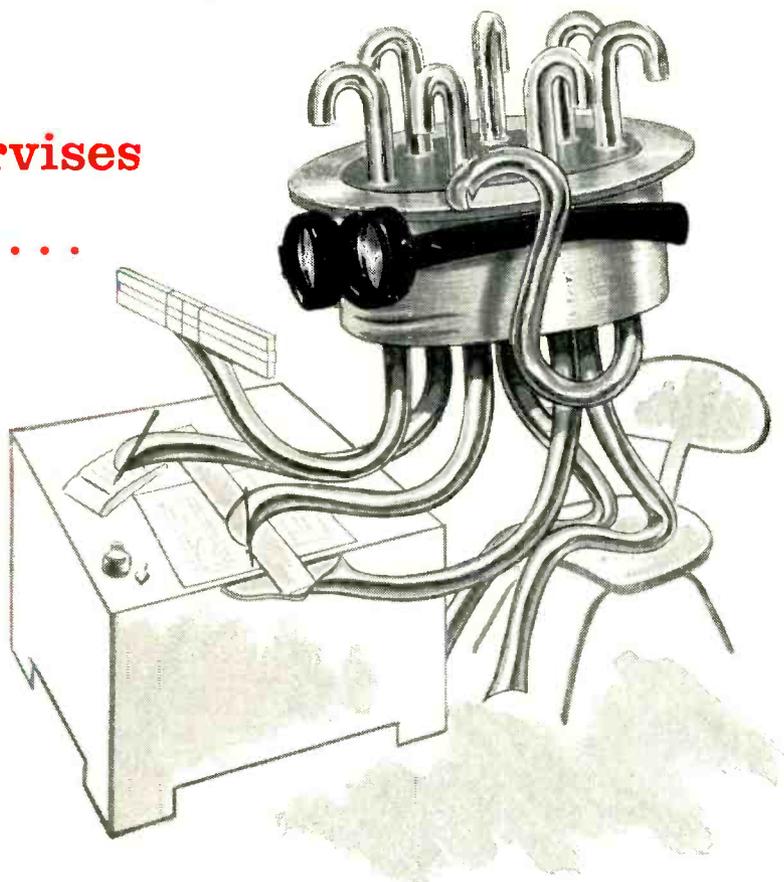
2. Half-turn locks it in place.

With production costs on the uptrend, you can figure on Spring-Lock as an assembly time and money-saver, because:

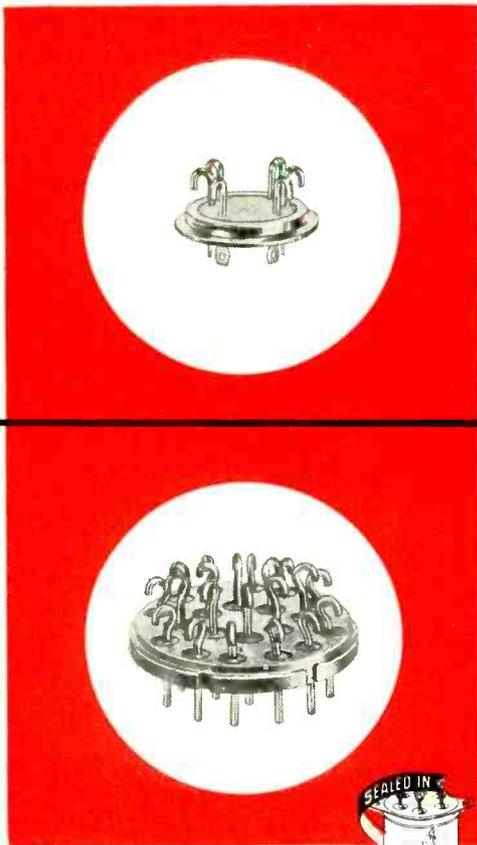
- Installation is **BLIND**
- Installation is **EASY**: no special tools are needed
- Installation is **QUICK**: a half-turn locks it in place
- Installation is **SECURE**: the *spring steel* locks the fastener, resists vibration

Send for details and samples, or write us about *your* fastening problem.

**Our Mr. Smith supervises
Multi-Header design . . .**



the most versatile glass-metal seal



Constant Multi-Header design development enables Hermetic to offer a Vac-Tite* Compression Multi-Header to suit every design and application requirement.

If requirements call for 4 to 28 solid or tubular terminal Multi-Headers with O.D.'s that range from .375 to 1.125 diameters, Hermetic Headers of "all-glass" or "individual-glass" construction can be supplied. However, to meet the most difficult specifications, Hermetic can provide Multi-Headers as large as you specify with as many terminations as is required in "individual-glass" construction and solid metal body.

Consult Hermetic for standard, as well as specially designed headers, with or without mounting studs, that act as cover and seal.

Write for your new addition to "Encyclopedia Hermetica" . . . a 16 page catalog containing the most diversified selection of Multi-Headers ever offered.

*VAC-TITE is Hermetic's new vacuum-proof, compression construction, glass-to-metal seal.

Hermetic Seal Products Company

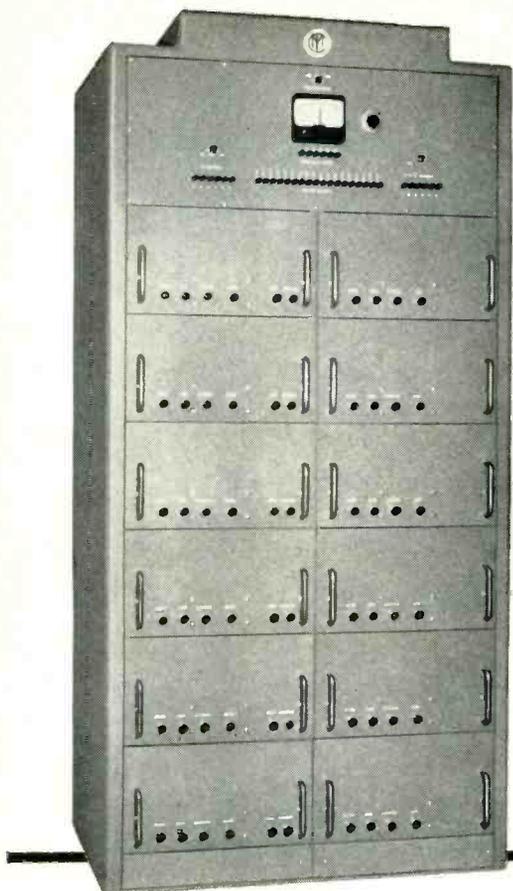
31 South Sixth Street, Newark 7, New Jersey

California Associate: Glass-Solder Engineering, Pasadena

F I R S T A N D



F O R E M O S T I N M I N I A T U R I Z A T I O N



**"MID-CENTURY'S
ELECTRONIC MULTIPLIER
LICKED OUR PROBLEMS..."**

because it has special high speed features
for computing
center work!"



The MC-700 AM-FM Electronic Multiplier is extremely accurate and performs at very high speed, thus saving many hours monthly in all types of computing center work. It consists of:

- 6 identical "A" units called MASTERS
- 12 identical "B" units called SLAVES
- Each Master Unit accepts two inputs, X and Y, and provides the product XY
- With the addition of the Slave Units, the products XZ and XW are obtained.

These Specifications of the MC-700 provide four quadrant multiplication:

- 1 The input and output ranges are plus or minus 100 volts, with an input impedance of greater than one megohm, and an output impedance equal to that of the D-C Amplifier in the unit.
- 2 The static accuracy is within 0.2 volts over full range.
- 3 The frequency response at full amplitude is flat to 400 cycles, with less than one degree of phase shift at 100 cycles.
- 4 The noise is less than .05 volts RMS.
- 5 The drift does not exceed 0.2 volts over an 8 hr. period.

MAIL THIS TODAY TO SAVE TIME TOMORROW!

MID-CENTURY INSTRUMATIC CORP.

611 Broadway, New York 12, N. Y.

I am interested in obtaining more information on the following, without obligation

- MC-700 Electronic Multiplier
- MC-300 Six Channel Recorder
- MC-400 Analogue Computer
- MC-500 D-C Analogue Computer
- MC-600 Six Channel Electronic Function Generator

FIRM NAME.....
STREET.....
CITY.....ZONE.....STATE.....
BY.....

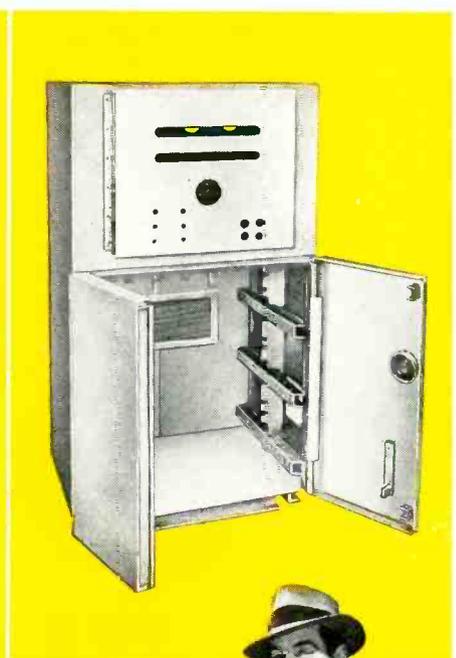
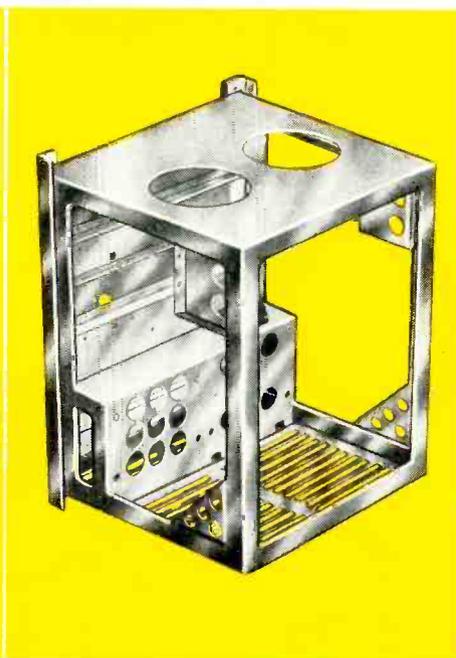
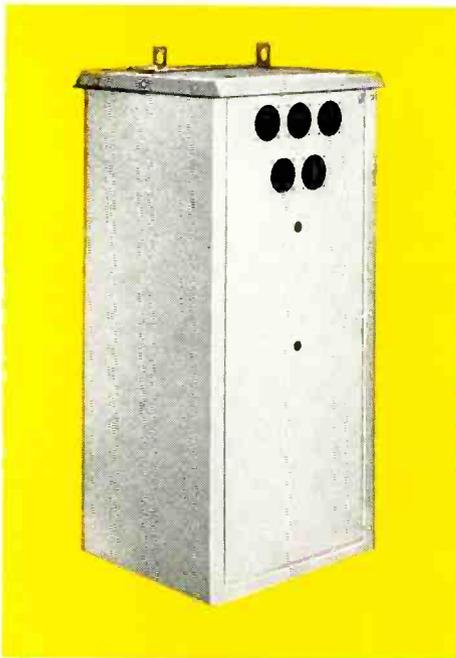


"precision is our business"

**MID-CENTURY
INSTRUMATIC CORP.**

611 BROADWAY

NEW YORK 12, N. Y.



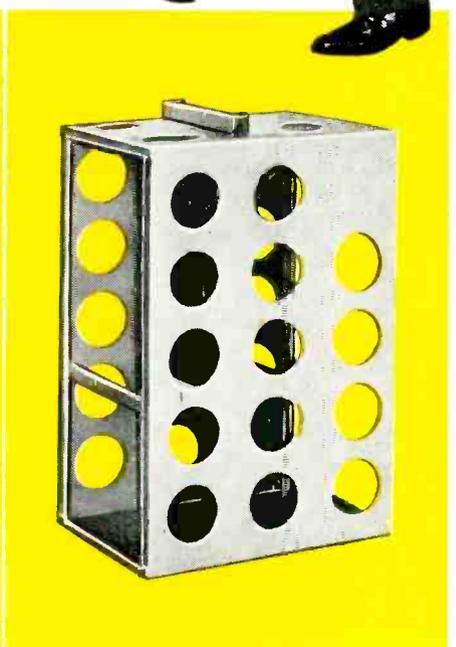
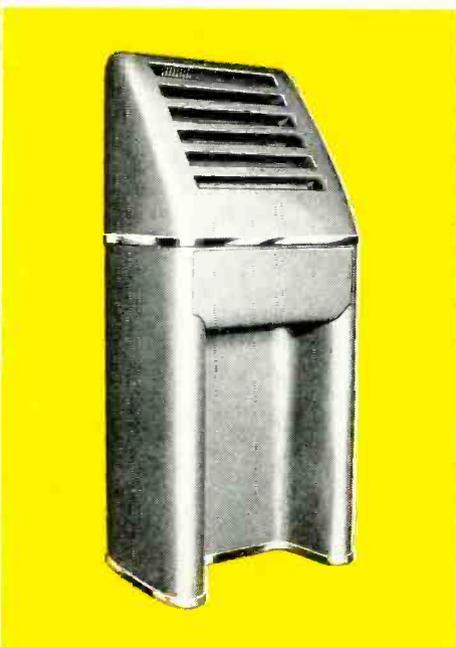
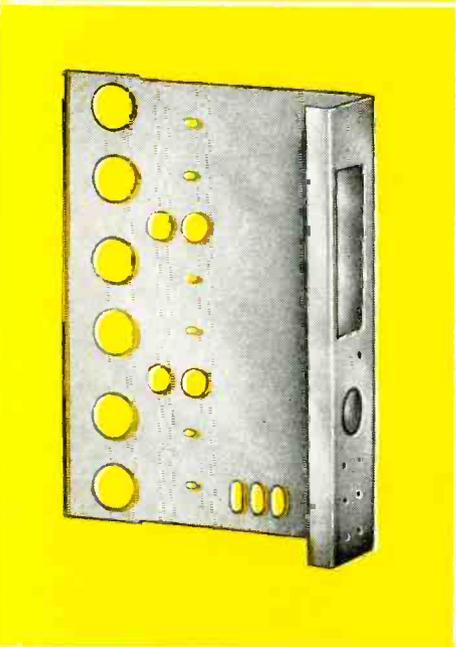
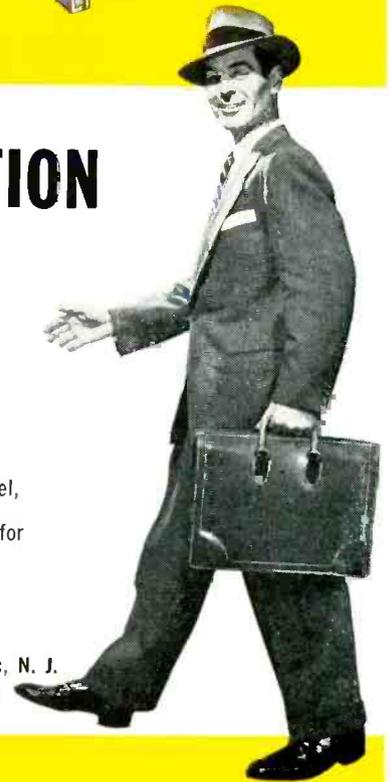
if it's
METAL FABRICATION
 your
FALSTROM MAN
 has the answer!

Since 1870 Falstrom engineers have been serving America's industry.

For fabrication of large or small shapes to close tolerances—in aluminum, sheet steel, stainless steel, copper, brass and other alloys—complete design—engineering—production service—modern facilities for punching, shearing, bending, welding, finishing . . . ask your Falstrom man—he'll have the answer.

Write for Bulletin 142 or send prints for quotation, without obligation.

FALSTROM COMPANY 93 Falstrom Court, Passaic, N. J.
 PRescott 7-0013 Since 1870



NOW

39

TUNG-SOL
"Series String"
TV TUBES

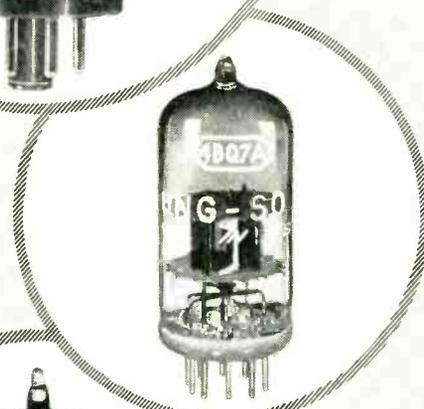
For Luxury-Set Performance
in the Low-Price Field

This complete line of 600 milliampere tubes, recently augmented by eight *new* types, delivers the performance requirements of present circuit designs as well as any foreseeable new circuitry. Additional tube types are being developed continually.

Rigid standards of quality control insure the same dependable performance from these Tung-Sol Tubes as from the prototypes . . . Experienced Tung-Sol engineering is ready to help you achieve smooth, efficient production . . . Reliable *co-ordinated* deliveries are meshed to meet the exacting schedules of mass manufacturing . . . And your design plans are held in strict confidence.

For additional information, write to Commercial Engineering Department, Tung-Sol Electric Inc., Newark 4, New Jersey.

Sales Offices: Atlanta, Chicago, Columbus, Culver City, Dallas, Denver, Detroit, Montreal (Canada), Newark, Seattle.



TUNG-SOL "SERIES STRING" TV TUBES

2AF4	3BZ6	5U8	12B4A
3AL5	3CB6	5V6GT	12DH7A
3AU6	3GS6	6AU7	12BQ6GT
3AV6	4BQ7A	6AU8	12BY7A
3BA6	4BZ7	6AX7	12GA5
3BC5	5AM8	6CG7	12L6GT
3BE6	5AN8	6S4A	12W6GT
3BF6	5AQ5	6SN7GTB	19AU4
3BN6	5BK7A	7AU7	25CD6GA
3BY6	5T8	12AX4GTA	

Tung-Sol also produces aluminized picture tubes for series string sets.



TUNG-SOL RADIO • TV TUBES
 DIAL LAMPS



Miniature Lamps



Sealed Beam Headlamps



Signal Flashers



Radio And TV Tubes



Aluminized Picture Tubes



Special Purpose Tubes



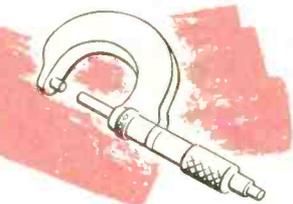
Semiconductors

Save assembly time...
with quality-controlled ceramics

made of

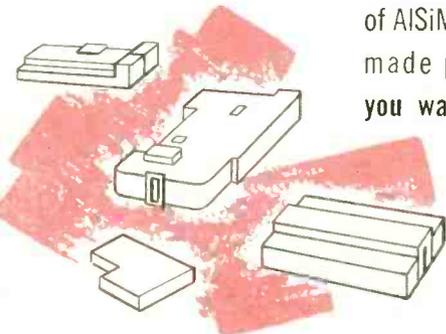
ALSiMAG[®]

Your line workers will appreciate the ease and speed with which they can assemble AISiMag ceramics. Your production planning staff will be well pleased with the excellent quality as well as the rapid delivery of these parts.

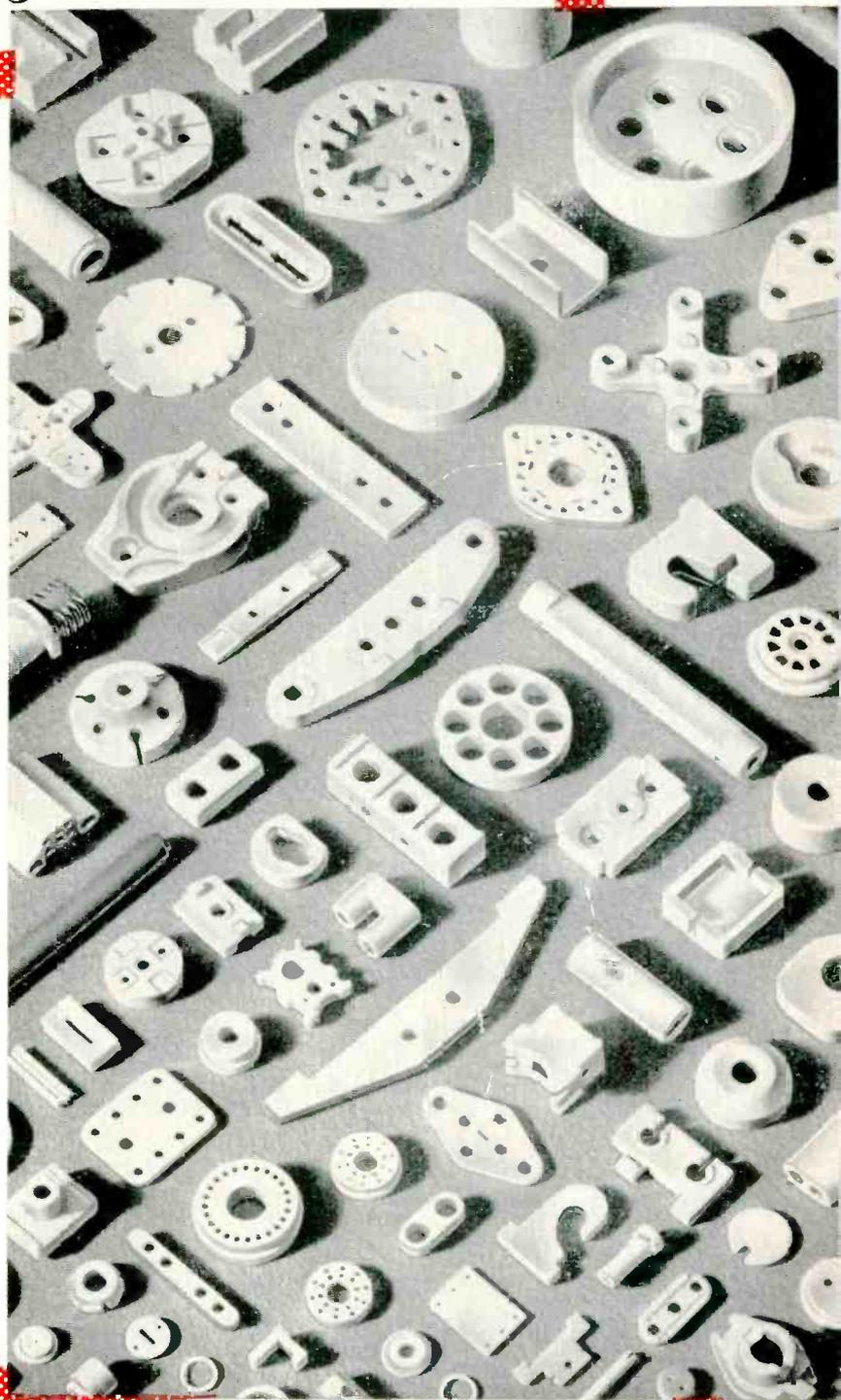


Physical dimensions and tolerances are checked at every key stage of manufacture by thoroughly trained Quality Control inspectors to insure shipment of a superior product.

Four large, completely equipped plants assure you of hundreds—or hundreds of thousands—of AISiMag precision made parts when you want them.



You can confidently specify AISiMag ceramics—backed by over fifty years of specialized experience in the technical ceramics field.

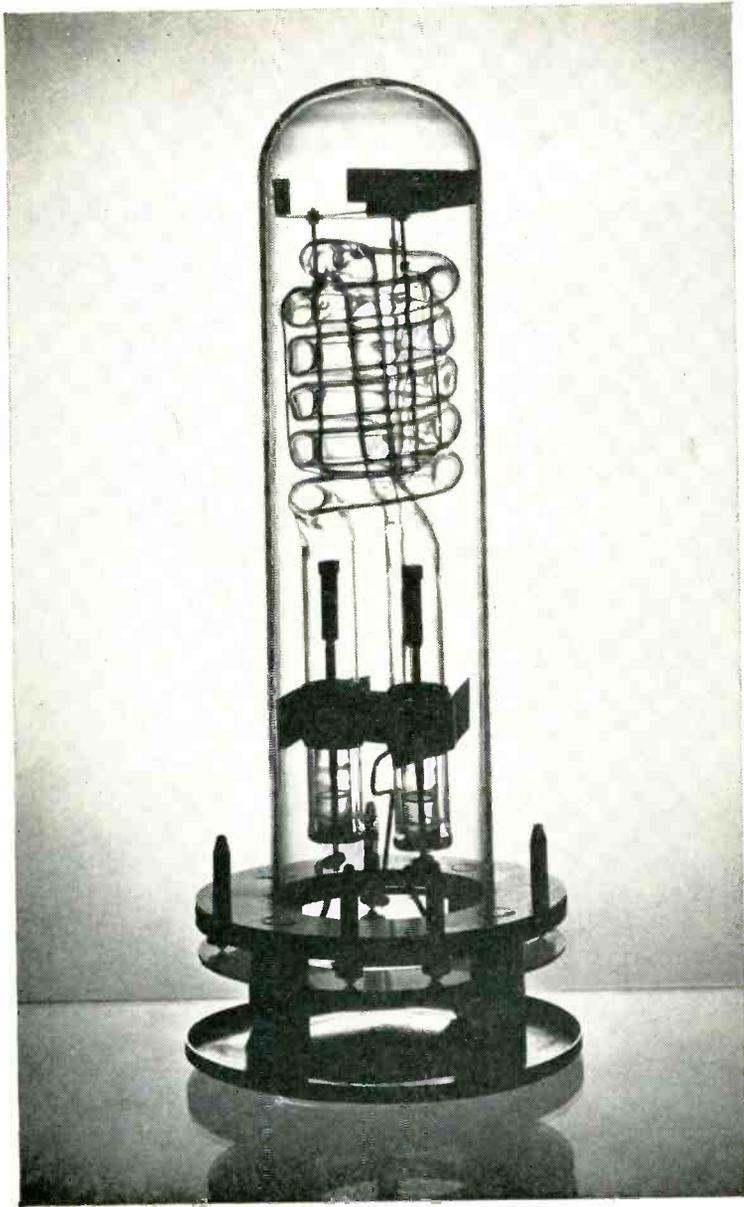


54TH YEAR OF CERAMIC LEADERSHIP

AMERICAN LAVA CORPORATION

A SUBSIDIARY OF MINNESOTA MINING AND MANUFACTURING COMPANY
CHATTANOOGA 5, TENNESSEE

Branch offices in these cities (see your local telephone directory): Cambridge, Mass. • Los Angeles, Calif. • Newark, N. J. • Philadelphia-Pittsburgh, Pa. • St. Louis, Mo. • Chicago, Ill. • Cleveland, Ohio • Dallas-Houston, Texas • Indianapolis, Ind. • South San Francisco, Calif. • Syracuse, N. Y. • Tulsa, Okla. Canada: Irvington Varnish & Insulator Div., Minnesota Mining & Mfg. of Canada, Ltd., P. O. Box 757, London, Ontario. All other export: Minnesota Mining & Mfg. Co., International Division, 99 Park Avenue, New York, N. Y.



*More
Electronics
Manufacturers
choose*

AMERICAN AIRLINES AIRFREIGHT

To be certain vital component parts arrive on time, more and more electronics manufacturers are now relying on American Airlines Airfreight. With fast and frequent flights to all 23 leading industrial states, American is better able to provide rapid, direct one-carrier service and dependable on-time deliveries *than any other airline.*

If you would like to see how American's speed and service can benefit your business, wire collect to: American Airlines, Inc., Cargo Sales Division, 100 Park Avenue, New York 17, New York.

*to get
missing parts
on time*

announcing

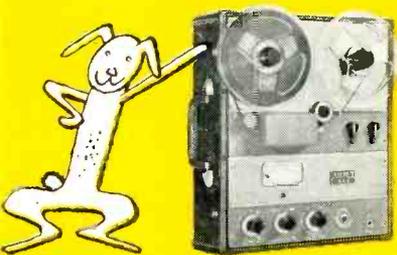
the new Ampex 610 and 612

the best now begins
at \$344...and with this
new price comes a smart idea
on complete tape equipment for
the broadcast or recording studio

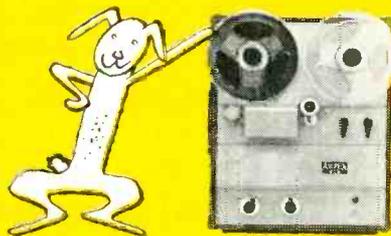


Both have all the extraordinary quality and reliability of the Ampex 600 Tape Recorder. They cost less because they are reproducers only. They eliminate chance for accidental erasure—hence are ideal for editing, copying, program auditioning, sales demonstrations and broadcast playback. The Ampex 610 plays half-track and full-track tapes. The 612 plays these and two-track stereophonic as well.

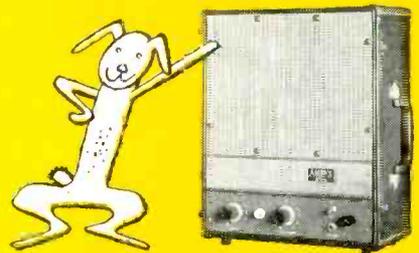
NOW YOU CAN BUY THIS matching family of three
FOR THE PRICE OF THE PROFESSIONAL CONSOLE RECORDER



AMPEX 600 — The tape recorder that combines ultra fidelity, timing accuracy, reliability and portability. It has successfully brought the Ampex Standard of Excellence within reach of every broadcast station. Prices are \$498 chassis for rack mounting or \$545 in portable case.



AMPEX 610 or 612 — The new tape reproducers that have identical characteristics to the Ampex 600. Prices of the 610 (half-track and full-track) are \$344 chassis only and \$359.50 in portable case or contemporary furniture cabinet. Prices of the 612 (half-track, full-track, and two-track stereophonic) are \$379.50 and \$395 respectively in same mountings as above.



AMPEX 620 — A companion amplifier-speaker for either 600, 610 or 612 that matches them in portability, appearance and quality. It provides compelling "live sound" demonstrations for selling station programs or spots (and also can be a sensitive station monitor). Prices are \$149.50 in portable case or \$169.50 in contemporary furniture cabinet.

For full specifications, write Dept. E-2294

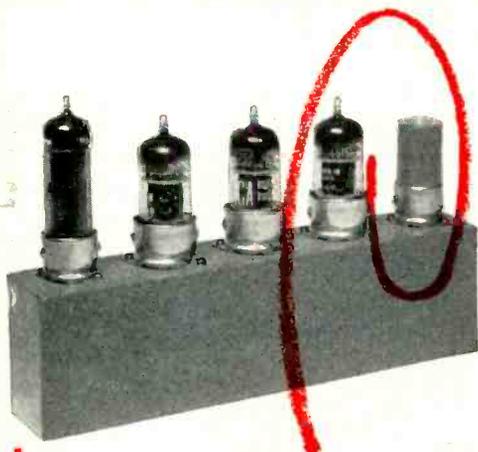
AMPEX
CORPORATION

SIGNATURE OF PERFECTION IN SOUND

934 CHARTER STREET • REDWOOD CITY, CALIFORNIA

Distribution in principal U.S. cities (listed in your classified directory under "Recording Equipment"); distributed in Canada by Canadian General Electric Company.

IS YOUR PROBLEM TO SAVE SPACE?



400-CPS AIRPAX CHOPPER PLUGS
INTO 7-PIN MINIATURE SOCKET
IN THIS COMPACT D-C AMPLIFIER

This miniature 400-cps chopper stands about $1\frac{3}{8}$ inches above the chassis, is about $\frac{3}{4}$ inch in diameter, and can be locked in place in a standard 7-pin tube socket with a tube shield.

Coil excitation of 20 milliamperes is readily obtained from 6.3-volt heater transformer.

Contacts of this single-pole double-throw continuously operating switch are rated for 1 milliamperes at 100 volts maximum. On tests at no current—most severe operating condition for life test—units have operated within design limits for well over the rated 2,000-hours life.

Contact noise across 1 megohm has a peak amplitude of about 1.5 millivolts, an average value of 200 microvolts.

Designated as Airpax Type 300, this chopper provides reliable operation in unusually small space. Consider saving space by using this Airpax Type 300 chopper in your miniature equipment.

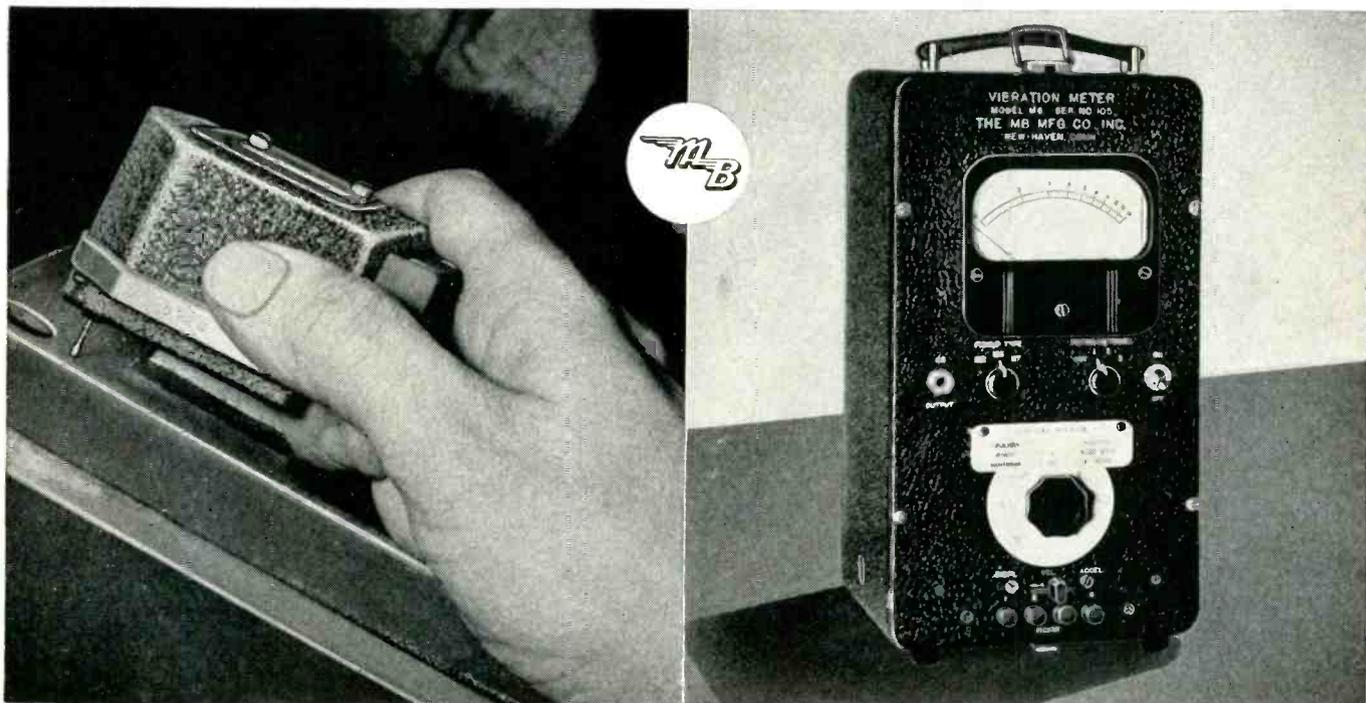
For complete specifications write to



MIDDLE RIVER

BALTIMORE 20, MD.

Two new "tools" to help you pin point vibration



MB Probe-type Pickup and Portable Meter *simplify reliable vibration detection and measurement*

Here's the pickup that really searches out vibration. It combines the extreme sensitivity of electromagnetic operation with the wide usefulness of a hand-held probing instrument.

With this new MB Type 115 Pickup, you can explore large panels . . . bearings, housing, structural members, bodies large and small. Since the light probe adds negligible loading or weight to the vibrating object, it translates any vibration into voltage with great accuracy for measurement. It lets you pin-point the trouble . . . determine quickly any need for corrective design.

The improved Model M6 MB Vibration Meter teams up with the pickup to give you the facts on vibration. With it, you measure the voltage generated in the pickup directly . . . in useful terms of amplitude, velocity, or acceleration of the vibratory motions.

You can connect as many as four MB Pickups to this meter . . . a selector switch enabling you to read any one at a time. The meter is portable, compact, ruggedized and operates on standard AC.

To lick vibration, you've got to locate it first. You'll find this pair a big help for that job. Write for more data.

the **MB** manufacturing company, inc.
1060 State Street, New Haven 11, Conn.

HEADQUARTERS FOR PRODUCTS TO ISOLATE VIBRATION...TO EXCITE IT...TO MEASURE IT

These hands can mold the future of your product . . .



U. S. Rubber engineers achieve new standards in precision moldings and extrusions

Here are the facts about "U. S." molded rubber as a basic material:

- 1) Molded rubber, in the hands of "U. S." engineers, is molded to tolerances never before obtainable.
- 2) "U. S." molds compounds to meet extreme flexing requirements.
- 3) "U. S." molds rubber that has achieved new standards in resistance to oil, water, cold, heat.
- 4) "U. S." compounds from natural and synthetic polymers.

The makers of general appliances, air conditioning, farm equipment, petroleum equipment, transportation equipment, plumbing fixtures, textile machinery, products for public utilities, chemicals and pharmaceuticals—to name just a few—are using "U. S." molded rubber to increase the performance efficiency and saleability of their products. They have obtained advantages no other material can provide.

Learn more about what United States Rubber Company can do with molded rubber for your products. Get in touch with United States Rubber Company's Molding and Extrusions Department through address below.



"U. S." Research perfects it... "U. S." Production builds it... U. S. Industry depends on it.

UNITED STATES RUBBER COMPANY
MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes
Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

Save!

with
**Magnetic Focusing
of Picture Tubes**

**... a typical
STACKPOLE
Ceramagnet use**



Stackpole Ceramagnet rings used as the "heart" of magnetic picture tube focusing units in television sets, spell these advantages:

- Lower material costs by comparison with electrostatic focusing. (Material savings alone run from 50c to \$1 in actual instances.)
- Faster, easier, more accurate factory focusing of sets.
- Lower incoming inspection costs because of consistently high quality of magnetic tubes.
- Superior, stable focusing over entire face of large tubes.
- Magnetic focusing readily adapted to use of increased second anode voltages. Less affected by voltage changes.
- Longer tube life.
- Easy service adjustment when tube replacement becomes necessary.

Photo shows unique magnetic focusing unit made by Glaser-Steers Corporation, Belleville, N. J. It uses a single Stackpole Ceramagnet ring 3 1/8" in diameter x 1/2" thick.

new star of the magnetic firmament !



STACKPOLE

Ceramagnet®

CERAMIC MAGNETS

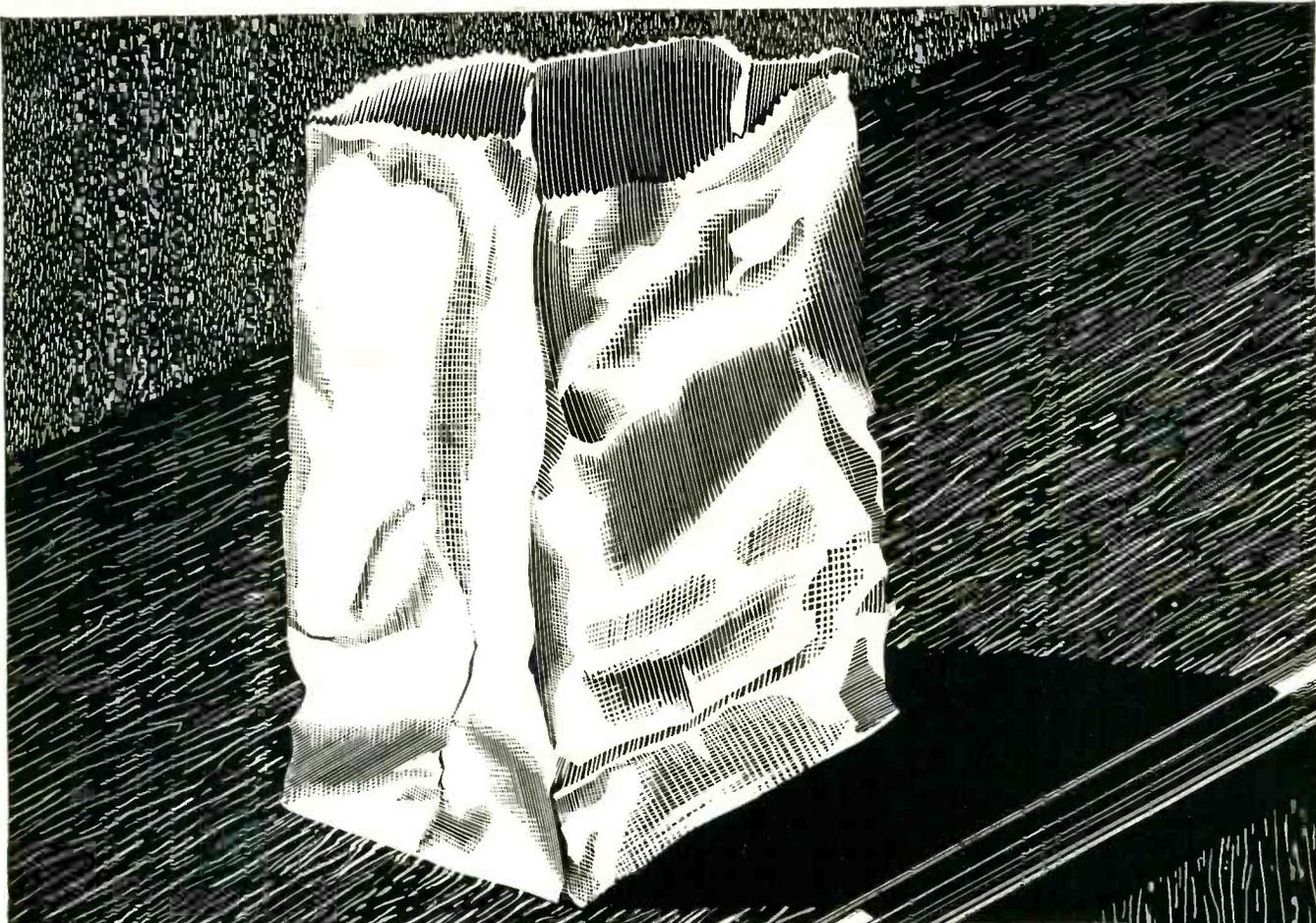
Ceramagnet, the unique new Stackpole ceramic magnet, material excels in high resistance, repelling, aging and other essential characteristics. Its cost—well below that of conventional magnetic materials—opens important new engineering horizons wherever positive, highly permanent attracting, repelling or even "cushioning" might be utilized.

Ceramagnet units can be supplied in almost any desired shapes or sizes. Send details of your application for recommendation and samples.

Electronics Components Division

STACKPOLE CARBON COMPANY

St. Marys, Pa.



...and a pound of precision, please

Those who shop for precision in mixer crystal testing, look for accurate measurement of these characteristics: Relative Noise Figure . . . Relative Sensitivity . . . Crystal Pair Matching . . . Conversion Loss . . . Noise Temperature.

ALL's Type 390A-3 Microwave Crystal Test Set achieves this at the highest standard of operating efficiency. But more important, all this precision comes delivered in a one-pound package, RFU* Field or Laboratory. Priced at \$97.00, the unit has been repeatedly selected by those who recognize in all ALL products the individuality of advanced design, which receives universal acceptance.

Literature available on request.

*Ready For Use



**AIRBORNE
INSTRUMENTS
LABORATORY**

I N C.

160 OLD COUNTRY ROAD, MINEOLA, L. I., N. Y.



Bomac

125 MW

REFLEX KLYSTRON



BL-800/6780 FOR X-BAND APPLICATIONS

A new and important addition to Bomac's line of microwave products is the BL-800 6780 Reflex Klystron.

Rugged and reliable the BL-800 6780 klystron offers improved local oscillator performance and dependability for X-band radar systems.

Unexcelled high altitude operation, without pressurization and ease of installation without disrupting associated components or plumbing is now possible.

Controlled manufacturing procedures and rigid testing standards assure the user electrical uniformity and mechanical stability.

FEATURES

1. Light-weight, rugged construction
2. Low microphonics
3. Rapid warm up
4. Lock-nut tuning
5. Viking connector for convenient installation

GENERAL CHARACTERISTICS

Frequency Range	8.5 to 10.0 kmc
Heater Voltage	6.3 v
Heater Current	1.2 amps

MAXIMUM RATINGS

Resonator Voltage	350 v
Resonator Current	42 ma
Reflector Voltage	0 to -1000 v

MECHANICAL CHARACTERISTICS

Output Connection	Bolts to UG-39/U flange or UG-40A/U choke for 1 x 1/2 x 0.050 inch waveguide
Base	Molded flexible leads. 7 inch leads terminated in Viking Connector (VP5, 2AA1 plug — VS7/23C1 hood)
Cooling	Convection
Tuner	Lock-nut

We invite your inquiries regarding

- ENGINEERING
- DEVELOPMENT
- PRODUCTION

Bomac Laboratories, Inc.

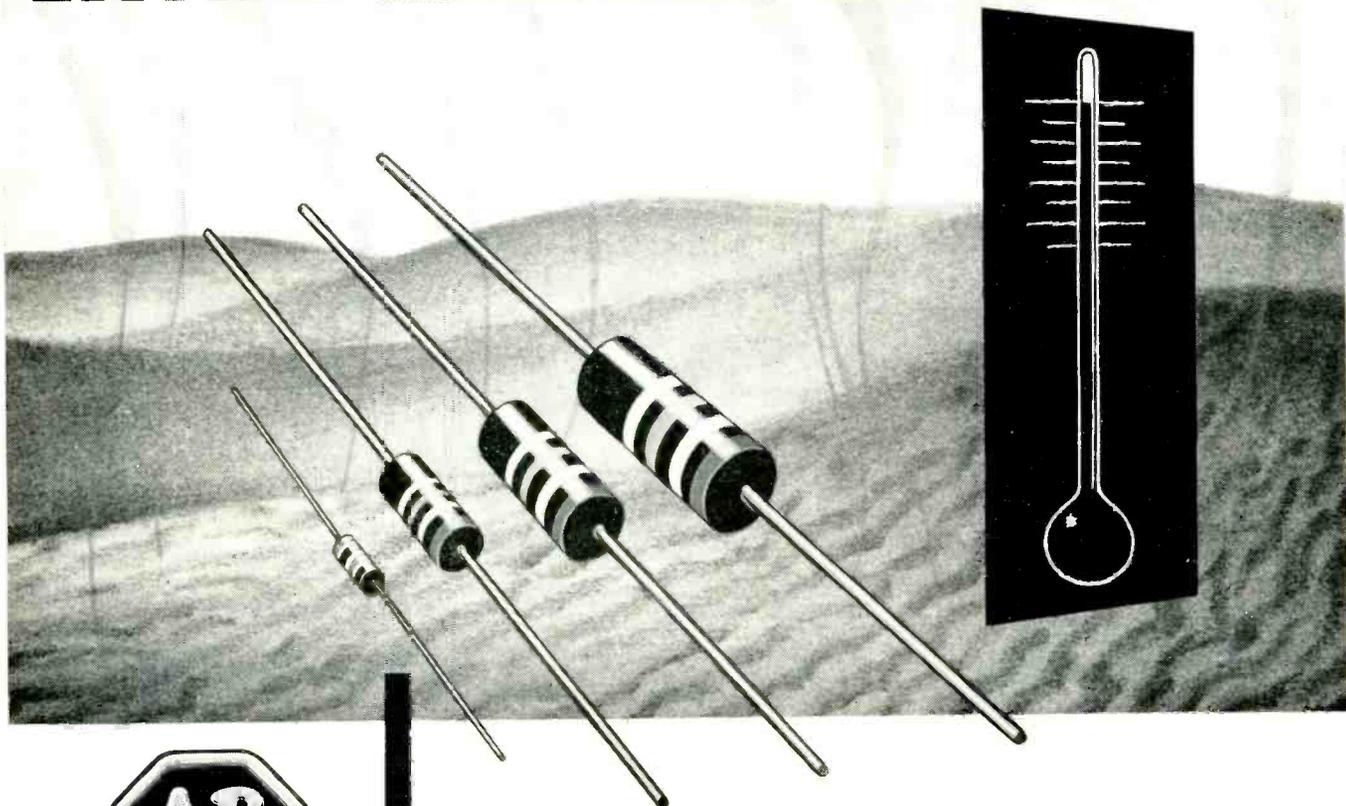
BEVERLY, MASSACHUSETTS

GAS SWITCHING TUBES · TR, ATR and Pre-TR · DUAL TR and ATR TUBES · SILICON DIODES · WAVEGUIDE SWITCHES
REFERENCE CAVITIES · MAGNETRONS · PRESSURIZING WINDOWS · SHUTTER TUBES · HYDROGEN THYRATRONS
REFLEX KLYSTRONS · TRAVELING WAVE AMPLIFIER TUBES · SYSTEMS

Catalog on request.
Write (on your company letterhead) Dept. E-9
BOMAC Laboratories,
Inc. Beverly, Mass., or
phone Beverly 6000.

for that

EXTRA MARGIN OF SAFETY

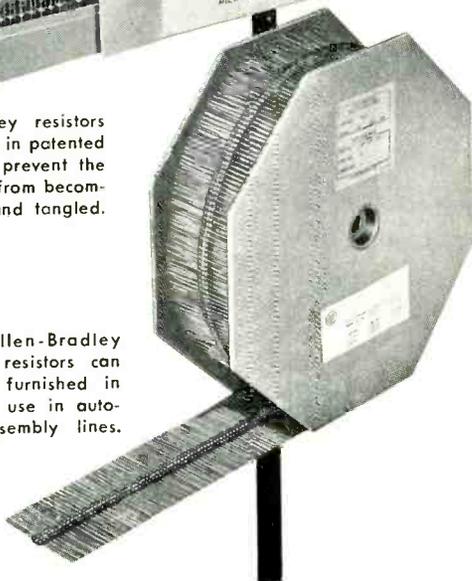


RATED AT 70C AMBIENT... NOT 40C



Allen-Bradley resistors are packed in patented cartons to prevent the lead wires from becoming bent and tangled.

These Allen-Bradley molded resistors can also be furnished in reels for use in automatic assembly lines.



Allen-Bradley molded composition fixed resistors are so widely recognized for their quality because they can withstand extremes of temperature, pressure, and humidity without deterioration. They are rated to operate continuously at 70C ambient temperature . . . not 40C, as are other resistors.

These reliable, uniform resistors are solid molded. They require no impregnation to pass salt-water immersion tests. For an application where the resistor *must not fail*, use Allen-Bradley. Of course, they are also "the best" for all uses and—they cost no more than ordinary resistors.

Allen-Bradley resistors are made in standard RETMA values, in 1/10, 1/2, 1, and 2-watt ratings from 10 ohms to 22 megohms. Write Allen-Bradley Co., 110 W. Greenfield Ave., Milwaukee 4, Wis. In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY

FIXED & ADJUSTABLE RADIO RESISTORS



ELECTRICAL



*what do you
want to measure?*



MECHANICAL



NUCLEAR



LIGHT



SOUND



HEAT



IN THE CENTER OF VIRTUALLY ALL MEASUREMENTS . . .

BRUSH INSTRUMENTATION

helps you obtain necessary data quickly, easily, in permanent chart form. Designed to simplify analysis.

When you get the facts with Brush Instrumentation you increase your engineering efficiency. Ask your Brush representative for complete information.

BRUSH ELECTRONICS COMPANY

DIVISION OF
CLEVITE CORPORATION



INDUSTRIAL AND RESEARCH INSTRUMENTS
PIEZOELECTRIC MATERIALS • ACOUSTIC DEVICES
MAGNETIC RECORDING EQUIPMENT AND COMPONENTS

**BRUSH RECORDING SYSTEMS OFFER
16 RECORDING SPEEDS, EASE OF
USE, INTERCHANGEABILITY**

GET THE FACTS and put them in writing with Brush recording systems—designed to give you the greatest flexibility in measurements. Your recorded data will be accurate, legible and permanent. You have a choice of 8 or 16 chart speeds—from 10 inches a day to 10 inches a second—in all systems from a single through multi-channel. An electrically controlled chart drive transmission permits instantaneous switching and remote control.

With the Brush coordinated designs, you can solve many measurement problems with one system.



**CONSOLE OR
RACK MOUNTED**

Single, dual, 4 and 6 channel oscillographs and amplifiers all fit standard 19-inch racks; may be obtained with individual covers for portable use.



PORTABLE

Brush portable instruments are designed for rugged service, have the same outstanding features as rack mounting units.



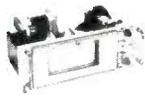
OSCILLOGRAPHS



4 channel



6 channel



1 and 2 channel

AMPLIFIERS



D. C. amplifier



Universal* amplifier

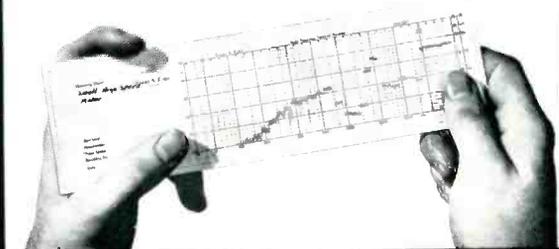


High gain D. C. amplifier

SOUND MEASUREMENT



Brush offers an integrated line of precision equipment for measuring and recording sound, noise, vibration. Typical is the Third-Octave Spectrum Recorder, a self-contained system for simultaneous analysis and recording of vibration and noise.



DIGITAL COUNTING

The Brush Countess* is the lowest-cost high-quality digital counter available, operates on one-fourth the power required by conventional counters.

For complete information or bulletins on Brush equipment write: Brush Electronics Company, Dept. 999, 3405 Perkins Avenue, Cleveland 14, Ohio.

*Trade Mark

BRUSH ELECTRONICS

INDUSTRIAL AND RESEARCH INSTRUMENTS
PIEZOELECTRIC MATERIALS • ACOUSTIC DEVICES
MAGNETIC RECORDING EQUIPMENT AND COMPONENTS



COMPANY

Division of
Clevite Corporation

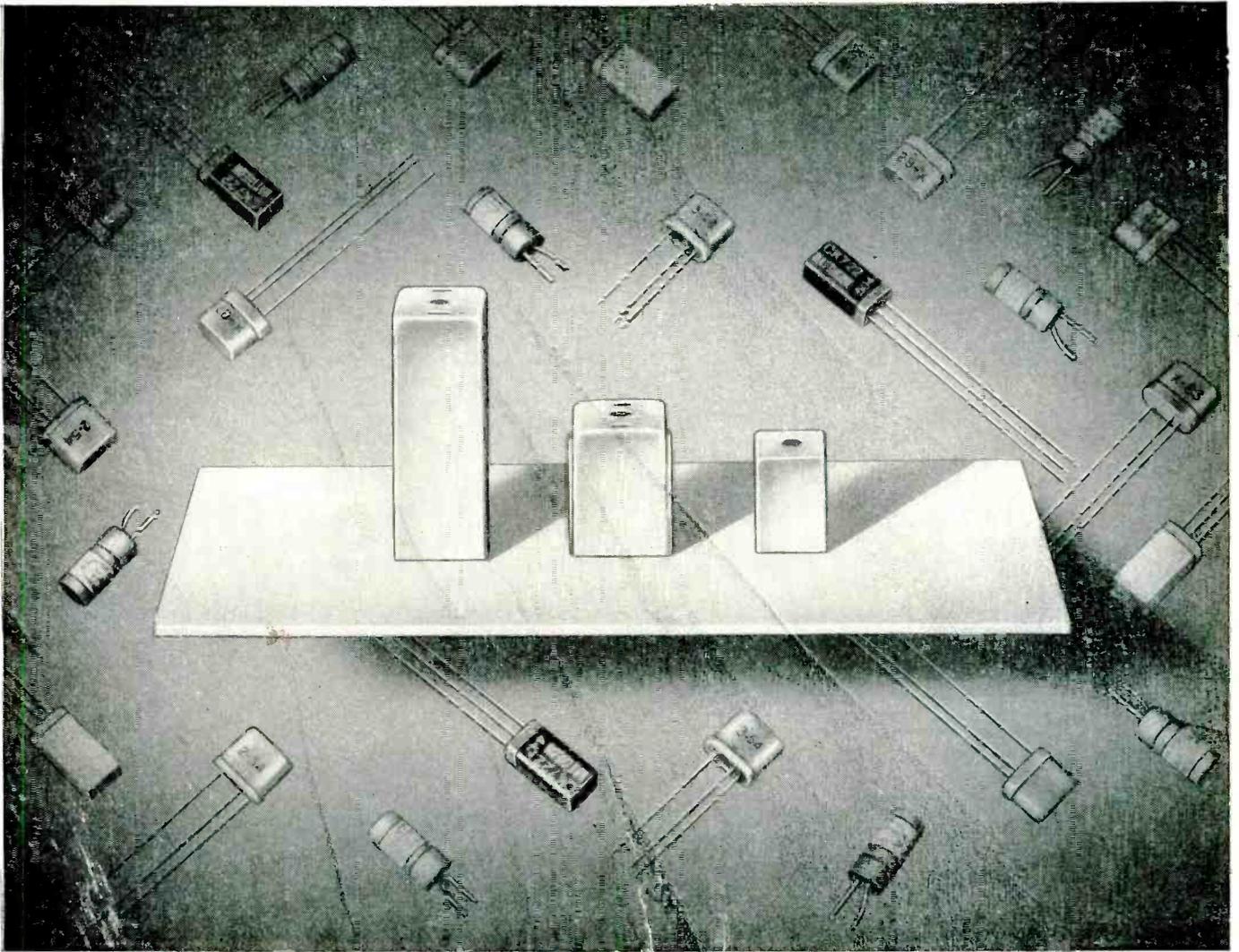


Photo actual size

AUTOMATIC makes the only complete line of standardized TRANSISTOR I.F.'s...K-TRANS

You can order *all* your Transistor I.F.'s from a single source—Automatic Manufacturing Corp. This will save you time and money and give you I.F.'s with the exclusive K-Tran features: *positive threading and controlled torque*. In any electronic miniaturization program, the small physical dimensions, combined with the highest electrical performance of the Transistor K-Trans, give you tremendous advantages.

We make three styles of Transistor K-Trans. Each style has capacity built into the base, and is available in frequencies from 262 KC up through standard frequencies.

From left to right these are the three styles:

STYLE 10. Permits double ended tuning. ($1\frac{1}{32} \times \frac{3}{64} \times \frac{3}{64}$)

STYLE 12. Permits single ended tuning. ($\frac{5}{64} \times \frac{3}{64} \times \frac{3}{64}$)

STYLE 15. Specific for severe space limitations. Permits single ended tuning. ($\frac{3}{64} \times \frac{1}{32} \times \frac{1}{32}$)

Standard size K-Trans ($1\frac{29}{32} \times \frac{3}{4} \times \frac{3}{4}$) are also available for transistor applications. Since the several types of the K-Tran* I.F. Transformer are all assembled from the same components,

they are immediately available for orders of any size.

★ ★ ★

For full engineering information on transistor and other type K-Trans, ask for your copy of the 45-page K-Tran Manual. It will help you design better transistor circuits.

AUTOMATIC MANUFACTURING CORPORATION
Subsidiary General Instrument Corporation

*Every part Automatic uses
... Automatic makes.*

**MASS PRODUCERS OF
ELECTRONIC COMPONENTS**

65 GOUVERNEUR ST.,
NEWARK 4, N. J.

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

FOR YOUR AUTOMATION PROGRAM

VARIABLE RESISTORS FOR PRINTED CIRCUITS

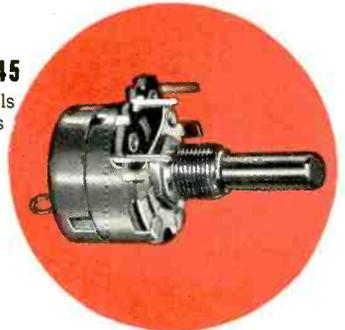


Type UPM-45

For TV preset control applications. Control mounts directly on printed circuit panel with no shaft extension through panel. Recessed screwdriver slot in front of control and 3/8" knurled shaft extension out back of control for finger adjustment. Terminals extend perpendicularly 7/32" from control's mounting surface.

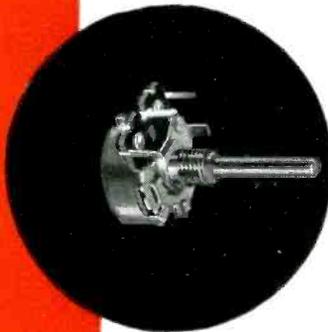
Type GC-U45

Threaded bushing mounting. Terminals extend perpendicularly 7/32" from control's mounting surface. Available with or without associated switches.



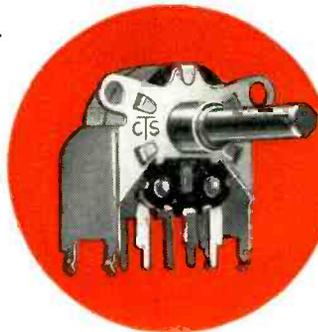
Type U70 (Miniaturized)

Threaded bushing mounting. Terminals extend perpendicularly 5/32" from control's mounting surface.



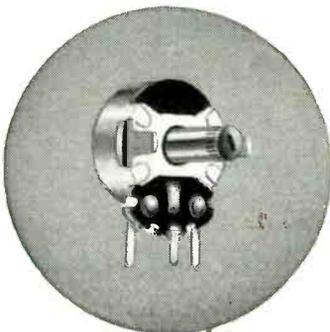
Type YGC-B45

Self-supporting snap-in bracket mounted control. Shaft center spaced 29/32" above printed circuit panel. Terminals extend 1-1/32" from control center.



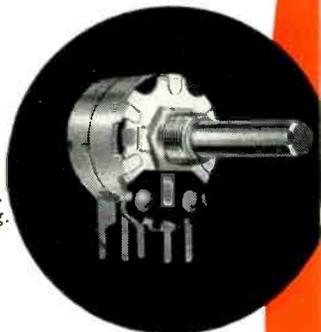
Type XP-45

For TV preset control applications. Control mounts on chassis or supporting bracket by twisting two ears. Available in numerous shaft lengths and types.

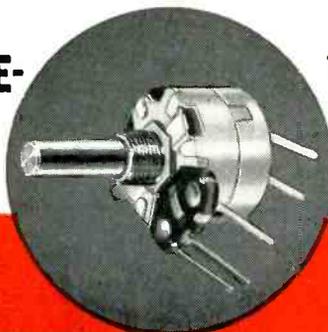


Type XGC-45

For applications using a mounting chassis to support printed circuit panel. Threaded bushing mounting.



VARIABLE RESISTORS FOR SOLDERLESS "WIRE-WRAP" CONNECTIONS



Type WGC-45

Designed for solderless wire-wrapped connections with the use of present wire-wrapping tools. Available with or without switch and in single or dual construction.

The controls illustrated are typical constructions. CTS' years of engineering and technical experience makes available many other types for your automation needs.



CHICAGO TELEPHONE SUPPLY
Corporation

ELKHART • INDIANA
FOUNDED 1894

EAST COAST OFFICE
Henry E. Sanders
130 North Broadway
Camden 2, New Jersey
Phone: Woodlawn 6-1668
TWX No. Camden NJ 380
Phila. Phone: Market 7-3129

WEST COAST OFFICE
Robert A. Stackhouse
928 S. Robertson Blvd.,
Los Angeles 35, Calif.
Phone: Crestview 4-5931
TWX No. BEV H 7666

SOUTHWESTERN U.S.A.
John A. Green Company
6815 Oriole Drive
P.O. Box 7224
Dallas 9, Texas
Phone: Dixon 9918

CANADIAN DIVISION
C. C. Meredith & Co., Ltd.
Streetsville, Ontario
Phone: 310

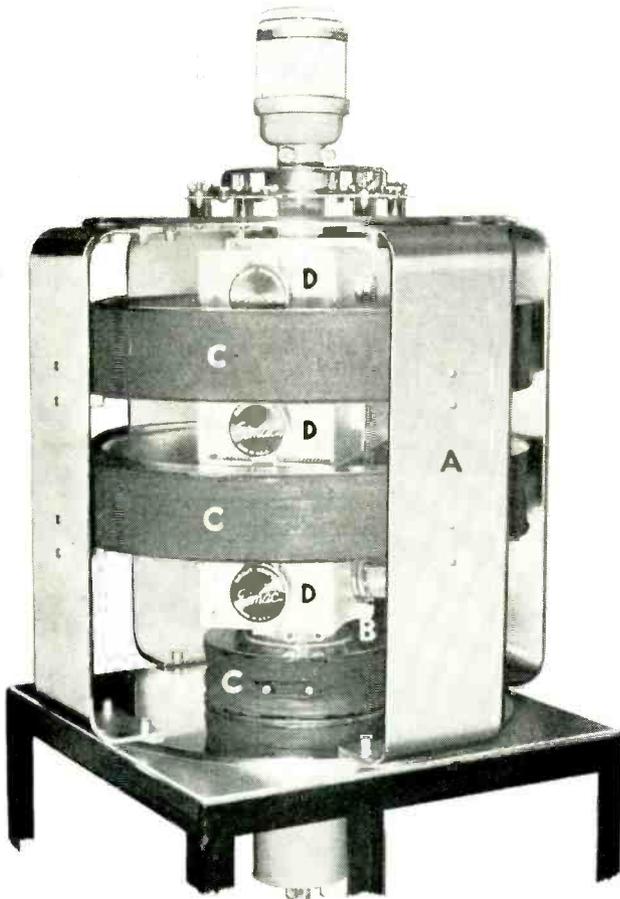
SOUTH AMERICA
Jose Luis Pontet
Buenos Aires, Argentina
Montevideo, Uruguay
Rio de Janeiro, Brazil
Sao Paulo, Brazil

OTHER EXPORT
Sylvan Ginsbury
8 West 40th Street
New York 18, New York
Phone: Pennsylvania 6-8239

The Exclusive Specialists in Precision Mass Production of Variable Resistors

Eimac Amplifier Klystrons and Circuit Components

—the easy, economical approach to high power,
UHF/microwave transmitters



Design and construction of a high power UHF/microwave transmitter for beyond-the-horizon communication and other microwave applications is simple and straight-forward with an Eimac amplifier klystron and circuit components. In fact, it's easier to build than a low frequency Class C amplifier. Eimac high power amplifier klystrons, plus Eimac circuit components consisting of A) Magnetic framework B) RF output load coupler C) Magnetic beam-control coils and D) Convenient tuning wide range RF resonant cavities comprise the essential elements of a final amplifier package. By adding conventional power supplies, control circuits, driver and cabinets to the Eimac klystron-circuit component package, high power at UHF is easily obtained. Eimac developed klystron and circuit components provide equipment manufacturers with the easy economical approach to high power microwave transmitters. In many cases, existing low power equipment can be used as a driver for the higher powered amplifier.

Radio Frequency circuitry is completed outside the vacuum system of Eimac klystrons through circuit components. This allows unmatched economy by eliminating repurchase of costly RF circuitry with each tube replacement.

The reliability and performance of Eimac klystrons is proven, as they were employed extensively in established microwave scatter-type communication systems.

For an easy and economical approach to reliable high power microwave transmitting equipment, investigate the incomparable capabilities of performance-proved Eimac developed klystrons and klystron circuit components.



A
Magnetic frame work



B
Output load coupler



C
Magnetic beam-control coils



D
Resonant cavities

EIMAC AMPLIFIER KLYSTRONS

FREQUENCY RANGE—MC		CW POWER	FREQUENCY RANGE—MC		CW POWER	FREQUENCY RANGE—MC		CW POWER
3K3000LA	400-600	2000w	3K20,000LF	580-720	5000w	3K50,000LF	580-720	10,000w
3K3000LQ	760-980	2000w	3K20,000LK	720-890	5000w	3K50,000LK	720-890	10,000w
3K20,000LA	470-580	5000w	3K50,000LA	470-580	10,000w	3K50,000LQ	850-1000	10,000w
						4K50,000LQ	750-1000	10,000w



For further information write our technical service department.

EITEL-McCULLOUGH, INC.
SAN BRUNO • CALIFORNIA

World's Largest Manufacturer of Transmitting Tubes

for
**HEARING
AIDS**



or
**RECORDING
HEADS**



or ANY MAGNETIC MATERIALS JOB ...

Write for
your Copy

**"MAGNETIC
MATERIALS"**

This 32-page book contains valuable data on all Allegheny Ludlum magnetic materials, silicon steels and special electrical alloys. Illustrated in full color, includes essential information on properties, characteristics, applications, etc. Your copy gladly sent free.

ADDRESS DEPT. E-69

You can rely on core materials like the Allegheny 4750 components illustrated above, in your receivers, recording heads or microphone assemblies.

In fact, whether your equipment is small or large, the extra-broad line of A-L magnetic materials will solve your magnetic core problems. It includes all grades of silicon steel sheets or coil strip, as well as Allegheny Silectron (grain-oriented silicon steel), and a wide selection of high-permea-

bility alloys such as 4750, Mumetal, Permendur, etc.

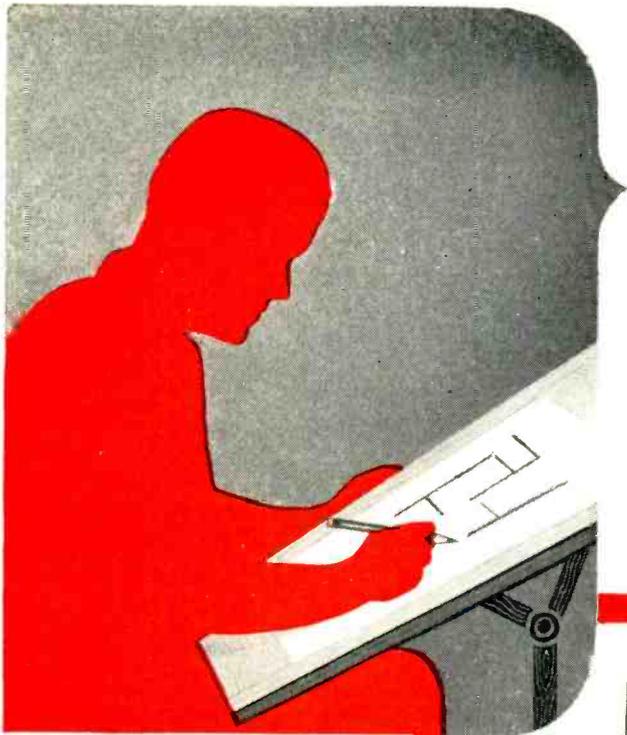
Our service on these materials also includes complete facilities for the fabrication and heat treatment of laminations. (For users of electrical sheets and strip, our lamination know-how is a real bonus value!) Either way, we'll welcome the chance to serve you. *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.*

STEELMAKERS to the Electrical Industry

Allegheny Ludlum

WAD 5335

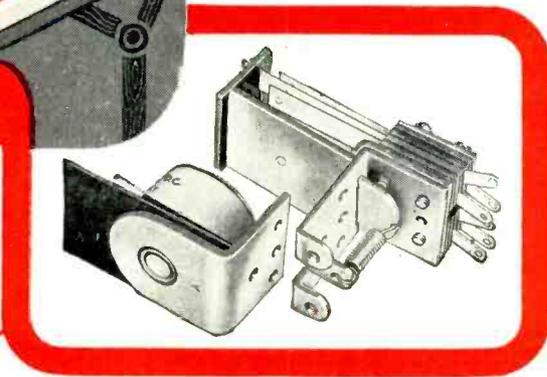




7 contact assemblies and
11 *Interchangeable* coils
 enable you to build a sample
GUARDIAN

SERIES 200 RELAY
 for Development Purposes

Ideal for Testing
 and Experimenting



Available
 at your local
 electronic
 parts
 distributor

Guardian Series
 A. C. 100 D. C.

Guardian Series
 A. C. 600 D. C.

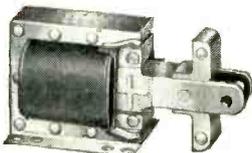


Your distributor can supply Series 200 Relays in quantities up to 100 units. For larger production runs of completely assembled, adjusted and tested relays, we recommend the Guardian Series 100 A.C., Series 105 D.C., Series 600 A.C., or Series 605 D.C., listing the same specifications as used to make up your Series 200 production sample.

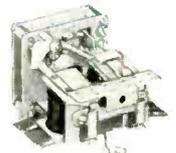
The complete GUARDIAN SERIES 200 RELAY parts assortment includes 7 Contact Assemblies and 11 Coils all of which are completely *interchangeable*. Contact assemblies vary from SPDT to 4PDT standard or midsize with contacts rated at 8 or 12½ amperes. Coils range from 6 v. A.C. to 230 v. A.C. and 6 v. D.C. to 110 v., D.C. plus a 5000 ohm plate coil. All you do is select the rated coil and contact assembly you require, fasten these together with a screwdriver and you have a top quality, correctly rated, *production sample* Guardian Relay. Test it. Examine it thoroughly and critically. Then order your production quantities. Ask your local electronic parts distributor about other Guardian industrial type relays, steppers, solenoids and ratchet relays, or write direct for further details.



NO. 1 SOLENOID



NO. 16 SOLENOID



MS-115 STEPPER

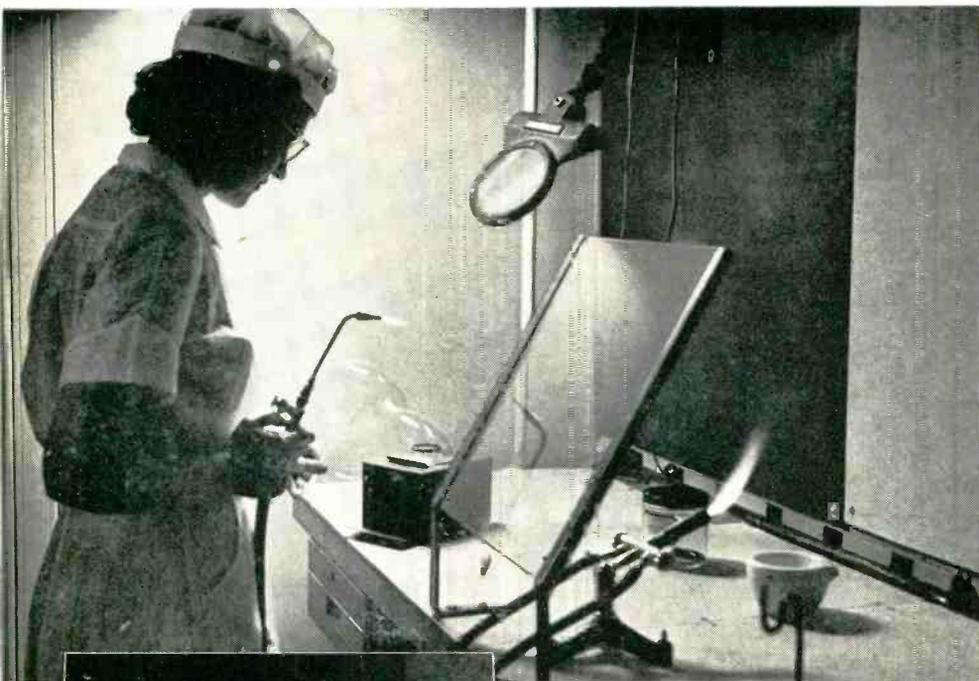


RC-100 RATCHET RELAY

See Your Local Parts Distributor for RELAYS, SOLENOIDS, STEPPERS and RATCHET RELAYS

GUARDIAN  **ELECTRIC**
 1625K W. WALNUT STREET CHICAGO 12, ILLINOIS
 A COMPLETE LINE OF RELAYS SERVING AMERICAN INDUSTRY

NEW HIGH STANDARDS OF CAMERA-TUBE PRODUCTION



Extreme delicacy in processing parts for G-E camera tubes is shown as this glass technician fabricates an image-orthicon target. The glass bubble she holds is only 1/10,000 inch thick. After cutting out a small section, she seals this carefully to a metal ring. Any slip or other false movement would completely ruin the fragile target.



Without aid from magnification, the human eye cannot see the openings (250,000 to a square inch) in this copper mesh for a G-E image orthicon—shown here being welded to its ring. Note the rubber finger cots used by the General Electric worker, to avoid contaminating the silk-fine mesh!



Target and mesh are assembled, then riveted together with a spacing of 1/500 inch, to form a link between optical image and electrical signal. A single dust particle could mar tube performance; so before work starts, these G-E specialists sit quietly for ten minutes, to permit any dust to settle that may remain in the air after filtering and conditioning.



18-inch offset screwdrivers are used to tighten the set-screws holding target and mesh assembly in place in the camera tube. Skill, care, and time are needed to complete the delicate operation. Again, dust and lint are barred. An important step toward cleanliness, is the lint-free Nylon garments worn by all persons in the G-E camera-tube area.

CRAFTSMANSHIP FEATURE BY GENERAL ELECTRIC!

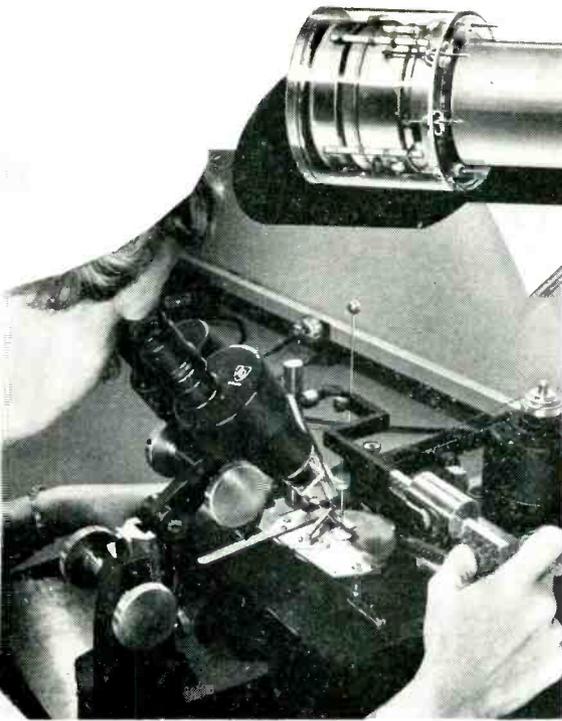
To include image orthicons, vidicons, other commercial and military types.

G.E.'s entry into camera-tube manufacture is a project of major proportions. Extensive facilities and advanced equipment have been acquired; impressive engineering and technical skills have been assembled; workers have been exhaustively trained.

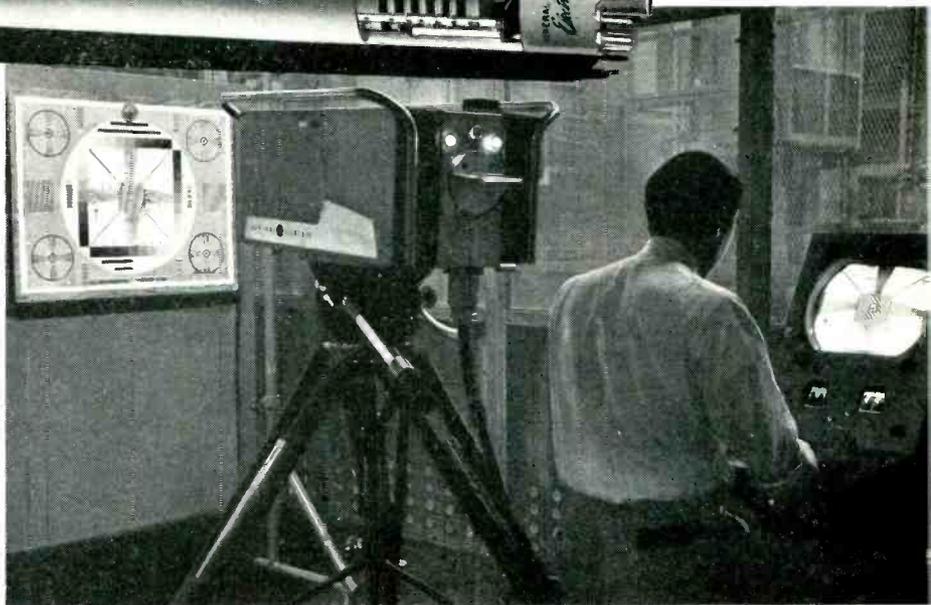
The purpose is high-quality, long-life camera tubes of *all types*—from TV image orthicons, now in full G-E production, to vidicons and other "seeing" tubes for commercial and military uses.

How improved performance is built into G-E camera tubes, these pictures show in part. Every operation described is rivalled by numerous others that call for the same or greater precision.

You are invited to familiarize yourself with G-E camera-tube manufacture, by written request for information. Problems involving camera tubes to meet your special design needs, will be welcomed. *Tube Dept., General Electric Co., Schenectady 5, N. Y.*



Powerful lenses aid trained hands. In building G-E camera tubes, numerous precision operations call for the aid of microscopes. Here a micro-drill operator drills a 1/500-inch hole—less than the diameter of a hair—for the beam-limiting aperture in the first dynode of a G-E image orthicon tube.



Final testing of a G-E image orthicon uses actual performance as the yardstick. Instrumentation supplements the verdict of the inspector's critical eyes. Life tests, under the most unfavorable conditions, also are regularly conducted by General Electric, to increase the service life and improve the performance of all G-E camera tubes . . . Above: a G-E image orthicon—Type GI-5820—ready for the TV camera.

Progress Is Our Most Important Product

GENERAL  ELECTRIC

NEW

additions to

ALLIED

CONTROL'S

MH

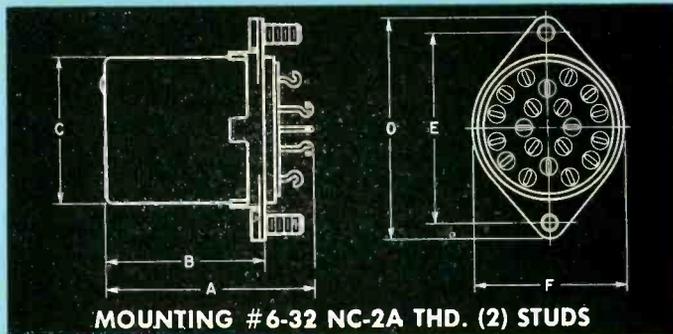
LINE

**THE ALLIED
ORIGINAL
MH SERIES**



Allied Type MHJ • Performance Data

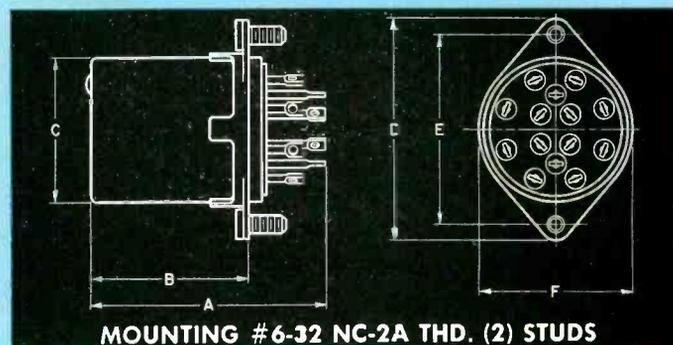
CONTACT RATINGS	Low level up to 2 amperes at 25v d-c or 115v a-c (non-inductive) Max. Contact Drop: 1 millivolt
CONTACT ARRANGEMENT	MHJ-12D: 4 PDT MHJ-18D: 6 PDT
COIL	MHJ-12D 26.5v d-c: 250 ohms resistance MHJ-18D 26.5v d-c: 200 ohms resistance (Other resistances are available.)
TEMPERATURE	Minus 65°C to plus 125°C
VIBRATION	10-55 cps at 0.125 inch double-amplitude 55-2000 cps at 20g
OPERATING SHOCK	100g
ALTITUDE	Sea level to 80,000 feet
WEIGHT	MHJ-12D: 3.0 ounces MHJ-18D: 4.2 ounces
OVERALL DIMENSIONS ..	MHJ-12D: 1-3/4 max. x 1-3/64 diameter MHJ-18D: 1-3/4 max. x 1-3/16 diameter
MILITARY SPECIFICATIONS	Meets tests conditions of MIL-R-5757B, MIL-R-6106A and MIL-R-25018



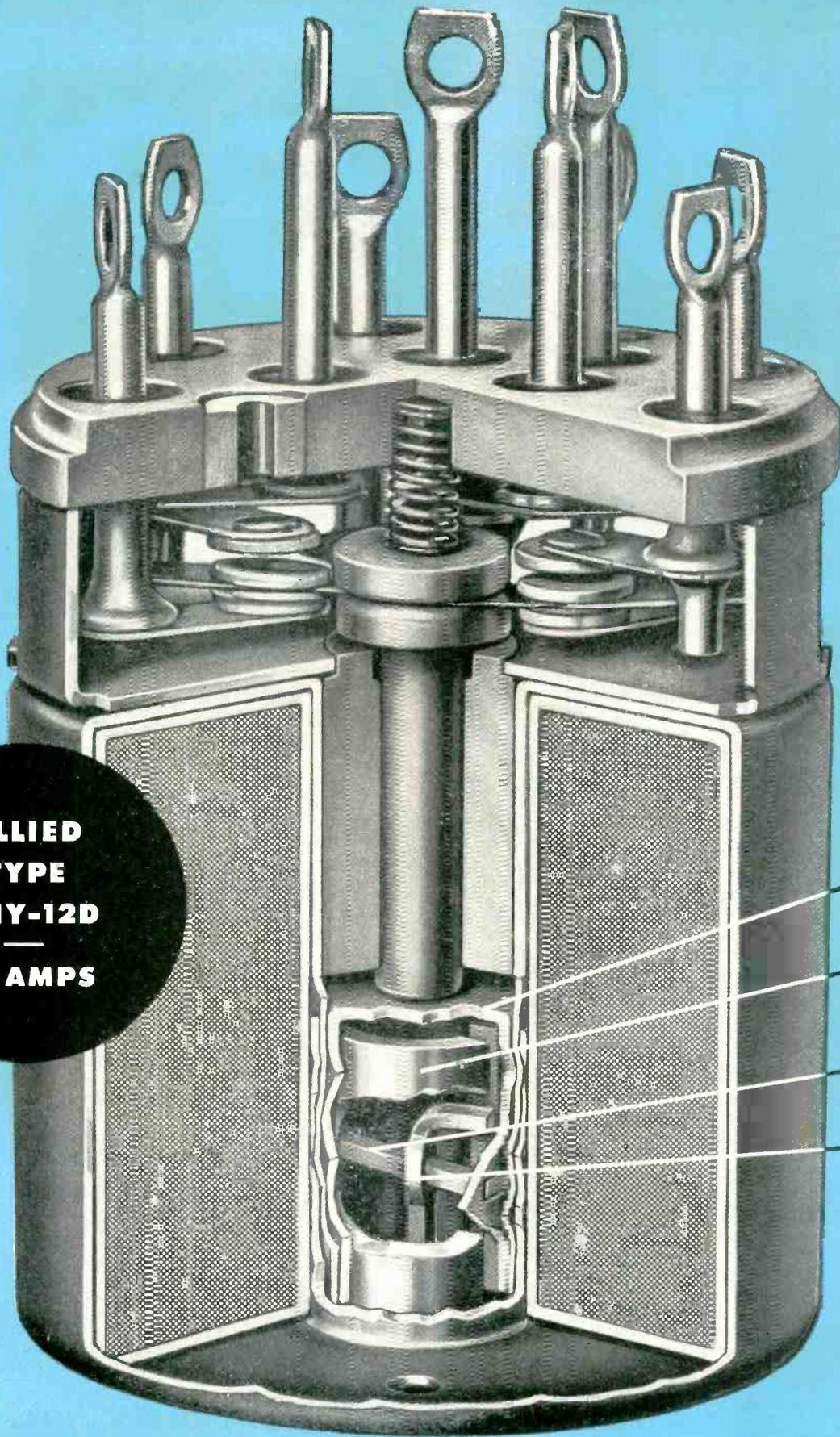
	A	B	C	D	E	F
MHJ-12D	1 3/4 max.	1 1/4	1 3/4	1 1/2	1.406	1 1/8
MHJ-18D	1 3/4 max.	1 1/4	1 3/4	1 1/4	1.562	1 1/4

Allied Type MHY • Performance Data

CONTACT RATINGS	10 amperes at 29v d-c or 115v a-c (non-inductive)
CONTACT ARRANGEMENT	MHY-6D: 2 PDT MHY-12D: 4 PDT
COIL	MHY-6D 26.5v d-c: 250 ohms resistance MHY-12D 26.5v d-c: 200 ohms resistance (Other resistances are available)
TEMPERATURE	Minus 65°C to plus 125°C
VIBRATION	10-55 cps at 0.125 inch double-amplitude 55-2000 cps at 20g
OPERATING SHOCK	100g
ALTITUDE	Sea level to 80,000 feet
WEIGHT	MHY-6D: 3.0 ounces MHY-12D: 4.2 ounces
OVERALL DIMENSIONS ..	MHY-6D: 1-25/32 max. x 1-3/64 diameter MHY-12D: 1-63/64 max. x 1-3/16 diameter
MILITARY SPECIFICATION	Meets tests conditions of MIL-R-5757B, MIL-R-6106A and MIL-R-25018



	A	B	C	D	E	F
MHY-6D	1 25/32 max.	1 1/4	1 3/4	1 1/2	1.406	1 1/8
MHY-12D	1 63/64 max.	1 1/4	1 3/4	1 1/4	1.562	1 1/4



**ALLIED
TYPE
MHY-12D
—
10 AMPS**

ARMATURE

COUNTER-
BALANCE

LINK

PIVOT

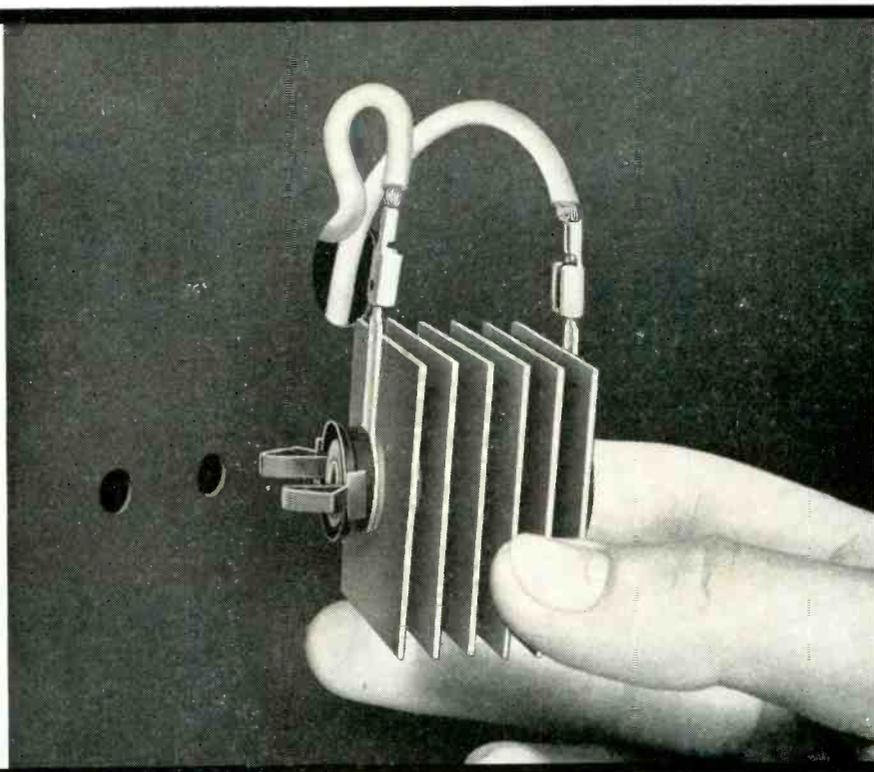


ALLIED CONTROL



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

Radio
Receptor's
NEW
money saving
rectifier
mounting!



"QUI-KLIP" *snap-in type*

SELENIUM RECTIFIERS

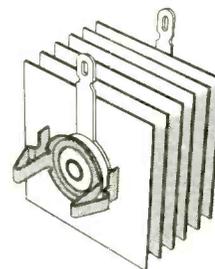
QUICK MOUNTING! QUICK REMOVAL!

Spring steel clips with safe edges snap into two round, large tolerance holes in chassis (approx $\frac{3}{16}$ " dia., $\frac{3}{4}$ " c. to c.). Solderless connectors as shown, when used, simplify servicing

Radio Receptor's unique QUI-KLIP rectifiers will soon make their debut in TV sets produced by one of the country's leading manufacturers, saving them countless dollars in production costs.

QUI-KLIP requires no tools or sockets for mounting. There are no studs to break or threads to strip and the locating tab is now unnecessary. QUI-KLIP provides a positive seat for the rectifier — no rocking. Yet any serviceman can remove the stack quickly by squeezing the QUI-KLIP prongs with his fingers and removing the solderless connectors.

Let us show you how to put the cost saving QUI-KLIP selenium rectifiers to work in *your* production . . . Available in most popular sizes with cells from 1" square to 2" square, for radio, TV and other electronic circuits. For detailed information, write Dept. E-10



- Speeds assembly time.
- Slashes production costs.
- Simplifies assembly.
- Eliminates stud rejects (No studs or nuts needed.)
- Permits easier replacement in the field.



Semiconductor Division

RADIO RECEPTOR COMPANY, INC.

In Radio and Electronics Since 1922

SALES OFFICES: 251 WEST 19TH ST., NEW YORK 11, N. Y., WATKINS 4-3633 • Factories in Brooklyn, N. Y.

SELENIUM RECTIFIERS, THERMATRON DIELECTRIC HEATING GENERATORS AND PRESSES, COMMUNICATION, RADAR AND NAVIGATION EQUIPMENT

REVERE

ROLLED

Printed Circuit Copper



No longer need the lack of material deter you from switching to printed circuitry. Revere *Rolled* Printed Circuit Copper is now available to laminators 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* Printed Circuit Copper is accurate in gauge, of high conductivity, and uniform density. It is easily etched and soldered.

The next time you order blanks from your laminator, specify Revere *Rolled* Printed Circuit Copper.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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

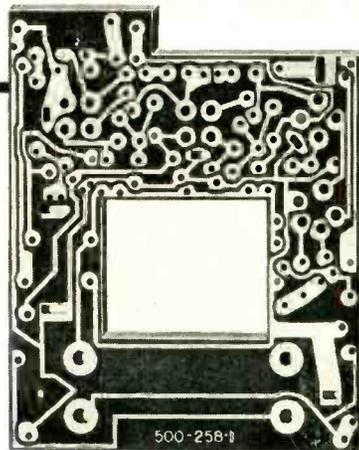
Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

FIRST TRANSISTOR RADIO MADE POSSIBLE

.. by *INSUROK*[®] copper-clad
printed circuits!



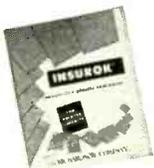
Here's a remarkable example of miniaturization . . . made possible mainly through the use of printed circuits and transistors. This diminutive radio weighs a scant 12 ounces, complete with battery. Yet, it has good tone, is selective, and delivers plenty of volume.



Here's the printed-circuit board used in the Regency . . . made with Richardson T-725 copper-clad INSUROK. Engineers of I.D.E.A., Inc. of which Regency is a division, laid out the circuit. Croname, Inc.* Chicago, took it from there . . . printed the complex circuit on Richardson T-725 copper-clad INSUROK, then etched it. Results: a lightweight, compact, efficient circuit . . . tedious, time-consuming wiring eliminated . . . faster assembly.

Many grades of Richardson laminate INSUROK are available copper-clad on one or both surfaces. We invite your inquiry.

**Here's what Croname has to say about T-725 copper-clad INSUROK, "Quality is superior . . . service good. And Richardson gives us helpful engineering assistance."*



Ask for descriptive bulletin,
"INSUROK Copper-Clad Laminates."

RICHARDSON
*Laminated and
Molded Plastics*

The **RICHARDSON COMPANY**

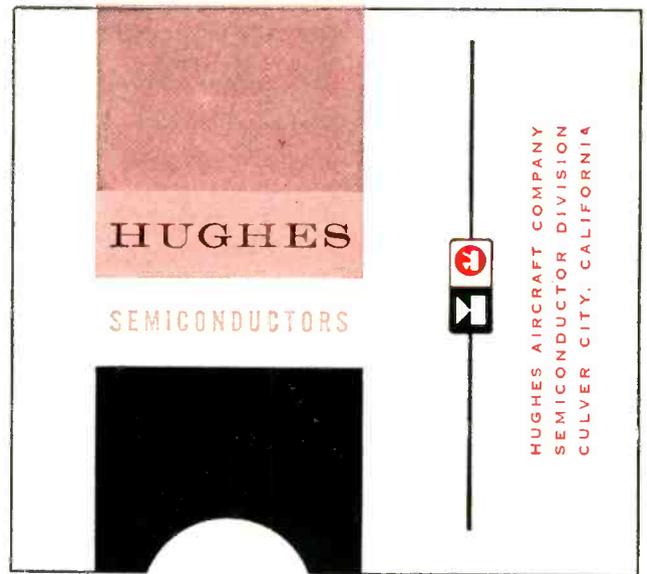
FOUNDED 1858

2797 Lake St., Melrose Park, Ill. (Chicago District)

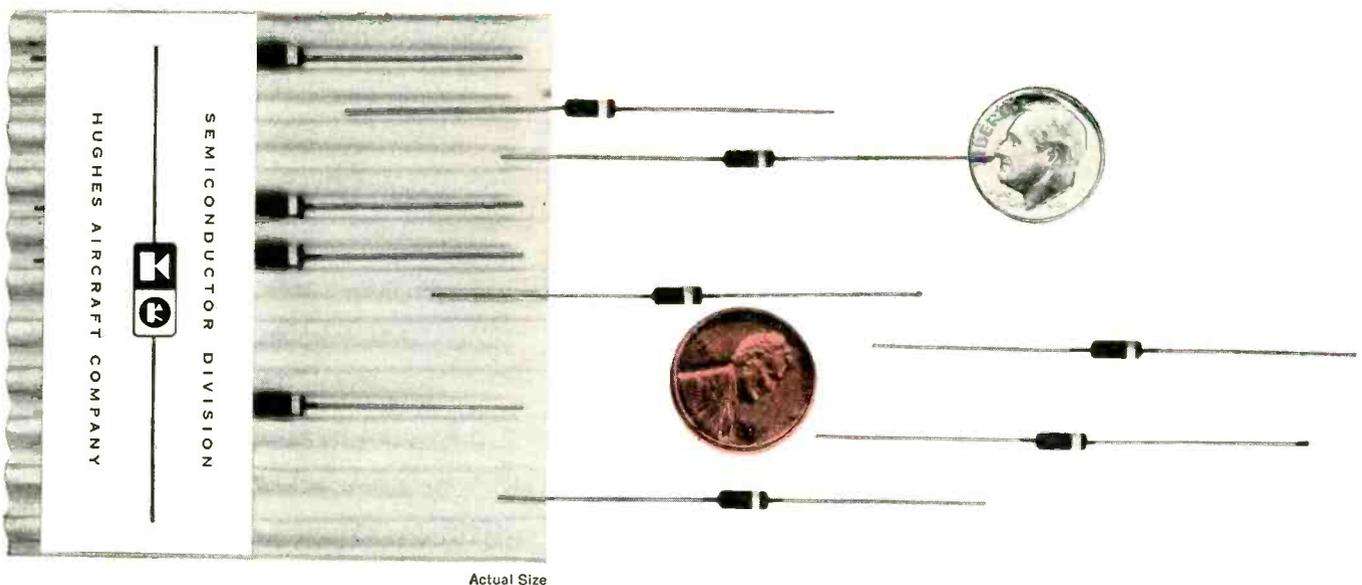
SIX PLANTS: Melrose Park, Ill. • Indianapolis, Ind.
New Brunswick, N. J. • Newnan, Ga. • Tyler, Tex. • Ogden, Utah

SALES OFFICES IN PRINCIPAL CITIES

*Highest
quality...
reliability...*



HUGHES SILICON JUNCTION DIODES



features:

- HIGH TEMPERATURE OPERATION*
- EXTREMELY HIGH BACK RESISTANCE
- VERY SHARP BACK VOLTAGE BREAKDOWN
- NO VOLTAGE DERATING AT HIGH TEMPERATURE
- EXCEPTIONALLY STABLE CHARACTERISTICS
- ONE-PIECE, FUSION-SEALED GLASS BODY
- AXIAL LEADS FOR EASY MOUNTING
- SUBMINIATURE SIZE**

The one-piece, fusion-sealed glass body is impervious to penetration by moisture or other external contamination—ensures electrical and mechanical stability. Shipments—in quantity—of all types of Hughes Silicon Junction Diodes are now being made in new, compact volume packaging. When your circuit requirements call for diodes with high temperature or high back resistance characteristics, be sure to specify Hughes Silicon Junction Diodes. They are first of all—for RELIABILITY. Listed and described in Bulletin SP4.

*Characteristics rated at 25° C and at 150° C. Ambient operating range, -80° C to +200° C.

**Actual dimensions, diode glass body—Length: 0.265-inch, max. Diameter: 0.105-inch, max.

HUGHES

Aircraft Company, Culver City, California

SEMICONDUCTOR DIVISION

New York Chicago
Los Angeles

introducing



EXCEPTIONAL
VERSATILITY
AT A PRACTICAL
PRICE

THE VARIAN MODEL G-10 GRAPHIC RECORDER... \$295

Actual size of G-10 Graphic Recorder is 10" wide x 7 1/8" high x 8" deep.

DESIGN FEATURES

Compact . . . weighs less than 15 pounds

Rectilinear trace representation . . . eliminates necessity for curved chart grids

High input impedance . . . minimizes loading effects

Unitized construction . . . chart drive and servo unit are separately available

Chopper Amplifier . . . gain at a.c. minimizes drift

Chart drive shaft extension . . . increases flexibility by allowing synchronization with other equipment

Full chart zero positioning . . . allows placement of pen zero position anywhere on chart

Panel damping control . . . provides optimum system stability through wide range of driving impedances

ELECTRICAL CHARACTERISTICS

Response time	2.5 sec. full-scale
Sensitivity	100 millivolts full-scale
Measurement accuracy	1%
Trace reproducibility	0.5% full-scale
Signal source resistance	0.5 megohm max
Line requirements	105-125 volts a.c., 35 watts, 60 cps

MECHANICAL CHARACTERISTICS

Maximum pen travel	7 inches
Normal pen travel	5 inches
Servo output torque	1 inch-lb @ 1/2 rps
Available chart speeds	4 inches per minute 2 " " " 40 inches per hour 16 " " " 4 " " "

This new, portable Varian Graphic Recorder meets the growing need for a compact instrument to record phenomena capable of representation by d.c. millivolt signals. It's flexible — has widespread applications when used directly as a recording millivolt-meter and — with appropriate transducers — to record pressure, light intensity, temperature and many other physical quantities for which continuously recorded measurement is desired.

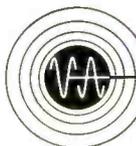
Operation — The Model G-10 Graphic Recorder operates on the principle of the self-balancing potentiometer. The recorder is actually a miniature servo system, in which a servo motor rotates a potentiometer to produce a d.c. voltage which exactly cancels the applied d.c. signal voltage. This action determines the position of the writing pen.

Write for complete technical data and price information . . . on this remarkable new instrument and its full line of accessories, priced well within the limits of a modest equipment budget.

Options . . . full-scale response time of 1.0 second and/or full-scale deflection sensitivity of 50 d.c. millivolts may be ordered at slight additional cost. A two-speed Chart Drive is also available to provide instantaneous selection of either of two speeds.

Delivery . . . Standard units generally available from stock.

THE
MARK OF
LEADERSHIP



SPECIAL PRODUCTS DIVISION

VARIAN associates
PALO ALTO 1, CALIFORNIA
Representatives in principal cities

KLYSTRONS, TRAVELING WAVE TUBES, BACKWARD WAVE OSCILLATORS, R. F. SPECTROMETERS, MAGNETS, STALOS, UHF WATERLOADS, MICROWAVE SYSTEM COMPONENTS, GRAPHIC RECORDERS, RESEARCH AND DEVELOPMENT SERVICES

**The
Greatest Names
in British
Electronics use**

**Mullard
TUBES**

Mullard

Electronic Tubes

used throughout the world

British equipment manufacturers are making a vital contribution to the development of electronics in all fields of application. Their products are being exported to every corner of the world, earning a universal reputation for advanced techniques and excellent performance.

The majority of these electronic equipment manufacturers consistently use Mullard tubes. This choice is decided upon because they prefer the greater assurance of efficiency and dependability, and because the vast manufacturing resources of the Mullard organisation guarantee ready availability of Mullard tubes wherever they are needed.

Write to the undermentioned distributors for full details of Mullard tubes:—

In the U.S.A. International Electronics Corporation,
Department E9,
81, Spring Street, N. Y. 12, New York, U.S.A.

In Canada Rogers Majestic Electronics Limited,
Department 1A,
11-19 Brentcliffe Road, Toronto 17, Ontario, Canada.

MULLARD OVERSEAS LTD., CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON, ENGLAND

*Mullard is the Trade Mark of
Mullard Ltd., and is registered in most of the principal countries of the world.*

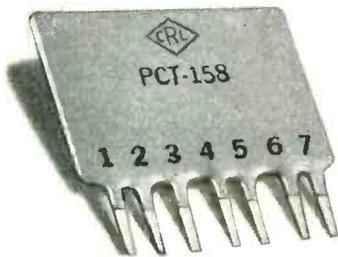


MEV 25

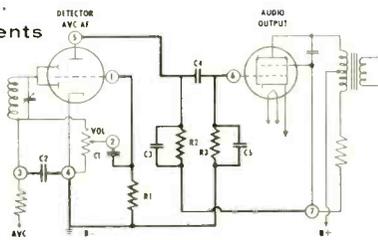
Utilizing modular design for electronic circuitry?

Centralab can help you

— with packaged electronic circuits . . .
“tinkertoy” plates . . . authoritative counsel



Centralab P.E.C.
with 8 components



Planning on “rolling your own” and assembling a circuit from scratch? That’s one place Centralab can help you. For Centralab can supply “tinkertoy” plates the way you want them — bare or with components attached.

Or would you rather save design and assembly time, by buying performance, instead of parts? Centralab can help you there, also. Centralab “packages” electronic circuitry — physically reduces a complete circuit, with all wiring, resistors, capacitors, and small inductances, to a two-dimensional form. You save space and weight — and you get a complete, sub-assembly “package” that is tested and guaranteed for specific performance.

Which way should *you* go? Talking it over with Centralab engineering specialists can help you decide, just as it has helped others. But—and this is important—call in Centralab *early* in the planning stage, *before* you’ve “frozen” your design.



“Tinkertoy” with 8 components

**More proof that
if it’s a job
for electronic components,
it’s a job for Centralab**

Centralab’s
advanced engineering
continues to create
the prototypes
of the components
industry



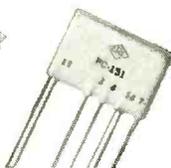
Volume Controls



Capacitors



Switches



Packaged
Electronic
Circuits



Ceramics

NEW THIS MONTH! Electroni-Kwiz No.7

1st Prize

Matched set of cowhide luggage
— including

1. Two-suitier
2. Brief bag

A combination you’re proud to own. Like to try for it? Simply answer this question in 50 words, more or less:

If a young man — perhaps your son—wanted to pursue an engineering career in the field of electronics, how would you advise him to prepare for it?

A leading editor will pick the winner of this month’s major prize.

Mail your entry to us before September 30.



†Nothing to buy. Employees of Centralab and their advertising agency not eligible. Duplicate prizes awarded in case of tie. Entries become the property of Centralab—none can be returned.

Y-558

Centralab

A DIVISION OF GLOBE-UNION INC.

9141 E. Keefe Avenue • Milwaukee 1, Wisconsin
In Canada: 804 Mt. Pleasant Road, Toronto, Ontario

*Trademark

SINCE 1922, INDUSTRY’S GREATEST SOURCE OF STANDARD AND SPECIAL ELECTRONIC COMPONENTS

THEY'RE
HERE!

FERRAMIC "Q"

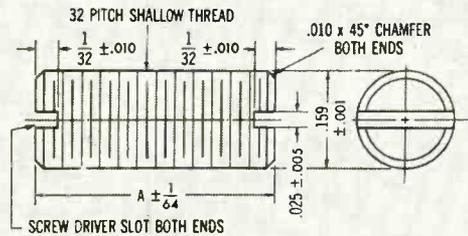
**THREADED
PERM-TUNING CORES**



(SHOWN TWICE
ACTUAL SIZE)



EE-F606-2

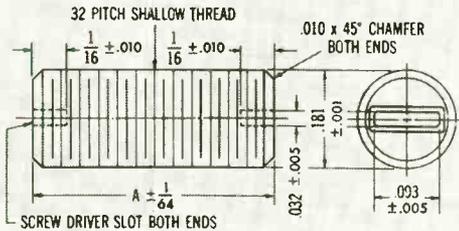


PART. NO.	DIMENSION A
F606-1	.250
EE-F606-2	.375

(SHOWN TWICE
ACTUAL SIZE)



EE-F607-1

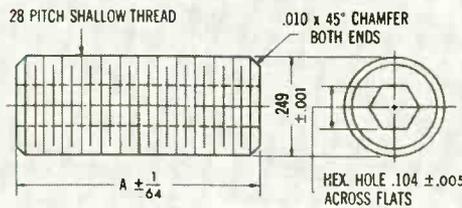


PART. NO.	DIMENSION A
EE-F607-1	.312
F607-2	.375

(SHOWN TWICE
ACTUAL SIZE)



EE-F608-1



PART. NO.	DIMENSION A
EE-F608-1	.375

...Economy—
engineered by
**GENERAL
CERAMICS**
to M. P. A.
Standard 11-53T

Following two years of intensive research and development by General Ceramics specialists, three standard threaded perm-tuning cores are now available from stock. These standard cores are offered in several lengths to meet industry's diversified requirements. Call, wire or write for quotations, today!

MAGNETIC PROPERTIES

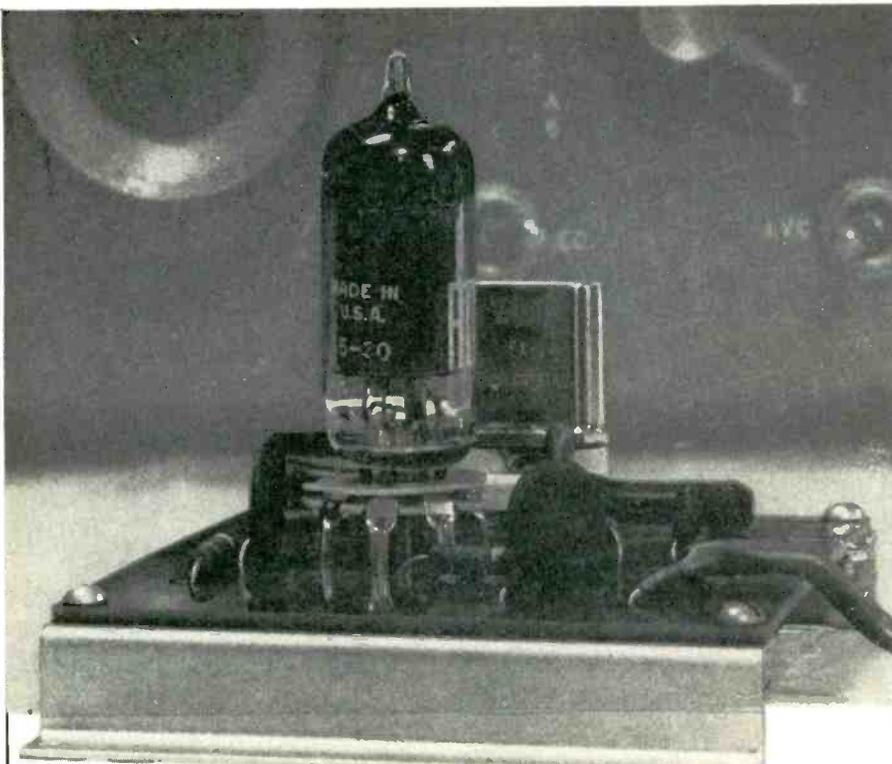
PROPERTIES	UNIT	"Q"
Initial Perm. at 1 mc/sec.	—	125
*Max. Perm.	—	400
*Sat. Flux Density	Gauss	3300
*Residual Mag.	Gauss	1800
*Coercive Force	Oersted	2.1
Temp. Coef. of Initial Perm.	%/°C	.10 max.
Curie Point	+ °C	350
Vol. Resistivity	ohm-cm.	High
Loss Factor:	$\frac{1}{u_0Q}$	
At 1 mcs/sec.	—	.000020
At 5 mcs/sec.	—	.000050

*Measurements made on D.C. Ballistic Galvanometer with Hmax = 25 oersteds. Above data is based on nominal values.



General CERAMICS CORPORATION
TELEPHONE: VALLEY 6-5100
GENERAL OFFICES and PLANT: KEASBEY, NEW JERSEY

MAKERS OF STEATITE, ALUMINA, ZIRCON, PORCELAIN, SOLDERSEAL TERMINALS, "ADYAC" HIGH TEMPERATURE SEALS, CHEMICAL STONWARE, IMPERVIOUS GRAPHITE, FERRAMIC MAGNETIC CORES



OSCILLATOR SPECIFICATIONS		
	FO-1 (fundamental)	FO-1B (overtone)
Freq. Range	200 KC-15,000 KC	15 MC-60 MC (in 4 ranges)
RF Output	3 to 10 volts into 1200 ohms	2 to 7 volts into 1200 ohms
Plate Power	210 volts @ 5 ma	210 volts @ 5 ma
Heater Power	6.3 volts @ 150 ma	6.3 volts @ 150 ma
Tube	6BH6	6AK5
Maximum Drift with $\pm 20\%$ Plate Voltage change—	.0002%	.0002%
Maximum Drift 40°F to 120°F— $\pm .002\%$ incl. crystal* (*except 200 to 500 KC $\pm .02\%$)		
Calibration Tolerance	.001% to .01%	.001% to .01% depending on FX-1 crystal used
Size	4"x4"x3" overall	4"x4"x3" overall
Mounting	4 holes (with brackets provided)	

PRINTED CIRCUIT OSCILLATORS

for Generating Spot Frequencies with **GUARANTEED Tolerance from 200 KC to 60MC**

Since the operating tolerance of a crystal is greatly affected by the associated operating circuit, the use of the FO-1 Oscillator in conjunction with the FX-1 Crystal will guarantee close tolerance operation. Tolerances as close as .001 percent can be obtained.

FO-1 for Fundamental Operation 200 KC to 15,000 KC

- FO-1—Oscillator Kit (less tube and crystal)\$3.95
- FO-1A—Oscillator, factory wired & tested with tube (less crystal) ...\$6.95

FO-1B for Overtone Operation 15 MC to 60 MC

- FO-1B—Oscillator Kit (less tube and crystal).....\$3.95*
- FO-1BA—Oscillator, factory wired & tested with tube (less crystal) \$6.95*

*Includes coil in one of four ranges: 15-20 MC, 21-30 MC, 31-40 MC, or 41-60 MC, specify when ordering. Extra coils 35c each.



FX-1 CRYSTAL Companion to the FO-1 Series Oscillator

The FX-1 Crystal is designed for use only with the FO-1 Oscillator. For tolerances of .01% and .005% any FX-1 Crystal can be used with any FO-1 Oscillator. For tolerances closer than .005% the Oscillator and Crystal must be purchased together. The Oscillator is factory wired, and the crystal custom calibrated for the specific oscillator.

For crystal prices consult table below:

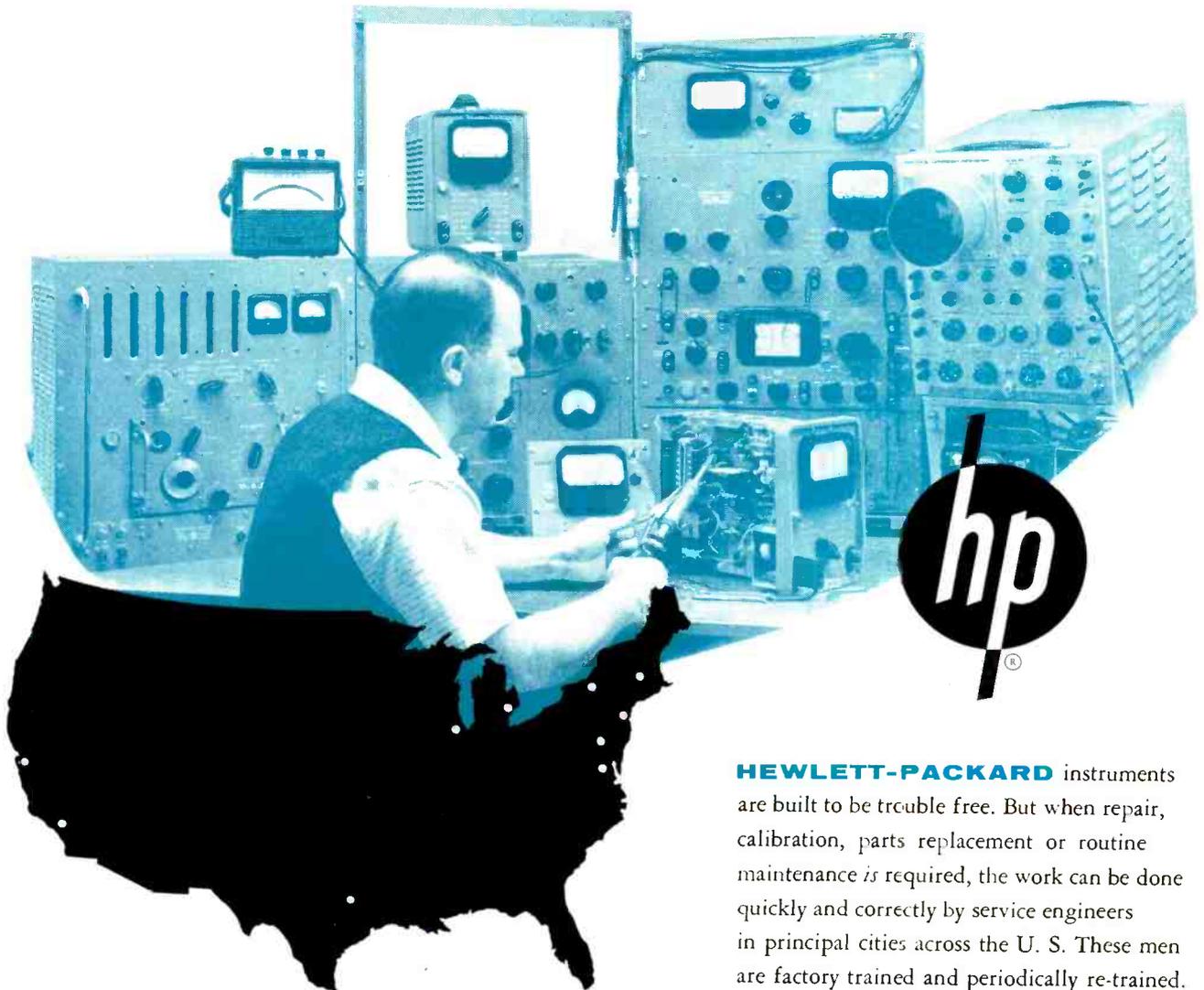
TOLERANCE	200-499 KC	500-999 KC	1000-1499 KC	1500-1999 KC	2000-9999 KC	10,000-15,000 KC	15 MC-29.9 MC	30 MC-60MC
.01%	\$ 8.75	\$12.50	\$ 5.25	\$ 3.75	\$ 2.50	\$ 3.25	\$ 3.00	\$ 4.00
.005%	\$12.50	\$15.00	\$ 6.00	\$ 4.50	\$ 3.00	\$ 4.00	\$ 5.00	\$ 6.50
(.0025% and .001% tolerances are available only by purchasing the FO-1 Oscillator and Crystal together)								
.0025%	\$17.50*	\$17.50*	\$ 6.75*	\$ 5.25*	\$ 3.75*	\$ 4.75*	\$ 6.50*	\$ 8.50*
.001%	\$25.00*	\$25.00*	\$ 8.00*	\$ 6.50*	\$ 5.00*	\$ 6.00*	\$10.00*	\$15.00*

*Prices are for crystal only. To insure tolerances closer than .005% crystal must be purchased with oscillator factory wired and tested. For total price add \$6.95 to price of crystal desired.

HOW TO ORDER: In order to give the fastest possible service, crystals and oscillators are sold direct. Where cash accompanies the order, International will prepay the postage; otherwise, shipment will be made C. O. D.

International CRYSTAL Mfg. Co., Inc. 18 N. Lee Phone FO 5-1165 OKLAHOMA CITY, OKLA.

Fast, local field servicing for **-hp-** instruments



HEWLETT-PACKARD instruments are built to be trouble free. But when repair, calibration, parts replacement or routine maintenance *is* required, the work can be done quickly and correctly by service engineers in principal cities across the U. S. These men are factory trained and periodically re-trained. They have complete repair and test facilities—in many cases the equal of those at the *-hp-* plant. They are constantly provided with the latest in service and maintenance techniques.

When you need good, fast service on *-hp-* instruments, call your *-hp-* representative—the authorized repair station for all *-hp-* equipment.

HEWLETT-PACKARD COMPANY

275 PAGE MILL ROAD • PALO ALTO, CALIFORNIA, U. S. A.
Cable "HEWPACK" • DAvenport 5-4451

For expedited field service call or write:

CHICAGO 3:
Alfred Crossley Assoc., Inc.
4501 N. Ravenswood Ave.,
Uptown 8-1141

DALLAS 9:
Earl Lipscomb Assoc.
P. O. Box 7084, Elmhurst 5345

DETROIT 35:
S. Sterling Company
15310 W. McNichols Rd.,
BRoadway 3-2900

N. HOLLYWOOD:
Neely Enterprises
3939 Lankershim Blvd.,
Stanley 7-0721

NEW YORK 21:
RMC Associates
170 E. 80th St., TRafalgar 9-2023

PALO ALTO, CALIF.:
Hewlett-Packard Co.
275 Page Mill Rd.,
DAvenport 5-4451

SYRACUSE 2:
Ryerson Assoc., Inc.
412 E. Genesee St.,
SYracuse 76-8344

UPPER DARBY, PA.:
I. E. Robinson Co.
7404 W. Chester Pike,
SHerwood 8-1294

WALTHAM 54, MASS.:
Yewell Assoc., Inc.
751 Main St., WALTHam 5-7420

WASHINGTON 9:
Horman Assoc., Inc.
2017 S St. N.W., DEcatur 2-5705

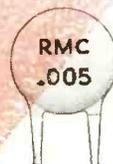
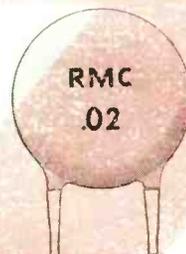
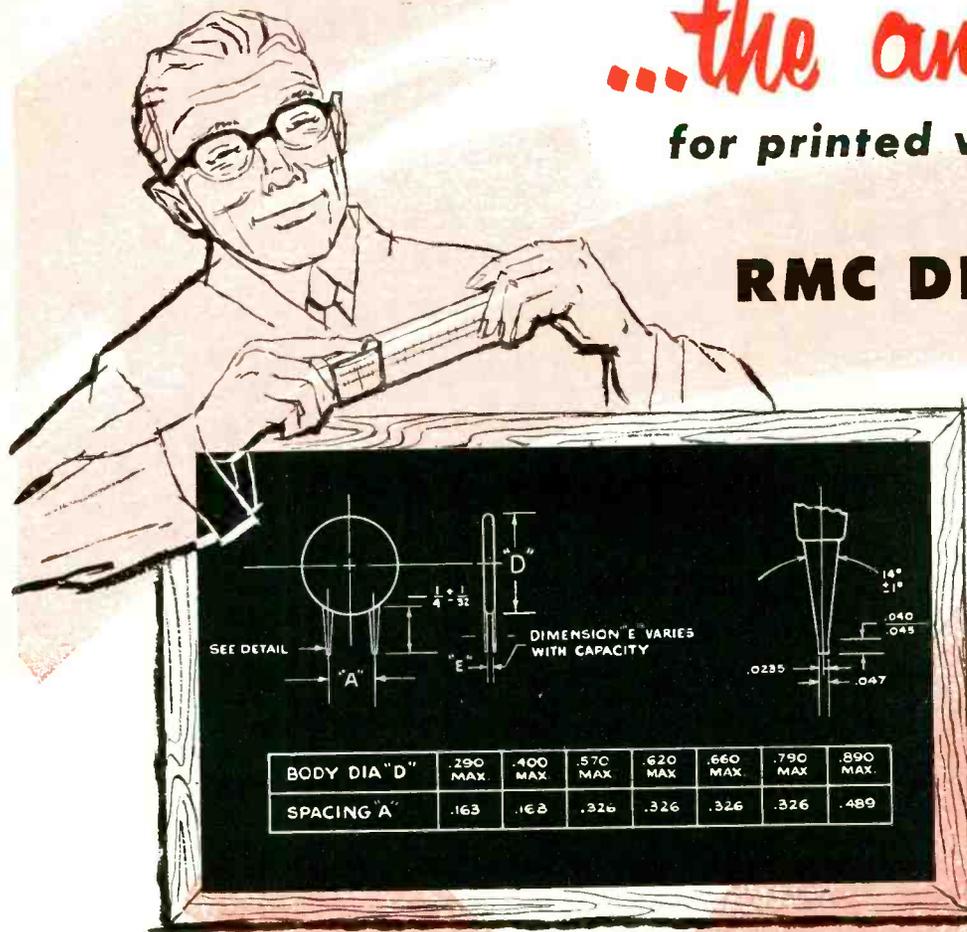


means complete coverage in service, too!

...the answer

for printed wire circuits

RMC DISCAPS®



Wedg-loc... The exclusive wedge leads on these DISCAPS lock securely in place on printed circuit assemblies prior to the soldering operation. There is no possibility of the capacitors becoming loose or falling out and the soldered connection is always uniform.

Available in capacities between 2 MMF and 20,000 MMF, Wedg-loc DISCAPS can be furnished in temperature compensating, by-pass, and stable capacity types. Suggested hole size is a .062 square.

Plug-in... RMC plug-in DISCAPS are designed to simplify production line problems on printed circuits. Leads are No. 20 tinned copper (.032 diameter) and are available up to 1½" in length. Plug-in DISCAPS are manufactured in temperature compensating, by-pass, and stable capacity types and include the mechanical and electrical features that have made standard DISCAPS the favorite of leading manufacturers.

Write today on your company letterhead for expert engineering help on any capacitor problem.

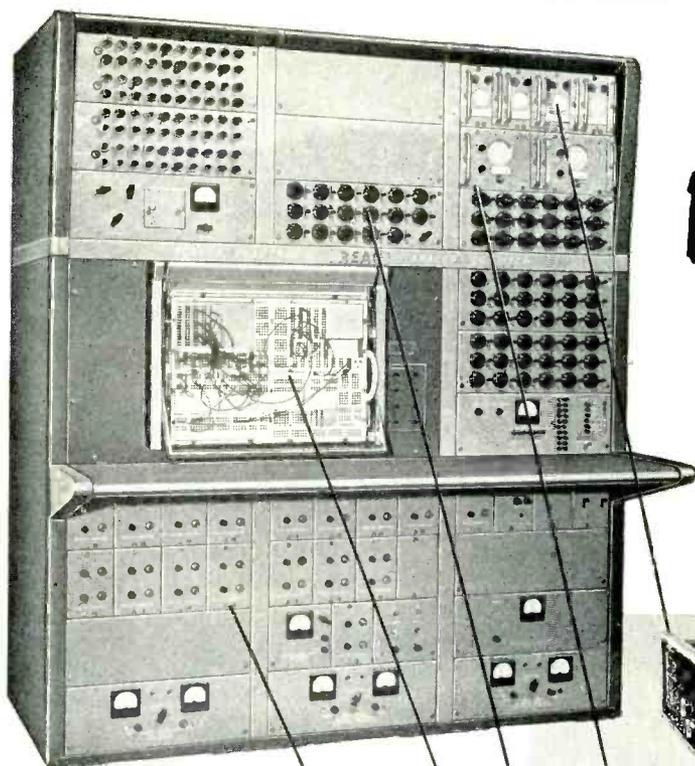
DISCAP
CERAMIC
CAPACITORS

RMC

RADIO MATERIALS CORPORATION
GENERAL OFFICE: 3325 N. California Ave., Chicago 18, Ill.

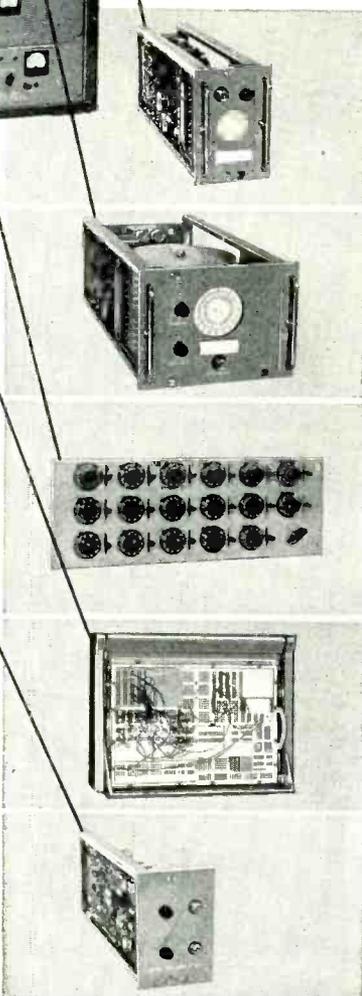
FACTORIES AT CHICAGO, ILL. AND ATTICA, IND.
Two RMC Plants Devoted Exclusively to Ceramic Capacitors

announcing the
New REEVES
REAC HIGH SPEED **400**
ANALOG COMPUTER



New
BUILDING-BLOCK
CONSTRUCTION

... an exclusive Reeves design principle that permits assembly of computer elements in any desired combination to form exactly the computer necessary to do a particular job or to expand an existing installation. REAC 400 can be assembled, component by component, to fit specific requirements at minimum cost, time, space and effort. REAC 400 is completely adaptable to the scope and complexity of your control problem, now or in the future.



New HIGH SPEED SERVOS

Servo multipliers have bandwidth over 50 cps. Velocity 1500 v/sec; acceleration 60,000 v/sec². Six gang pots; two tapped with front panel plug-in turrets for function generation.

New HIGH SPEED RESOLVERS

Vastly improved dynamic performance ... 35-cycle bandwidth. Rectangular and Polar operation; Full AGC either mode. Front panel plug-in turrets for easy padding for function generation.

New PROBLEM CHECK

New Reeves development permits verification of problem solution directly from equations before problem is run.

Checks { Operation of all components used
 Patching of problem from diagram
 Diagramming of problem from equations

New CONVENIENT PATCHBAY

Available in units of 1632, 3264 or 4891 holes for maximum flexibility. Color-coded mask aids in patching. Patchboard changes possible during operation.

New POWERFUL AMPLIFIERS

New dual amplifier chassis, individually chopper-stabilized. Noise less than 3 mv rms in cabinet. Phase shift 0.025° @ 100 cps. Bandwidth 10KC under cabinet conditions.



REEVES INSTRUMENT CORPORATION

A Subsidiary of Dynamics Corporation of America
 201 East 91st St., New York 28, N. Y.

REAC
 Analog
 Computers



Precision
 Floated
 GYROS



Precision
 RESOLVERS and
 PHASE SHIFTERS



SERVO
 MECHANICAL
 PARTS





CAUGHT!—by Silent Sounds

Suddenly, the lights snap on. Someone yells —

"Don't move or we shoot!"

How had the burglar been detected? No one saw him enter. No sign of an alarm system.

No obvious sign, that is. But there was an Alertronic Burglar Alarm.

This unusual protective device operates by sending out 19,200 cycle-a-second sound waves, too high for human ears to hear. The slightest movement of an intruder disturbs these waves and activates the alarm.

What produces the vibrations? Two slender nickel rods — and a principle of physics called magnetostriction (the peculiar way nickel changes length in a changing magnetic field).

Putting magnetostriction to work in this ultrasonic burglar alarm wasn't an overnight job. The inventor made his first experiments twelve years ago.

The search for a material with necessary magnetostrictive properties ended when he came to Inco. Nickel proved to be the material he was seeking.

And, as it turned out, he got more than a metal from Inco . . .

In the years that have passed, he has found Inco always ready to help in supplying information on the properties of Inco Nickel Alloys and other metals . . . on the technical aspects of magnetostriction . . . and on questions involving metal fabrication.

This same type of friendly cooperation, of course, is yours for the asking. Let's get together on your problem.

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

Inco Nickel Alloys



Want more information? Use post card on last page.

NICKEL ITEMS

Who can guess what new use of magnetostriction will be announced next? Nickel transducers from little rods the size of match sticks up to ton-size blocks are already being used for killing germs by silent sounds, to measure ocean depths, to locate fish, for dust precipitation, for faster drilling of wells, for shaping gems and cutting tool materials so hard they normally have to be cut laboriously with diamonds.

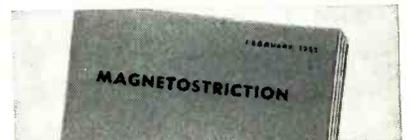
When installed according to specifications of insurance underwriters and connected to central protective system, Alertronic enables users to qualify for 60% reduction in insurance premiums.



Even the motion of heated air from burning wad of paper in ash tray sets off Alertronic alarm as pictured by jumping lines of the oscillograph tube in this demonstration set-up.



Inventor Samuel Bagno, Vice President of The Ultrasonic Division of Walter Kidde & Co., Inc., flips a switch as he leaves his own plant to connect the alarm unit into Central Patrol Office.



If you really want more facts and technical data on the magnetostrictive properties of nickel, ask for our bulletin "Magnetostriction." It is written for engineers and physicists.

MONEL® • "R"® MONEL • "K"® MONEL
"KR"® MONEL • "S"® MONEL • INCONEL®
INCONEL "X"® • INCONEL "W"®
INCOLOY® • NIMONIC® ALLOYS • NICKEL
LOW CARBON NICKEL • DURANICKEL®



ON TIME

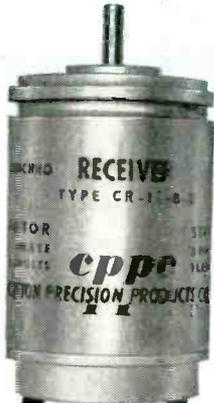
MEMO

From: Engineering & Production
To: Sales Department
Subject: Size 8 and 22 Synchros

As promised last November, our size 8 and 22 standard synchros are now in production and available for 3 weeks or less delivery. In addition, we have added the BuOrd type size 15 transmitter to the line.

Next

Size 15
1.437" diameter
ACTUAL SIZE



Size 11
1.062" diameter
ACTUAL SIZE



Size 10
.937" diameter
ACTUAL SIZE

BuOrd Size 15
1.437" diameter
ACTUAL SIZE



BONUS

Size 22
2.161" diameter
ACTUAL SIZE



HERE!

Next



HERE!

Size 8
.750" diameter
ACTUAL SIZE

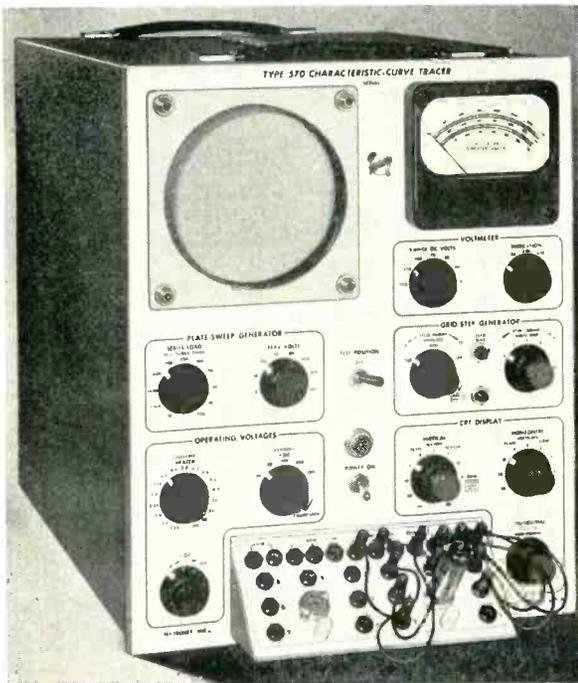
Look to *cppe* for Synchro Progress

CLIFTON PRECISION PRODUCTS CO., INC.
CLIFTON HEIGHTS PENNSYLVANIA



Save Time in Circuit Design

Get advance information...in graphic form...
on vacuum-tube behavior in new circuitry—
with the **Type 570 Characteristic-Curve Tracer**



The **Tektronix Type 570 Characteristic-Curve Tracer** can save you many hours in circuit-development work by providing quick, accurate pictures of vacuum-tube characteristics. You have complete control of the operating-condition setup, permitting a realistic approach to actual circuit conditions, whatever they may be. You get curves that can be very important in a particular circuit problem; but are rarely, if ever, published in handbooks.

The Type 570 can also be used for rapid preselection of vacuum tubes, either by comparison with another vacuum tube, or with curves outlined on a crt mask.

Please call your Tektronix Field Engineer or Representative or write direct for new booklet, Type 570 Technical Description.

Displays Families of Curves on CRT Screen

Choice of four to twelve characteristic curves per family—with as many as 8 positive-bias curves per family.

Plots All Important Characteristics

Plate current against plate voltage.
Plate current against grid voltage.
Screen current against plate voltage.
Screen current against grid voltage.
Grid current against plate voltage.
Grid current against grid voltage.

Calibrated Controls

Accurate current and voltage readings directly from the crt screen.

Wide Display Range

11 current ranges from 0.02 ma/div to 50 ma/div.
9 voltage ranges from 0.1 v/div to 50 v/div.
11 series-load resistors from 300 ohms to 1 megohm.
7 grid-step values from 0.1 v/step to 10 v/step.

Price — \$925

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

See and try the Type 570 at the National Electronic Conference in Chicago, Booths 133 and 134.

Tektronix, Inc.

P. O. Box 831, Portland 7, Oregon

CYpress 2-2611

Cable: TEKTRONIX

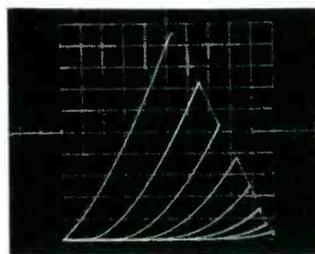


Fig. 1 — Plate current plotted against plate voltage for one triode section of a 12AU7. Plate load is 5 k, peak plate-supply voltage is 500 v. Grid voltage is changed 5 v between curves, from -35 v. to zero. Vertical sensitivity is 5 ma/div, horizontal sensitivity 50 v/div. Calibrated controls permit accurate current and voltage readings directly from the screen.

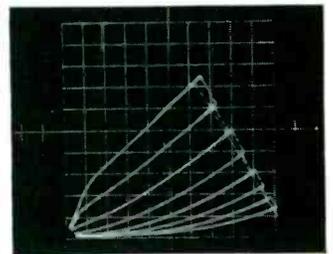


Fig. 2 — Same triode section of 12AU7 with only 20-v peak plate supply and sensitivities increased to 0.2 ma/div vertical and 2 v/div horizontal. Grid voltage is changed 2 v between curves, from -14 v to zero. This is essentially a 25-times magnification of the lower left portion of Fig. 1, showing the operating characteristics at low plate-supply voltage.

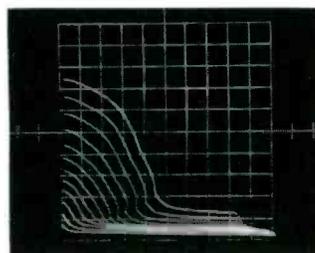


Fig. 3 — Screen current plotted against plate voltage with positive grid bias on a 6AQ5. Plate load is 300 ohms, peak plate voltage is 100 v, screen-grid voltage is 100 v, with grid voltage changing 2 v/step from +16 v to below zero. Vertical scale is 10 ma/div, horizontal scale 10 v/div.

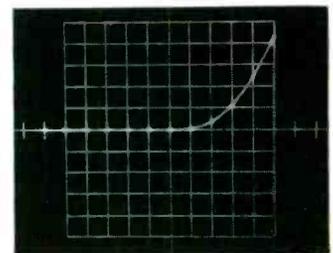


Fig. 4 — Typical Germanium Diode curve. Inherent flexibility of the Type 570 permits accurate evaluation of diode characteristics and detailed examination of any part of the curve. Calibrated scales above are 0.2 v/div horizontal, 0.5 ma/div vertical, with zero points at center of screen.

hitch your missile to a star...



Navigation and Control Devices **PRODUCED** for Missiles and Aircraft

Kollsman has designed, developed and produced the following navigation and control systems and components:

FOR NAVIGATION OR GUIDANCE

CLASSIFIED Photoelectric Sextants for remote semi-automatic celestial navigation.

CLASSIFIED Automatic Astrocompasses for precise automatic celestial directional reference and navigation.

Photoelectric Tracking Systems For many years Kollsman has specialized in high precision tracking systems.

Periscopic Sextants for manual celestial observations.

CLASSIFIED Computing Systems to provide precise data for automatic navigation and guidance, operated by optical, electromechanical, and pressure sensing components.



kollsman INSTRUMENT CORPORATION

60-10 A 45th AVE., ELMHURST, NEW YORK • GLENDALE, CALIFORNIA • SUBSIDIARY OF *Standard* COIL PRODUCTS CO. INC.

FOR CONTROL
*proven components
now in production*

Pressure Pickups and Synchrotel Transmitters

to measure and electrically transmit

- true airspeed • indicated airspeed • absolute pressure
- log absolute pressure • differential pressure • log differential pressure • altitude
- Mach number • airspeed and Mach number.

Pressure Monitors — to provide control signals for altitude, absolute and differential pressure, vertical speed, etc.

Acceleration Monitors — for many applications now served by gyros.

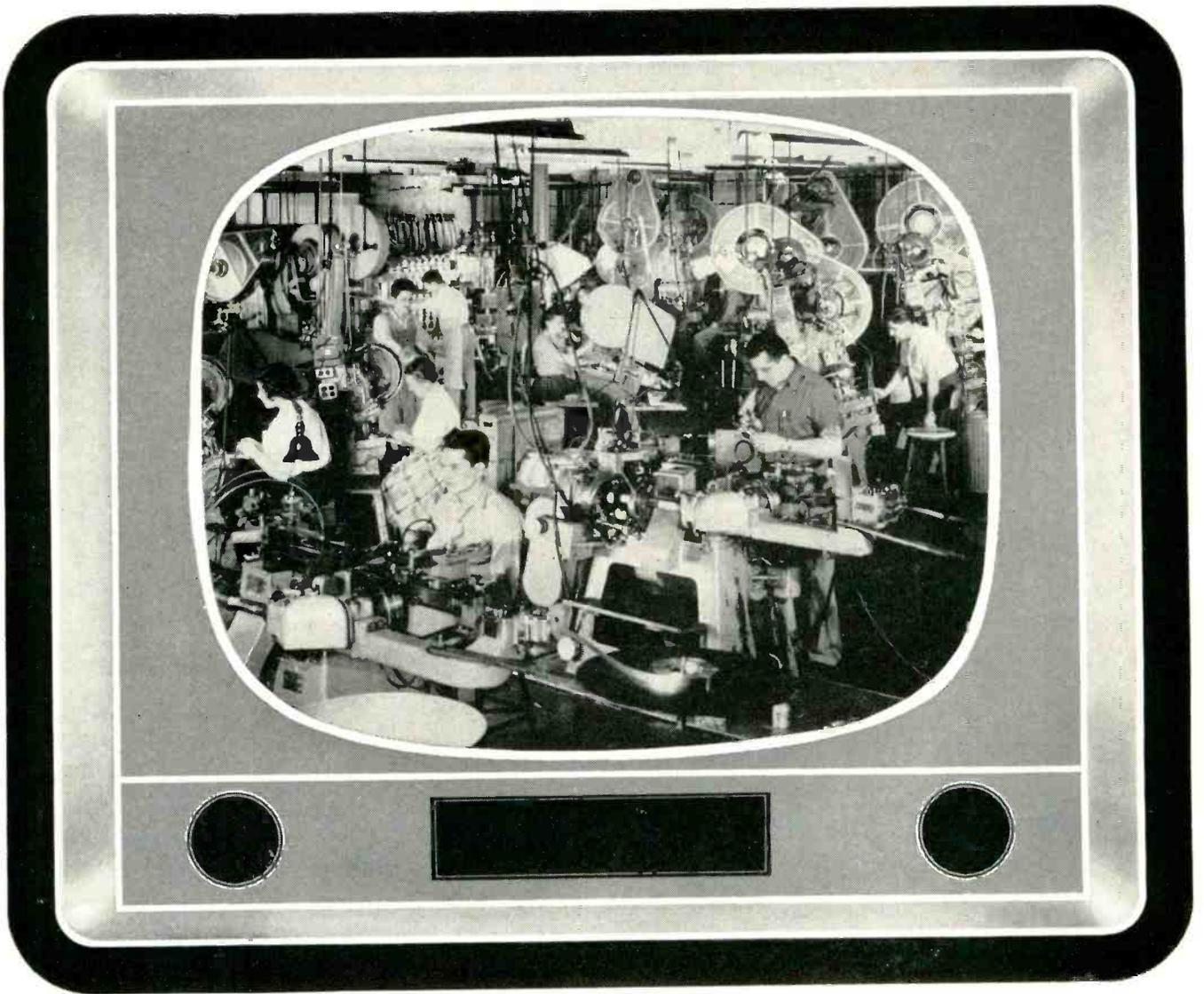
Pressure Switches — actuated by static pressure, differential pressure, rate of change of static pressure, rate of climb or descent, etc.

Motors — miniature, special purpose, including new designs with integral gear heads.

SPECIAL TEST EQUIPMENT

optical and electromechanical for flight test observations.

Please write us concerning your specific requirements in the field of missile or aircraft control and guidance. Technical bulletins are available on most of the devices mentioned.



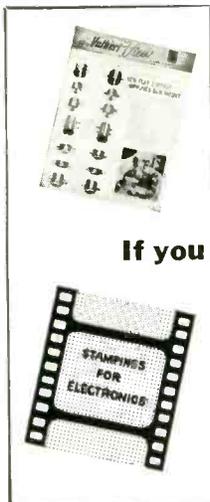
Picture of Your Set Being Improved by Volkert Stampings Production

We would really need a "wide-screen" TV set to show the many rows of power presses, eyelet machines and four-slide machines that enable Volkert to meet all your precision stamping needs...but this picture gives you some indication of the modern, fully-automatic equipment that we use in turning out more than ten million accurate stampings a week for leading tube and set manufacturers.

And these unsurpassed production facilities are only a *part* of Volkert's complete service to design, tool and produce precision electronic stampings to *your* specifications.

If you want the complete picture of electronic stampings, here are two suggestions:

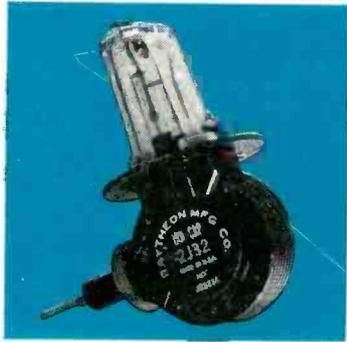
Ask for *The Volkert View* quarterly; let us show our color film, *Stampings for Electronics*, in your plant.



VOLKERT STAMPINGS, INC.
222-34 96th Avenue, Queens Village 29, L. I., N. Y.

for design...tooling...and production of precision stampings

Volkert



2J32 MAGNETRON



2K28 KLYSTRON



HELPING ESTABLISH RELIABILITY RECORDS

Raytheon Magnetrons and Klystrons in proved Gilfillan ASR-1 Radar

Civil Aeronautics Administration reports record-breaking reliability of Gilfillan airport surveillance radar. Boston International Airport had 8,760 hours continuous performance with only 7½ hours involuntary outage—less than 1/10 of 1%—from their Gilfillan installation.

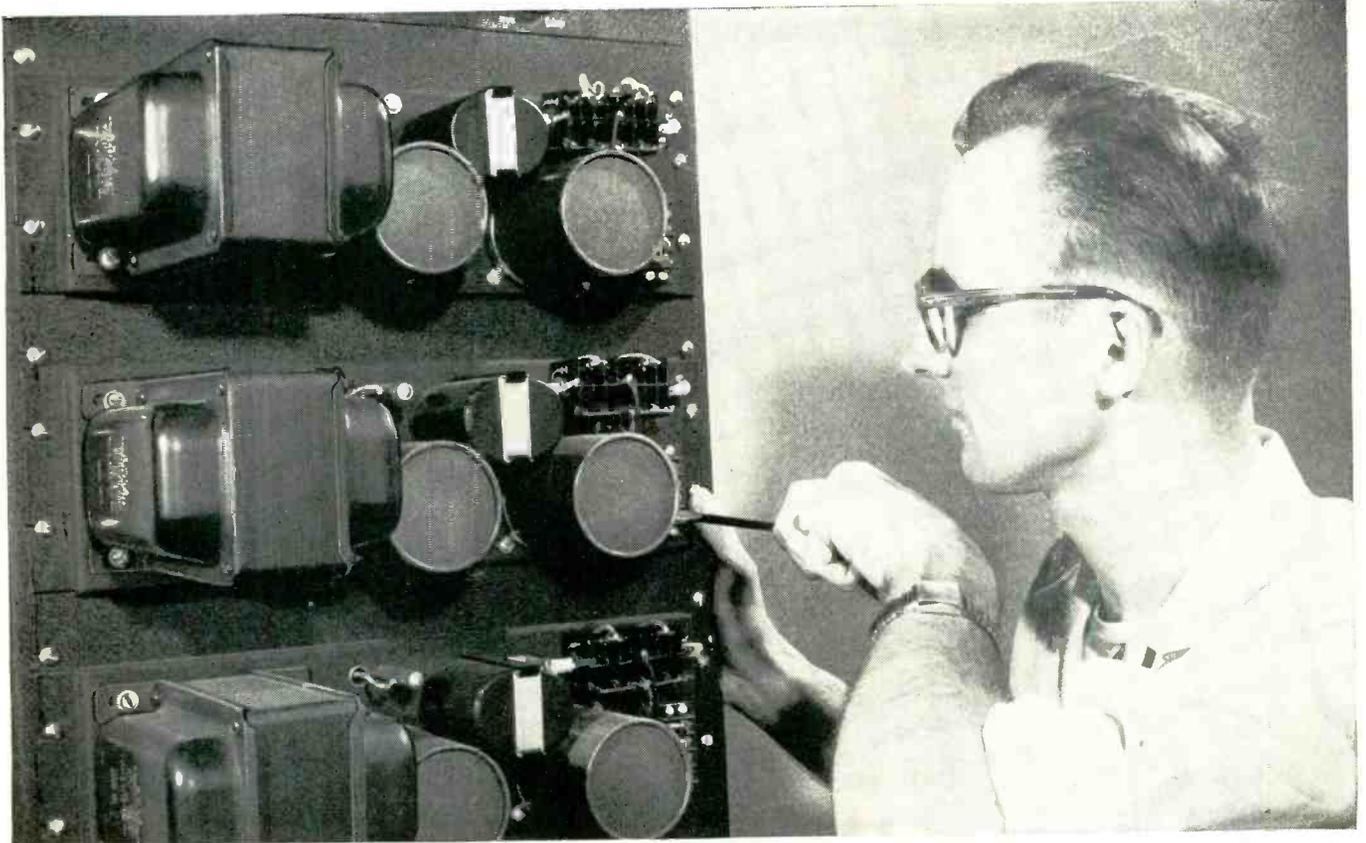
Check these performance records of Raytheon tubes in the Gilfillan ASR-1. Average life, 2J32 Magnetron: 4,000 hours. Average life, 2K28 Klystron: 2,500 hours.

Your microwave and radar equipment offers extra reliability when you specify Raytheon Magnetrons and Klystrons. Use these rugged, reliable tubes in your present and proposed systems. Contact Power Tube Sales to take advantage of Raytheon's Application Engineer Service, without obligation. Write for free Tube Data Booklets.

Condensed Typical Operating Data							
	Power Output	Frequency Range, mc	Reflector Voltage	Resonator Voltage	Maximum Temp. Coef.	Tuning	Cavity
2K28	140 mw	1200-3750	-140 v. to -300 v.	300 v.	± .15	Mech. Inductive	Ext.
	Power Output	Frequency Range, mc	Anode kv	Anode Amps.	Pulse Width	P.R.R.	
2J32	285 kw min.	2780-2820 Fixed freq.	20	30	1 μsec	1,000	



*Excellence
in Electronics*



The photograph above shows three typical Sola Constant Voltage DC Power Supplies being mounted on a relay rack.

Each chassis is completely assembled by Sola Electric Co. and supplied as a single unit.

CONSTANT VOLTAGE TRANSFORMER SUPPORTS GERMANIUM RECTIFIER AND ALL-CAPACITY FILTER IN MEETING A TOUGH DC POWER PROBLEM

This unique dc power supply assembly uses three unusual components:

- A CONSTANT VOLTAGE transformer
- A germanium rectifier
- A high-capacitance filter (no choke).

They mutually support and protect each other in providing high output voltage stability in the face of varying or heavy "pulse" loads.

Result: — They are being adopted by manufacturers of computers, tabulating machines, and others who *must have reliable operation* of relays, solenoids, etc., in spite of severe line voltage and load fluctuations. Specifically, these special assemblies provide:

1. $\pm 1\%$ or less output voltage change with $\pm 15\%$ line voltage variations.
2. Minimum output voltage change with wide, rapid load changes.
3. High, short-time overload capacity without damage to components.
4. Ripple approximately 1%.
5. High overall economy by eliminating overload ca-

capacity needed with other types of power packs for this duty.

6. Simplicity, compactness, and light weight as compared with equipment employing saturable cores, heavy chokes, tubes, revolving or other movable parts.

Sola is now designing and assembling complete dc power supply assemblies in the general ranges of up to 50 volts at 25 amperes; or up to 400 volts at 0.4 amperes. Series and parallel operation have proved quite feasible for serving higher demands. While featuring the special capabilities of voltage-regulating transformers, germanium rectifiers, and high-capacitance filter as a "team"; Sola invites inquiries on assemblies of any type of transformer, rectifier, and filter, or separate voltage-regulating transformers designed to feed existing rectifier-filter combinations. Write for descriptive folder, or contact your nearest district sales engineer.

SOLA *Constant Voltage*
TRANSFORMERS

CONSTANT VOLTAGE TRANSFORMERS for Regulation of Electronic and Electrical Equipment • LIGHTING TRANSFORMERS for All Types of Fluorescent and Mercury Vapor Lamps. • SOLA ELECTRIC CO., 4633 West 16th Street, Chicago 50, Illinois, Blshop 2-1414 • NEW YORK 35: 103 E. 125th St., Trafalgar 6-6464 • PHILADELPHIA: Commercial Trust Bldg., Rittenhouse 6-4988 • BOSTON: 272 Centre Street, Newton 58, Moss., Blgelow 4-3354 • CLEVELAND 15: 1836 Euclid Ave., Prospect 1-6400 • KANSAS CITY 2, MO.: 406 W. 34th St., Jefferson 4382 • LOS ANGELES 23: 3133 E. Olympic Blvd., ANgelus 9-9431 • TORONTO 9, ONTARIO: 617 Runnymede Rd., Lyndhurst 1654 • Representatives in Other Principal Cities

Visibility Zero



but **POSITION** always known!

Thanks to the NEW **LORAL** AUTOMATIC SHORT-RANGE

GROUND **P**OSITION **I**NDICATOR

ACCURATE!
INSTANTANEOUS!

Developed Specifically for LIGHT AIRCRAFT
and HELICOPTERS.

A new dead reckoning navigational computer —
AUTOMATICALLY indicating ground position —
derived from airspeed, heading and wind.

TOTAL SYSTEM WEIGHT — 18 LBS.

LORAL—Serving in AVIONICS

- AIRBORNE NAVIGATIONAL EQUIPMENT
- COMMUNICATION SYSTEMS
- RADAR EQUIPMENT
- TEST EQUIPMENT



Dept. E9

LORAL ELECTRONICS CORPORATION

794 EAST 140th STREET

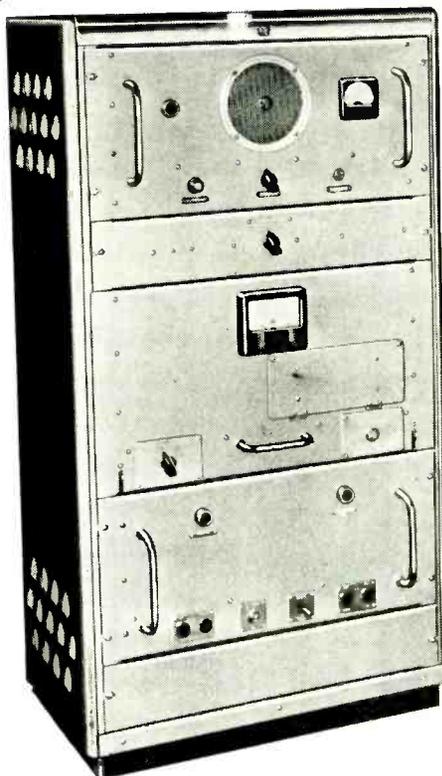
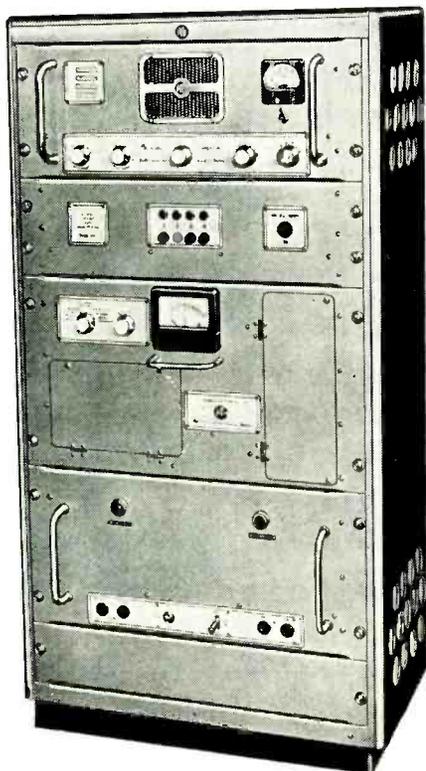
NEW YORK 54, N. Y.

AN

OUTSTANDING



PAIR



**60-WATT H.F.
FIXED STATION**

1.6—14 Mc/s

Newly designed to use the most modern valves and components available, this station incorporates local or remote push-button selection of up to four channels, remote control being possible to a distance of 15 miles.

**50-WATT V.H.F.
FIXED STATION**

60—184 Mc/s

Employing the latest techniques this most efficient station is of particular value for fixed and mobile V.H.F. schemes, ground-to-air control of aircraft and point-to-point links. Six-channel operation is available if required.



Telecommunications

CAMBRIDGE

ENGLAND



Pye (New Zealand) Ltd.
Auckland C.I., New Zealand

Pye Radio & Television (Pty.) Ltd.
Johannesburg
South Africa

Pye Canada Ltd.
Ajax, Canada

Pye Limited
Mexico City

Pye-Electronic Pty., Ltd.
Melbourne, Australia

Pye Limited
Tucuman 829
Buenos Aires

Pye (Ireland), Ltd.
Dublin, Eire

Pye Corporation of America
270 Park Avenue
New York

PYE LIMITED

• •

CAMBRIDGE

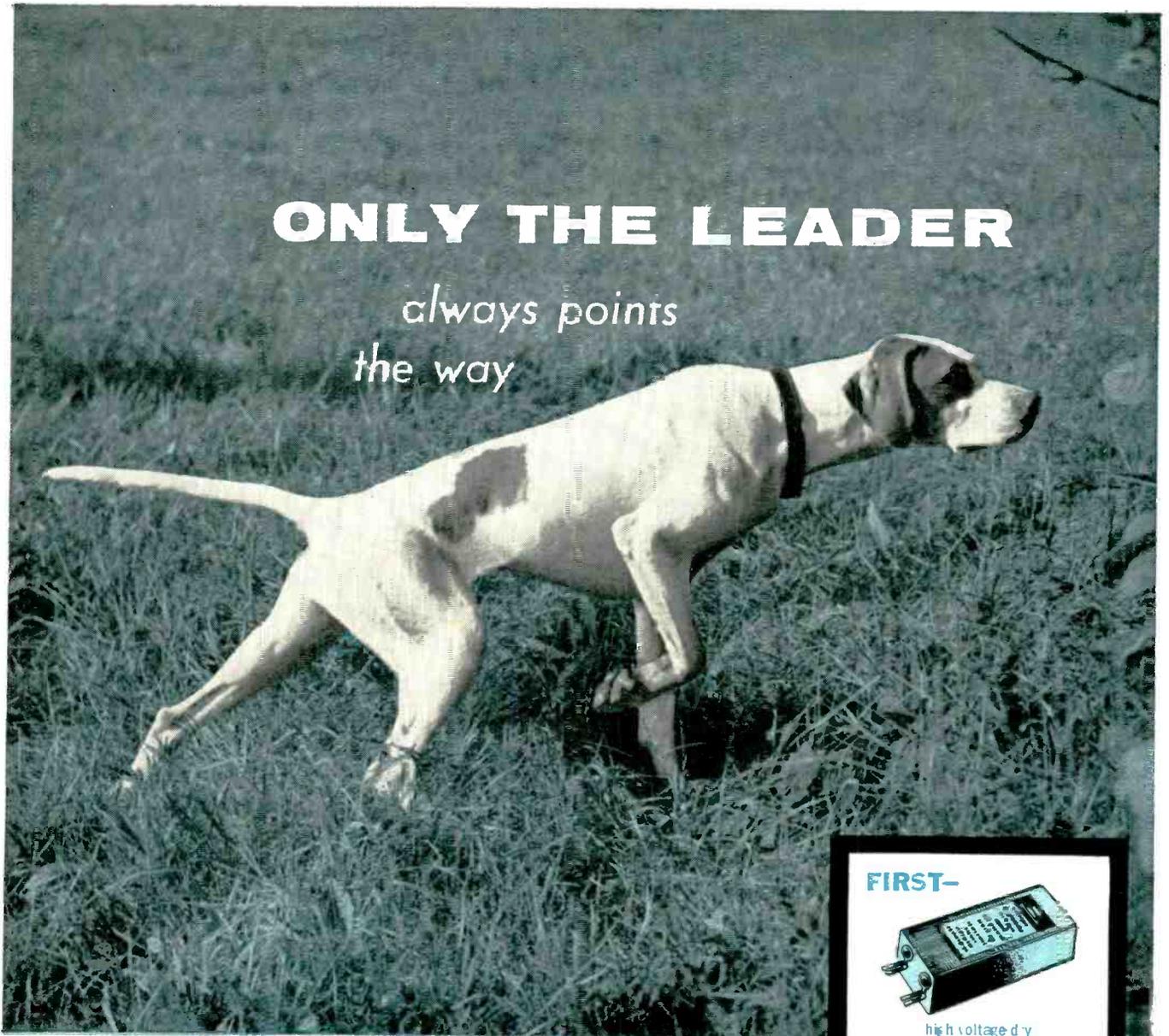
• •

ENGLAND

Telephone: Teversham 311

ONLY THE LEADER

*always points
the way*



FIRST-



high voltage dry electrolytic capacitors.

FIRST-



capacitor to use anodic aluminum foil electrochemically etched.

C·D...45 YEARS OF FAMOUS FIRSTS

Typical of these "famous firsts" are the three examples shown here... *proof* that whatever your capacitor requirements may be, your needs can be filled by C-D. Write to Cornell-Dubilier Electric Corp., Dept. K-95, South Plainfield, N. J.

FIRST-



miniature, metal-based electrolytic capacitors.

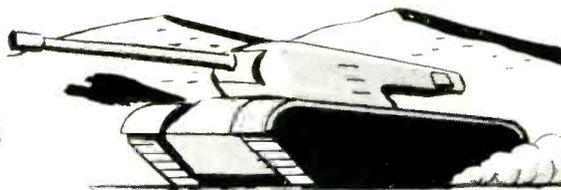
CONSISTENTLY DEPENDABLE
CORNELL-DUBILIER CAPACITORS

PLANTS IN SO. PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD AND FUQUAY SPRINGS, N. C.; SUBSIDIARY, RADIART CORP., CLEVELAND, OHIO.

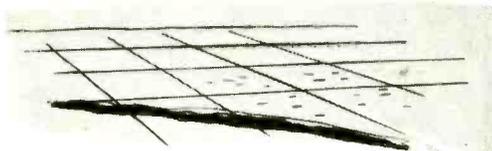
THERE ARE MORE C-D CAPACITORS IN USE TODAY THAN ANY OTHER MAKE



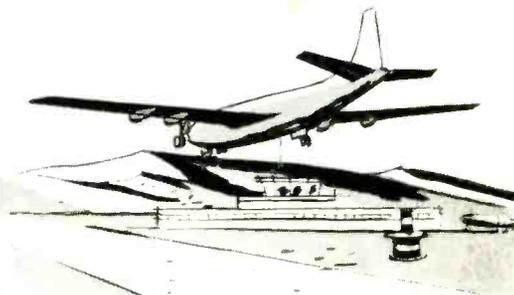
Wincharger dynamotors help power the nation's defense



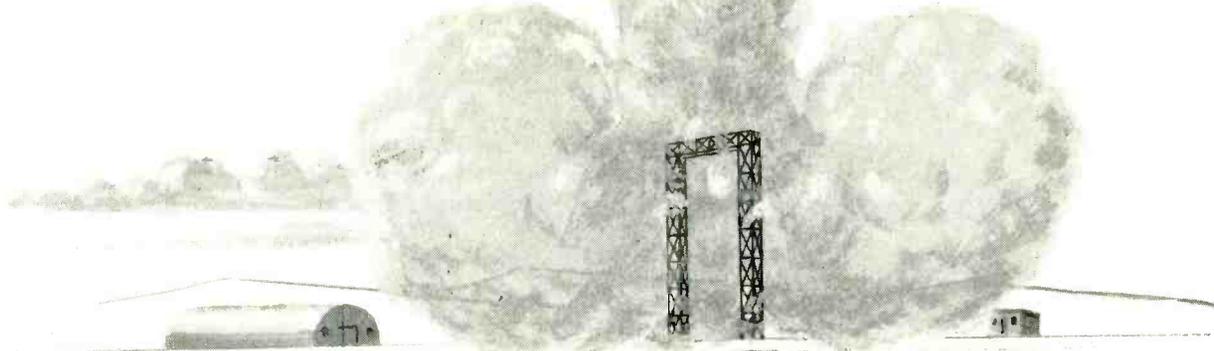
Vehicular HF Communication Transmitters



Airborne UHF and HF Communications Transceivers



VHF Omirange Navigation Receivers



Guided Missile Development

WINCHARGER CORPORATION

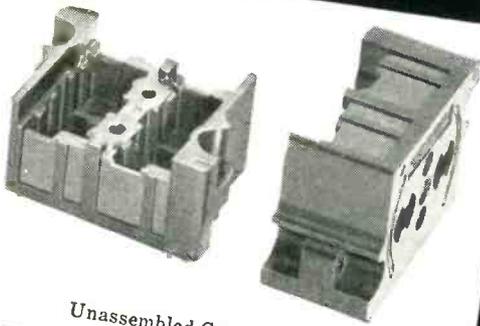
Sioux City 2, Iowa

A wholly owned subsidiary of Zenith Radio Corporation

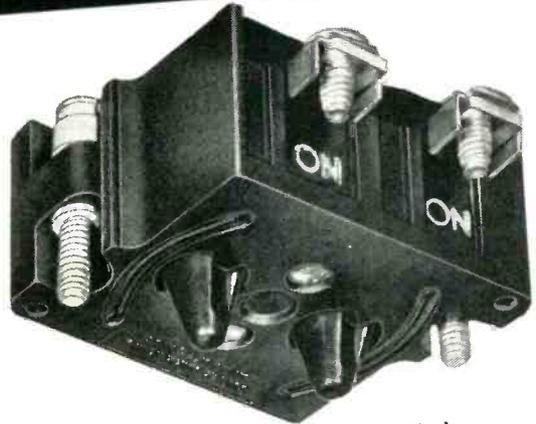
Engine Generators • Universal Motors • Dynamotors
Inverters • Wind Driven Generators

Cutler-Hammer selects **RESINOX* 3700**

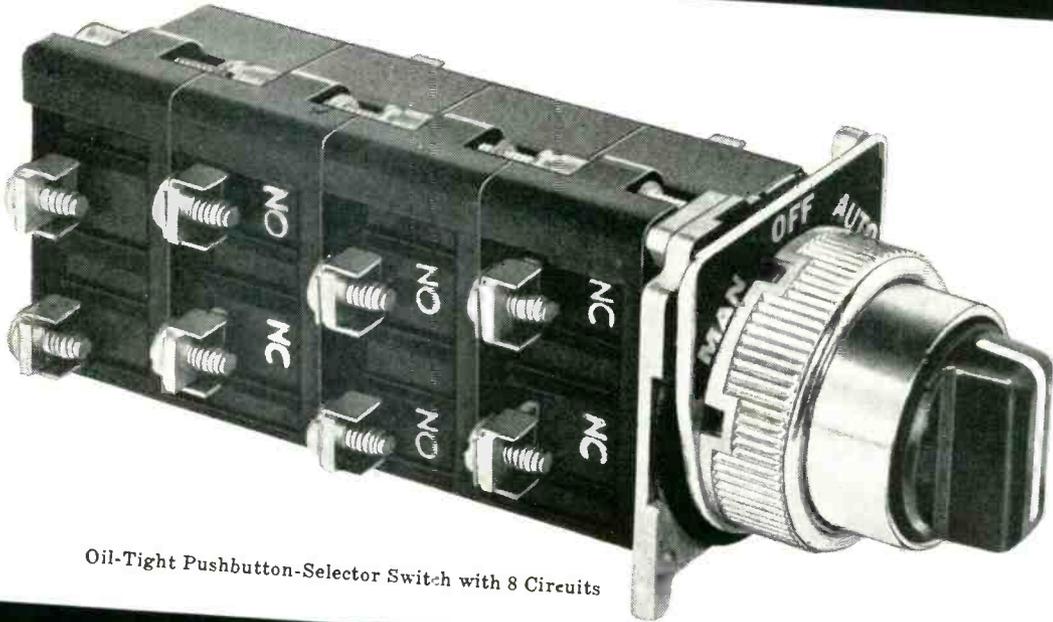
to mold contact blocks for new selector switches



Unassembled Contact Blocks



Oil-Tight Pushbutton Contact Block



Oil-Tight Pushbutton-Selector Switch with 8 Circuits

MONSANTO'S THERMOSETTING MOLDING MATERIAL COMBINES IMPROVED ELECTRICAL PROPERTIES WITH NON-CRITICAL MOLDABILITY

Mark up another job where outstanding results have been achieved with Resinox 3700! The contact blocks for Cutler-Hammer's new line of heavy-duty oil-tight pushbutton switches are molded of this mineral-filled Monsanto material. Resinox 3700 was chosen for this specialized application because of its excellent electrical properties and short-cure cycles.

Other characteristics of Resinox 3700 which are improving the profit picture for manufacturers of electrical parts include high arc resistance, dielectric strength, dimensional stability, heat resistance and durability. Perhaps Resinox 3700 is exactly what *you* need to solve an electrical parts problem.

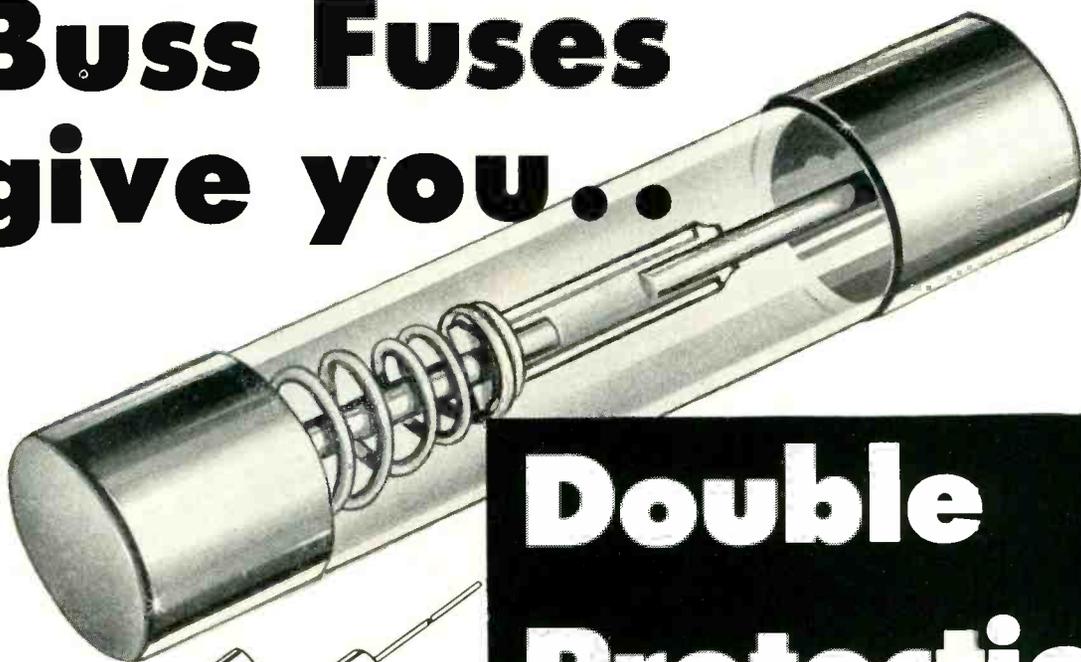
Write today for full information. Monsanto Chemical Company, Plastics Division, Dept. E9, Springfield 2, Mass.



For outstanding electrical properties, specify **RESINOX 3700**

*RESINOX: REG. U. S. PAT. OFF.

Buss Fuses give you...



Double Protection

.. Against loss of Customer Satisfaction

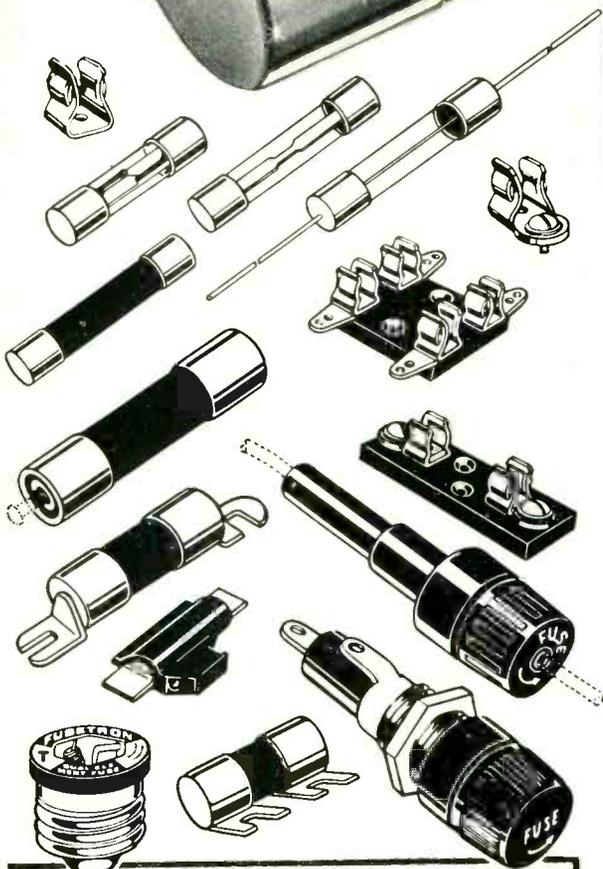
To make sure of proper operation under all service conditions — every BUSS fuse normally used by the Electronic Industries is tested in a sensitive electronic device. Any fuse not correctly calibrated, properly constructed and right in all physical dimensions is automatically rejected.

That's why BUSS fuses won't blow when trouble doesn't exist. Useless shutdowns caused by poor quality fuses blowing needlessly are not only irritating to customers — but customers' confidence in your product or service could be jolted.

However, when there is an electrical fault BUSS fuses open to prevent further damage to equipment — saving users the expense of replacing needlessly damaged parts.

When you standardize on BUSS fuses, you are doubly safe.

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



SAVE ENGINEERING TIME ON ELECTRICAL PROTECTION PROBLEMS

The BUSS fuse research laboratory and its staff of engineers are at your service to help you with problems involving electrical protection. Submit description or sketch and tell us your requirements.

Whenever possible, the fuse or fuse mounting selected will be available in local wholesalers' stocks, so that your device can easily be serviced.

Be sure to get the latest information on BUSS and FUSETRON small dimension fuses and fuse-holders . . . Write for bulletin SFB.

BUSSMANN MFG. CO.

FUSETRON
TRUSTWORTHY NAMES IN
ELECTRICAL PROTECTION

Div. McGraw Electric Co.

ELRC 955

University at Jefferson

BUSS

St. Louis 7, Mo.

A directly calibrated generator of continuous wave or pulse modulated radio frequency signals, government model TS-419 U.

Modulation - (a) by external or internal pulse generator.
(b) by synchronization to an external pulse or sine wave generator

Frequency Range - 900 to 2100 MC/S, one band, $\pm 1\%$.

Power Output - calibrated 0 to -120 dbm



TS-419/U



SIGNAL GENERATOR NE-12-20-SG

Attenuation - uncalibrated. Variable 3 to 70 db

Sensitivity to CW - Spectrum Amplified Pos. -- 80 db. below 1 watt for 1 inch deflection.

- Spectrum Position -- 55 db. below 1 watt for 1 inch deflection.

Maximum dispersion of spectra - 1.5 MC/S per inch

The government model TS-148/UP Spectrum Analyzer:

Frequency-meter Range - 8470 to 9630 MC/S
 ± 5 MC/S max. error.



TS-148/UP

**NORTHEASTERN
ENGINEERING, INC.**
manchester, new hampshire

SPECTRUM ANALYZER NE-11-20-S

LARGEST EXCLUSIVE MANUFACTURERS OF RF INTERFERENCE FILTERS



At COIL WINDERS, INC.
Westbury, New York . . .

They cast their lot with **SCOTCHCAST!**

REG. U.S. PAT. OFF.

BRAND

Before settling on "SCOTCHCAST" Resin to encapsulate their coils, Coil Winders, Inc., Westbury, New York, tried many variations of standard insulating methods. They wanted something *better* than just good. They wanted extremely high moisture resistance, superior physical and electrical properties. So they cast their lot (over 30,000 coils in the last year) with "SCOTCHCAST"!

"SCOTCHCAST" is a two-part liquid epoxy-type resin which when combined with a suitable hardener, quickly cures into a solid, shock-resistant, moisture-resistant plastic. It is avail-

able with a wide range of properties, in rigid, semi-rigid and flexible forms.

And remember this: Unlike other resins, "SCOTCHCAST" sticks tight to terminals and leads, most metals, plastics and conductors, yet it's unaffected by acids, alkalies, solvents, oils and water.

For complete information, write Minnesota Mining and Manufacturing Company, Dept. CA-95, St. Paul 6, Minn. Learn how "SCOTCHCAST" can save you time and money, how it can do things you'd never dream an insulating material could do! Write today!

PRODUCT OF
3M
RESEARCH

REG. U.S. PAT. OFF.

SCOTCHCAST Resin

BRAND

The term "SCOTCHCAST" is a registered trademark of Minnesota Mining and Manufacturing Company, St. Paul 6, Minn. Export Sales Office: 99 Park Ave., New York 16, N.Y. In Canada: P.O. Box 757, London, Ontario.



1. POTENT POWER +

Up to 5100 mmf
at 300 vDCw
Up to 3900 mmf
at 500 vDCw

2. SMALL SIZE

(size) Length 3/4"
average Width 7/16"
average Thickness 3/16"
DM-20 shown actual size

El-Menco Dur-Mica DM-20



DIPPED MICA CAPACITOR WITH
PARALLEL LEADS

3. PEAK PERFORMANCE

ideal for new miniaturized designs
and printed wiring circuits

MEETS ALL HUMIDITY, TEMPERATURE AND
ELECTRICAL REQUIREMENTS OF
MIL-C-5 Specifications!

TEST IT AND COMPARE!

- El-Menco's Dur-Mica DM20 costs even less than our famous molded mica capacitors.
- Provides greater versatility — wider applications.
- Tougher phenolic casing assures longer-life and greater stability through wide ranges in temperature.
- Parallel leads simplify application in transistor and sub-miniature electronic equipment including printed circuits for military and civilian use.

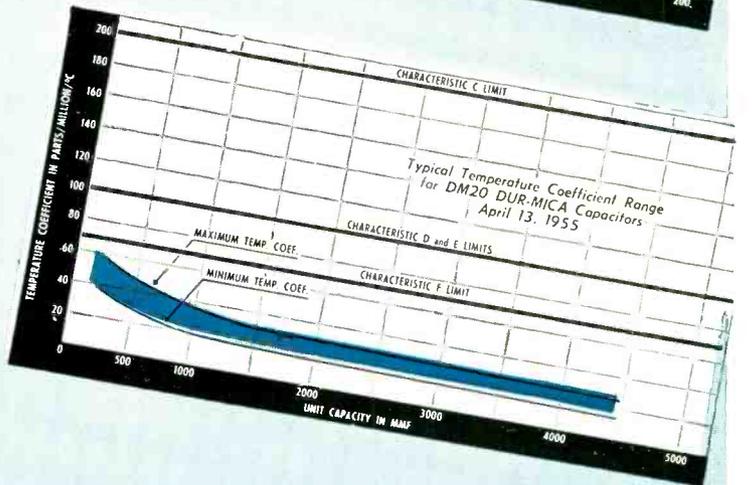
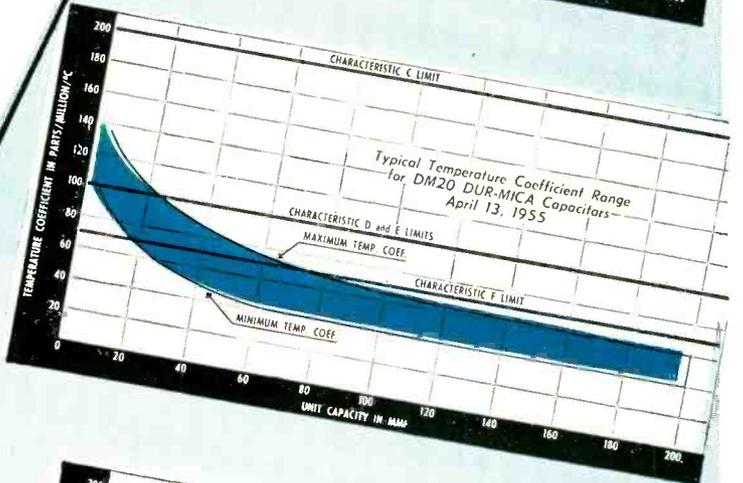
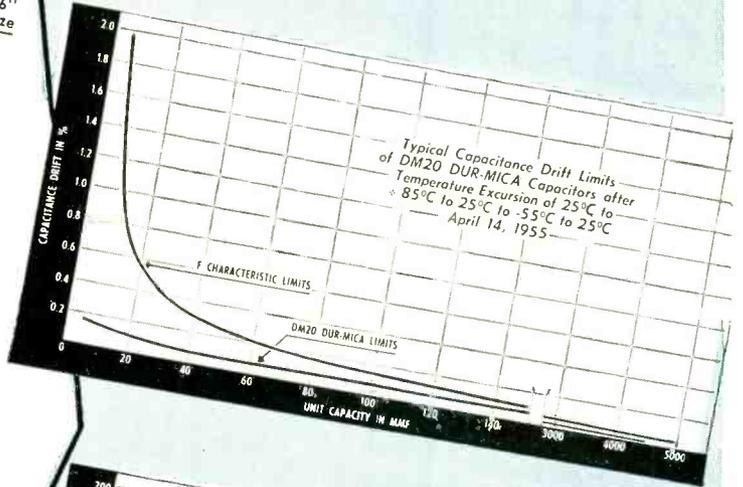
For Extreme Miniaturization Use Our DM15

DM15 — Up to 510 mmf at 300 vDCw
Up to 400 mmf at 500 vDCw

Available in 125°C operating temperature.
Minimum capacity tolerance available $\pm 1/2\%$
or 0.5 mmf (whichever is greater).



to meet modern
miniature
requirements



For your special requirements — we are pleased to offer information and assistance. Write for free samples and catalog on your firm's letterhead.

THE ELECTRO MOTIVE MFG. CO., INC.

WILLIMANTIC CONNECTICUT

- molded mica • mica trimmer
- tubular paper • ceramic

Arco Electronics, Inc., 103 Lafayette St., New York, N. Y.
Exclusive Supplier To Jobbers and Dealers in the U.S. and Canada

El-Menco Capacitors

Precision "Glasline" Crystals over a complete range of 800 cycles to 5 mc, including the JK G-12A with a proven stability of one part in one billion per day at 1000 kc.



To the man with a problem in

The engineer with an eye on new horizons finds kindred souls at the James Knights Company. For this is the home of today's top crystal engineers, and the source of today's most advanced crystal product developments.

Here you will find mature vision—a recognition that with channels narrowing, in an already congested radio spectrum, frequency control tolerances must narrow too. We are meeting that challenge.

Today James Knights crystal products are *certified* to previously unheard of stability tolerances, providing the advanced precision and stability necessary in the control of generated frequencies and filtered reception to assure interference-free land, sea and air communications. Today's longer range navigation systems, are basically dependent upon ultra-precise crystal controlled time bases.

Some of the newer JK developments outlined here show the new scope, the new opportunities provided you by today's advanced crystal engineering. The James Knights research and development laboratory is available to help in the solution of your frequency management problems.

THE JAMES KNIGHTS COMPANY
SANDWICH, ILLINOIS



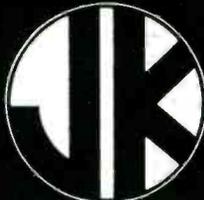
JK-09 OVEN

Precision Temperature Control, compact in design and capable of maintaining a set temperature around crystal with less than $\pm 1^\circ\text{C}$ variation over the range of -55°C to $+100^\circ\text{C}$.

Miniaturized Precision "Glasline" Crystals, in a range from 1000 cycles to 150 mc, combining minimum size with maximum stability.



Crystals for the Critical



PRODUCTS

Precision "Glasline" Crystal Filters, crystals plus all required circuit components including termination transformers sealed in a vacuum. A complete plug-in crystal filter designed for optimum performance and reliability. Frequency range and performance characteristics available upon request.



"Thermystal", an advance design that combines plug-in simplicity with extreme precision. Calibration accuracy: ± 1 cycle $\pm .0001\%$. Temperature stability: 30 to 900 kc $\pm .0001\%$, 1000 kc to 150 mc $\pm .00005\%$. Oven temperature varies less than $\pm 1^\circ\text{C}$ over range of -55°C to $+85^\circ\text{C}$. Secular stability: Less than .001% per year. Oven power: 6.3 V @ 1.5 amp. max.



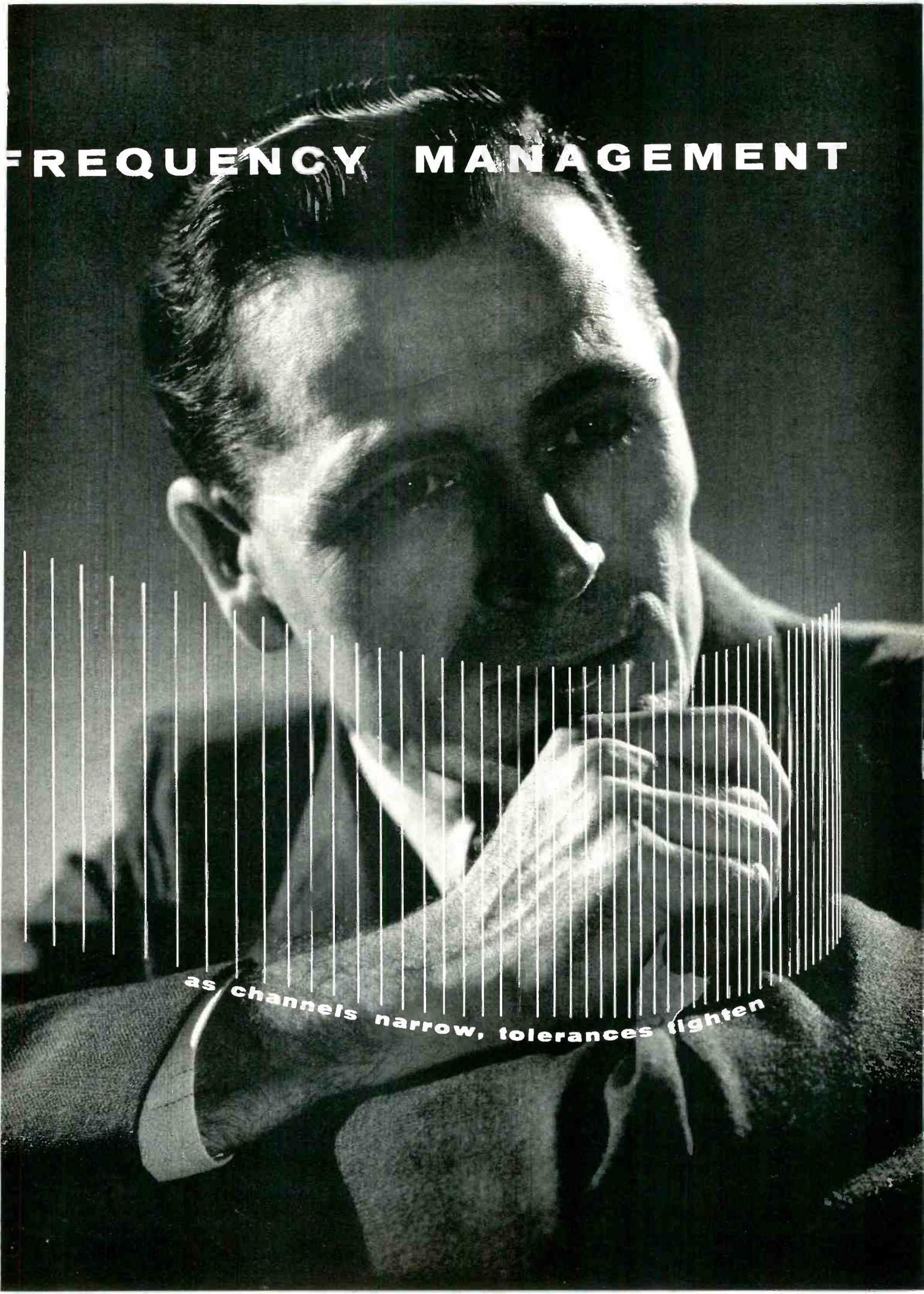
JK-THERMYSTAL

Complete Precision Plug-in Signal Source, a complete, precise crystal controlled transistorized oscillator compactly designed within the famous JK-09 oven, affording fixed temperature and humidity environment for transistor as well as all circuitry elements.

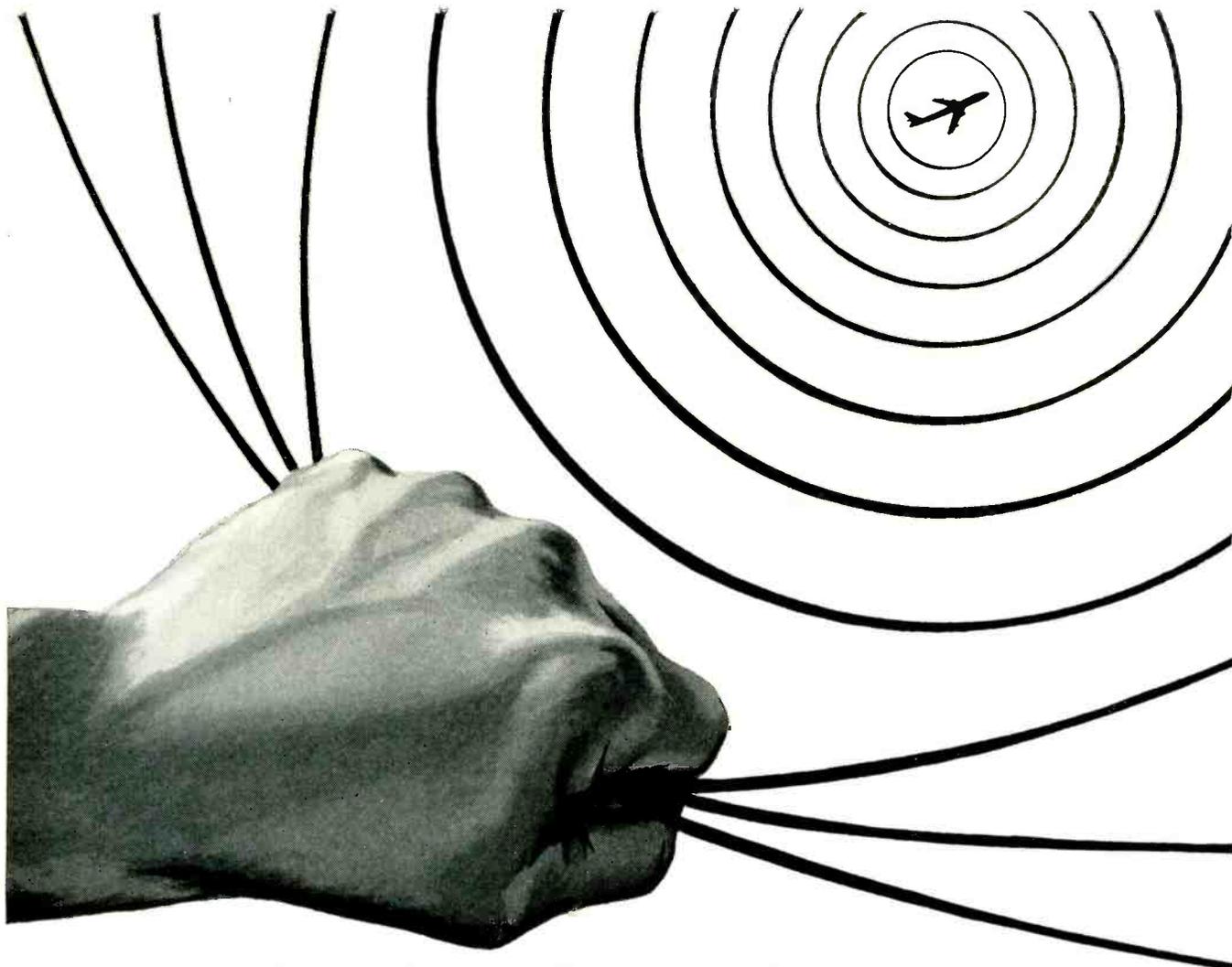
TRANSISTORIZED
THERMYSTAL OSCILLATOR



FREQUENCY MANAGEMENT



as channels narrow, tolerances tighten



Stretching the Path of an Electronic Pulse

Military coding equipment takes one pulse and inserts it into a delay line and in effect sends it over a number of paths, each of different lengths. Combining the output of the paths gives a pulse train with pulses spaced in accordance with artificial length of the path. Ordinarily the flexibility of the equipment is limited by the fixed taps in the delay line and the accuracy is established by auxiliary circuitry.

Now Admiral research has developed a completely new type of delay line which is infinitely

variable within its over-all capacity. It is adjustable with the greatest facility for any desired interval. The accuracy of this line is limited only by the accuracy of the measuring equipment. Moreover, the Admiral delay line requires less complicated switching apparatus. Weight and bulk are reduced. Fewer components permit faster production at lower cost. Here is one more example of Admiral's capabilities in the field of military electronics. Address inquiries to:

Admiral

C O R P O R A T I O N
Government Laboratories Division
Chicago 47, Illinois

LOOK TO **Admiral** FOR

• RESEARCH • DEVELOPMENT • PRODUCTION

in the fields of:

COMMUNICATIONS, UHF and VHF, airborne and ground.
MILITARY TELEVISION, receiving and transmitting, airborne and ground.

RADAR, airborne, ship and ground.

RADIAC • MISSILE GUIDANCE • CODERS and DECODERS
TELEMETERING • DISTANCE MEASURING • TEST EQUIPMENT



Send for Brochure . . . complete digest of Admiral's experience, equipment and facilities.

ENGINEERS! The wide scope of work in progress at Admiral creates challenging opportunities in the field of your choice. Write to Director of Engineering and Research, Admiral Corporation, Chicago 47, Illinois.



SERAMELITE

CAPACITORS

OPERATING TEMPERATURE

-65°C to +125°C



High Heat and Humidity Resistance • Low Cost



The Trend is to Seramics!

COMPARITIVE SERAMELITE SIZES

CAP MFD.	VOLTS	PAPER Dielectric Dia. Length	"MYLAR" Dielectric Dia. Length
.001	200	3/16 x 1	7/32 x 27/32
.0022	200	3/16 x 1	7/32 x 27/32
.0047	200	3/16 x 1	7/32 x 27/32
.01	200	3/16 x 1	7/32 x 27/32
.022	200	3/16 x 1	7/32 x 27/32
.047	200	3/8 x 1 1/2	3/8 x 1
.1	200	1 1/2 x 1 1/4	2 3/4 x 1
.22	200	1 1/2 x 1 1/4	3/8 x 1 1/4
.47	200	2 3/4 x 1 1/4	1 1/2 x 1 1/4
1.0	200	3/4 x 2 1/4	3/8 x 1 1/4

High performance and low comparative cost make GOOD-ALL "SERAMELITES" the number one choice.

Tubular ceramic case and new thermo-setting end seal will not lose its bond under any rated operating temperature.

Seramic plastic combination guarantees tightest possible seal against heat and humidity.

Good-All Seramelites are available with "MYLAR"* or paper dielectric. "MYLAR" offers the important advantages of high Insulation Resistance, Smaller Size and Higher Operating Temperatures (up to 125°C).

*Du Pont Trade Mark for its Polyester Film.

For further information, write direct or contact our nearest sales representative



ELECTRIC MFG. CO. 120 FIRST ST • OGALLALA, NEBRASKA



Dial Skirted Round;
175 Series
(actual size)

Why spend \$1.04 for this knob?

Sure, you could pay less for an ordinary knob, but the premium price of the Raytheon Standard Control Knob is well worth the difference! Here's why:

Raytheon knobs conform to government specifications for material, high and extreme temperature, humidity, salt spray, vibration, impact and torque. They are handsomely designed and molded of "Tenite II." They have anodized aluminum inserts with dual Allen head set screws. Most important, Raytheon knobs offer the smartly turned professional look that adds so

much to the fine appearance of your product. You put time, skill, money *inside* your equipment. You incorporate the finest circuitry; you select each component with care—your goal is quality in every detail. Naturally, this means quality *outside*, too. The right knobs, the finest knobs give the important finishing touch. They help convince your customers that yours is thoughtful, thorough craftsmanship.

Let us send you complete information on the finest control knobs available today. Write Dept. 6120, or see your electronic supplier.

OTHER FINE RAYTHEON STANDARD CONTROL KNOBS

Prices range from
69¢ to \$3.10



Round



Skirted
Round



Pointer



Skirted
Pointer



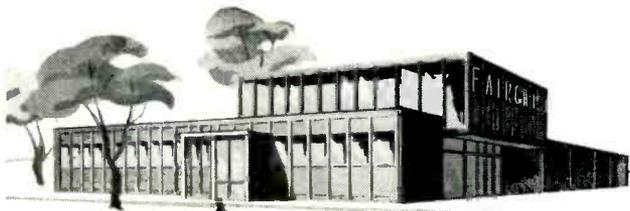
Crank Knob



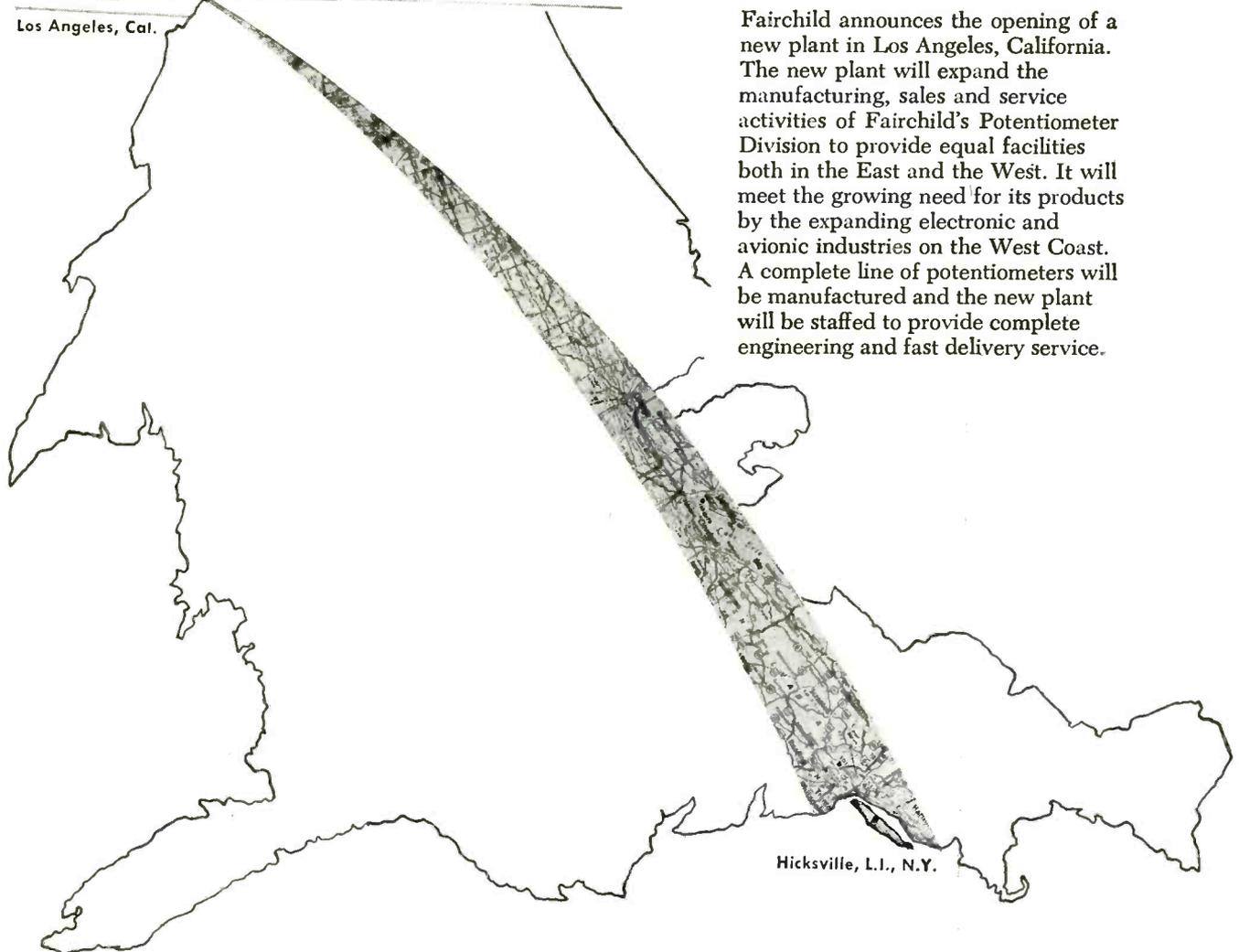
RAYTHEON MANUFACTURING COMPANY

Equipment Marketing Division

Waltham 54, Mass.



Los Angeles, Cal.



Hicksville, L.I., N.Y.

Fairchild announces the opening of a new plant in Los Angeles, California. The new plant will expand the manufacturing, sales and service activities of Fairchild's Potentiometer Division to provide equal facilities both in the East and the West. It will meet the growing need for its products by the expanding electronic and avionic industries on the West Coast. A complete line of potentiometers will be manufactured and the new plant will be staffed to provide complete engineering and fast delivery service.

AVAILABILITY AND SERVICE

from L.I. to L.A.

The opening of Fairchild's new West Coast plant means that henceforward the name Fairchild will not only stand for the finest in precision potentiometers . . . it will mean faster delivery and better service, too. You will be able to get complete engineering service, quotations, order handling, delivery and repair from either plant, whichever is most convenient to you.

This is another example of how Fairchild can always give you the answers, no matter what factors govern your choice of precision potentiometers. Write Potentiometer Division, Fairchild Controls Corp., a subsidiary of Fairchild Camera and Instrument Corp., Dept. 140-66A1.

EAST COAST
225 Park Avenue
Hicksville, L.I., N.Y.

WEST COAST
6111 E. Washington Blvd.
Los Angeles, Cal.



FAIRCHILD

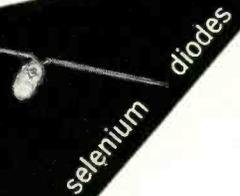
PRECISION POTENTIOMETERS

International

Selenium Rectifiers



high voltage cartridges



selenium diodes



hermetically sealed cartridges



industrial power rectifiers



selenium color tv rectifiers



selenium tv and radio rectifiers

The WIDEST RANGE in the INDUSTRY

- ★ Power Ratings from Microwatts to thousands of Kilowatts!
- ★ Efficiency to 87%

The most widely used Industrial Power Rectifiers in industry today.

International Rectifier

C O R P O R A T I O N

EXECUTIVE OFFICES: 1521 E. GRAND AVE., EL SEGUNDO, CALIFORNIA • PHONE OREGON 8-6281
New York Office: 501 Madison Avenue, Phone PLaza 3-4942 • Chicago Office: 205 West Wacker Drive, Phone FRanklin 2-3889
In Canada: Atlas Radio Corp., Ltd., 50 Wingold Ave. W., Toronto, Ontario • Phone RU 1-6174

WORLD'S LARGEST SUPPLIER OF INDUSTRIAL METALLIC RECTIFIERS

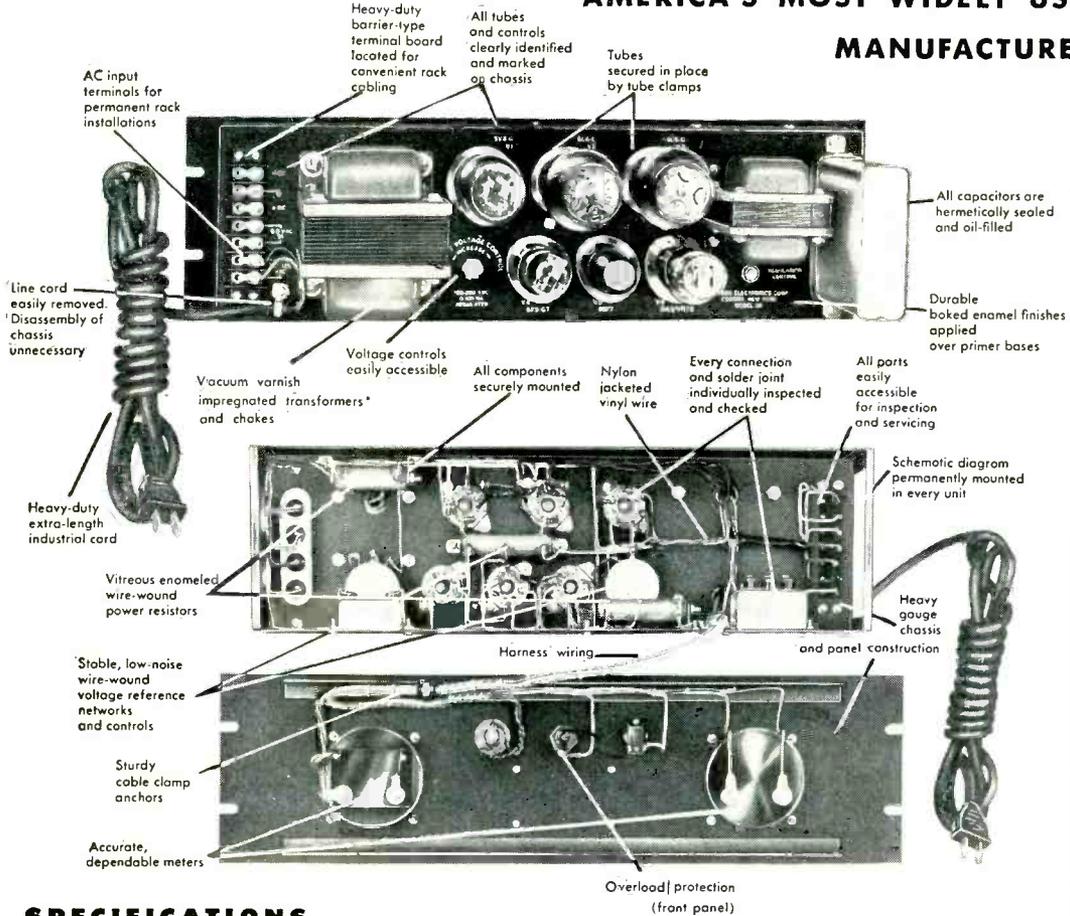
COMPLETE POWER SUPPLY

DEPENDABILITY \$57⁵⁰

FOR AS LITTLE AS



AMERICA'S MOST WIDELY USED POWER SUPPLIES,
MANUFACTURED AND GUARANTEED
BY LAMBDA



Model 28
200-325 VDC, 0-100 MA
\$57.50

Model 29
100-200 VDC, 0-100 MA
\$67.50

Model 28M (with meters)
200-325 VDC, 0-100 MA
\$87.50

Model 29M (with meters)
100-200 VDC, 0-100 MA
\$97.50

Rack models 28, 28M, 29 and 29M are long-lasting, dependable sources of power that deliver "workhorse" service... yet cost as little as \$57.50 (for Model 28).

Intended primarily for fixed voltage use, these compact supplies are precision-built, as carefully engineered and quality-controlled as the most intricate models. They provide a convenient, low-cost power source for auxiliary equipment, also are well suited to production line applications.

SPECIFICATIONS

DC OUTPUT (regulated for line and load):
Voltage and Current

Models	Voltage Range ¹	Current Range ²
28, 28M	200-325 VDC	0-100 MA
29, 29M	100-200 VDC	0-100 MA

¹Voltage is continuously variable over entire range.
²Current rating applies over entire voltage range.

Regulation (line) ... Better than 1%. For input variations from 105-125 VAC.

Regulation (load) ... Better than 1%. For load variations from 0 to 100 MA.

Internal Impedance ... Less than 10 ohms.

Ripple and Noise ... Less than 10 millivolts rms for Models 28, 28M. Less than 5 millivolts rms for Models 29, 29M.

Polarity ... Either positive or negative may be grounded.

AC OUTPUT (unregulated): 6.5 VAC at 3A (at 115 VAC input) ... Allows for voltage drop in connecting leads. Isolated and ungrounded.

AC INPUT ... 105-125 VAC, 50-60 CPS, 120 watts.³

³With all outputs loaded to full ratings and input at 125 VAC.

AMBIENT TEMPERATURE AND DUTY CYCLE ... Continuous duty at full load up to 50°C (122°F) ambient.

OVERLOAD PROTECTION:

External Overload Protection ... AC fuse, front panel.

INPUT AND OUTPUT CONNECTIONS: Heavy duty barrier terminal block, rear of chassis. 8 foot heavy duty rubber covered line cord with integral molded plug, also supplied.

METERS:

Output Voltage ... 3 1/2" rectangular voltmeter on meter models.

Output Current ... 3 1/2" rectangular milliammeter on meter models.

CONTROLS:

DC Output Control ... Screw driver adjusting control, rear of chassis.

AC Switch ... Front panel.

PHYSICAL DATA: Mounting ... Standard 19" rack mounting.

Size ... 5 1/4" H x 19" W x 8" D.

Weight ... 19 lbs. net, 23 lbs. shipping weight.

Panel Finish ... Black ripple enamel (standard). Special finishes available to customer's specifications at moderate surcharge.



LAMBDA Electronics Corp.

THE FIRST NAME IN POWER SUPPLIES

103-02 NORTHERN BLVD. • CORONA 68, NEW YORK



Vacuum-melted metals — new weapon in the fight for miniaturization . . .

Because of the superior properties of vacuum-melted metals, weight and size of motors, transformers, controls and instruments can be substantially reduced. What's more, vacuum-melted metal's greater magnetic permeability means you get superior performance . . . greater reliability. That's why they are being proposed for aircraft instruments, synchronous motors, power tubes, receiving tubes, controls for automatic production lines, computers.

The reason these alloys are superior is easy to explain. *Vacuum-melting removes unwanted gaseous impurities and inclusions — literally*

sucks them from the molten metal. Result: close composition control . . . high-purity, gas-free metals that far outperform those made by conventional air-melted methods.

Vacuum Metals Corporation, pioneer in development and leading producer of vacuum-melted and cast metals, has a wide variety of these unique new metals available for electrical and electronic uses. If you have an application you believe they can improve, please write, giving full details. Our engineers will give your letter prompt, careful attention. *Vacuum Metals Corporation, P. O. Box 977, Syracuse 1, N. Y.*



VACUUM METALS CORPORATION

Jointly owned by Crucible Steel Company of America and National Research Corporation

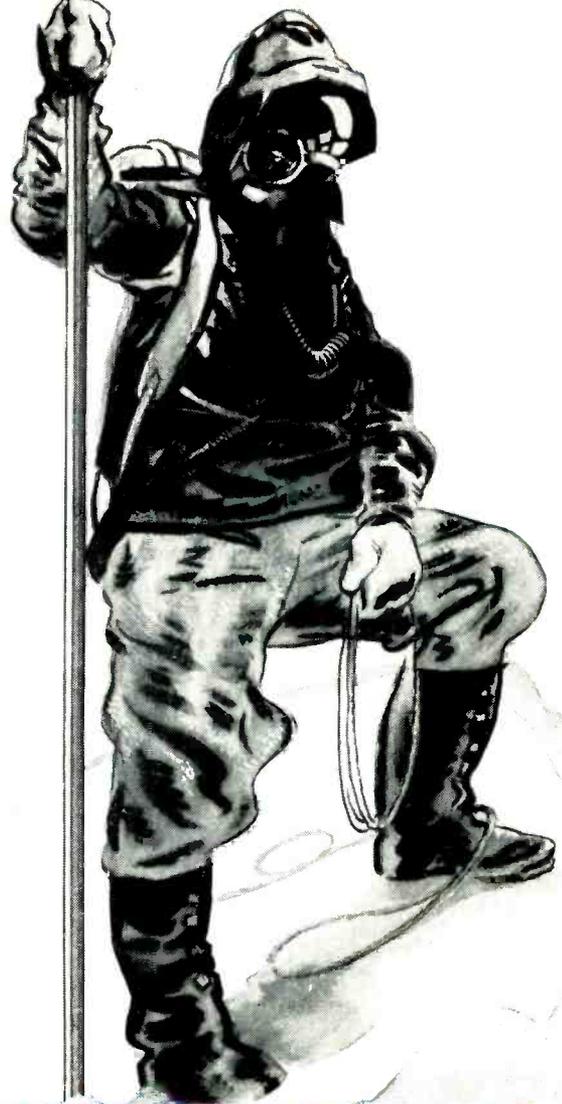
another conquest... this time in electronics

YOU TOO will be right ON TOP

See the new Solartron Transfer Function Analyser at Booth D 610, International Instrument Exhibition, Los Angeles, September 12th to 16th. Cable Solartron for our engineer to give you a demonstration. The advantages over contemporary equipment will cause you to use it, as do all United Kingdom G.M. manufacturers.



- Tests AC, DC or carrier servos
- Plots high accuracy Nyquist diagrams
- Covers 0.1 c/s to 1,000 c/s
- Independent of harmonics, noise and spurious frequencies
- Answers G.M., fire-control, simulator, computer, vibration, magamp and all servo problems



THE SOLARTRON ELECTRONIC GROUP LTD.

Thames Ditton, Surrey, England

Cables: Solartron, Thames Ditton

Telephone: EMBerbrook 5522

WHILE NEW YORK CITY SLEEPS Amperex® VHF TUBES STAND GUARD

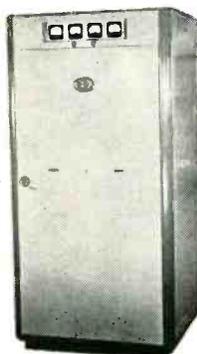
... and over 70,000 Amperex 5894 or 6252 VHF transmitting tubes are now in use all over the country, in approved equipment by Fire Departments, Civil Defense, Police and other Municipal Emergency Services ...

**because
Amperex TUBES
have proven
MOST DEPENDABLE**

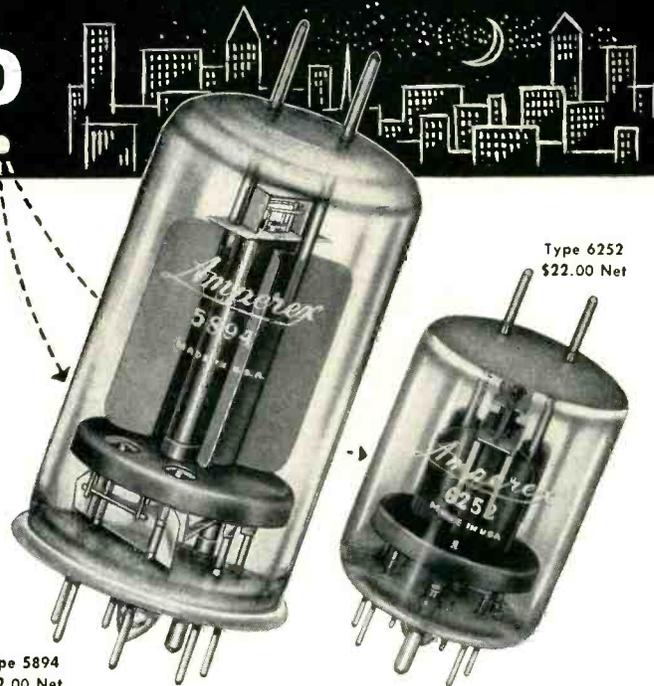
If disaster should strike, will your communication equipment meet the test? In time of disaster, there is no substitute for dependability — even initial cost becomes secondary! Long life, ruggedness and reliability were the watchwords in the final selection of these tubes. If you are planning new fixed or mobile stations, insist on AMPEREX type 5894 or 6252 to be sure!



Sonar Radio Corporation's FCDA-approved, Model CD-2 Transmitter, designed for CD fixed and emergency operation uses the Amperex type 6252.



Radio Engineering Laboratories' Type 715 Transmitter, used by New York City's Fire Department, employs the Amperex type 5894.



Type 5894
\$22.00 Net

Type 6252
\$22.00 Net

COMPARISON PROVES AMPEREX SUPERIORITY

Maximum Plate Input & Voltage VS Frequency
(Push-pull, Class C Operation)

Service ICAS	Frequency Band (Mc)	AMPEREX 6252		Nearest Rated Competitive Tube	
		Plate Input Watts	Plate Volts	Plate Input Watts	Plate Volts
Plate	144-148	72	600	49	435
Modulated	220-225	72	600	44	370
Telephony	420-450	51.5	475	31	300

The AMPEREX 6252 ICAS higher voltage and input ratings show the advantage of the independently suspended anode construction which eliminates the need for internal insulation. Competitive tubes use mica insulators between the plate and the rest of the internal structure, resulting in low maximum anode voltage and greater derating at higher frequencies.

RETUBE WITH Amperex

AMPEREX ELECTRONIC CORPORATION

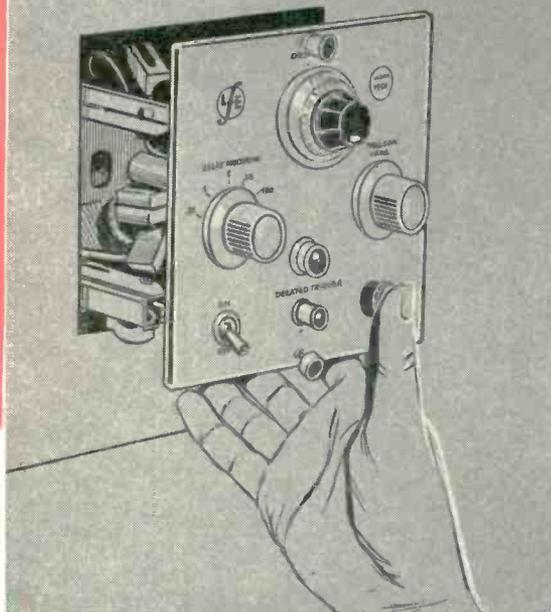
230 Duffy Avenue, Hicksville, New York

In Canada: Rogers Majestic Electronics Ltd.
11-19 Brentcliffe Road, Leaside (Toronto 17)



AS EASY AS ROLLING OFF A LOGARITHM.....

LFE'S *easy-six* →
411
OSCILLOSCOPE



We're frankly throwing out our chests.

In the 411 Oscilloscope we've come up with a Jack-of-all-trades that's master of every one! That's why we call it the "Easy-Six". This high-accuracy scope is so *easy* to operate, yet it features *six* X-axis plug-in units and all the bandwidth and sensitivity needed for advanced electronic research.

We're pleased as Punch to have engineered such a terrific scope, and we know you'll be just as pleased to use it. Here are some of the ingenious features of the "Easy-Six" that have put satisfied smiles on our customers' faces.

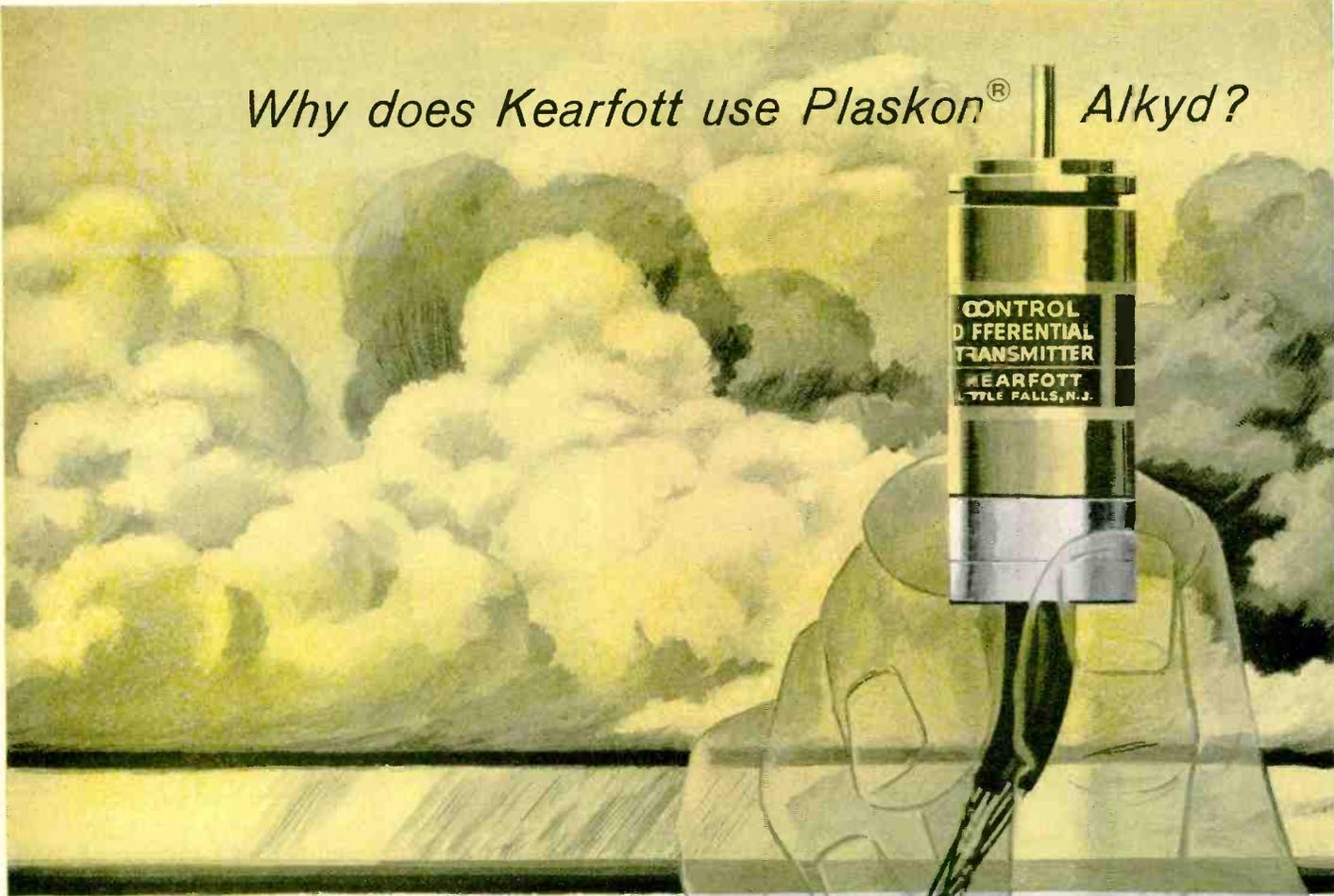
- **TRIGGER** — Only two controls needed — trigger selector and trigger amplitude.
- **DELAY** — One switch only. Simply turn sweep selector switch to delay. No additional cables necessary.
- **SWEEP SPEEDS** — No more than two controls needed to vary Sweep Speed. Direct-reading, incrementally variable Sweep Ranges, whose accuracy is maintained uniformly, avoid ambiguity and interpolations.
- **DELAY SYSTEM** — Delay control is calibrated *directly* in microseconds of delay. Same trigger for the delay as for the undelayed sweep.
- **VOLTAGE CALIBRATOR** — May be operated simply by turning the signal calibrator switch.

For specifications and more details about the "Easy-Six", write for our informative, free bulletin and the name of the LFE Engineering Representative nearest you.

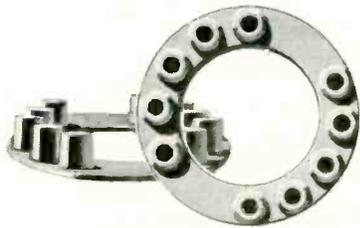


LABORATORY FOR ELECTRONICS, INC.
75 Pitts Street, Boston 14, Mass.

Why does Kearfott use Plaskon[®] Alkyd?



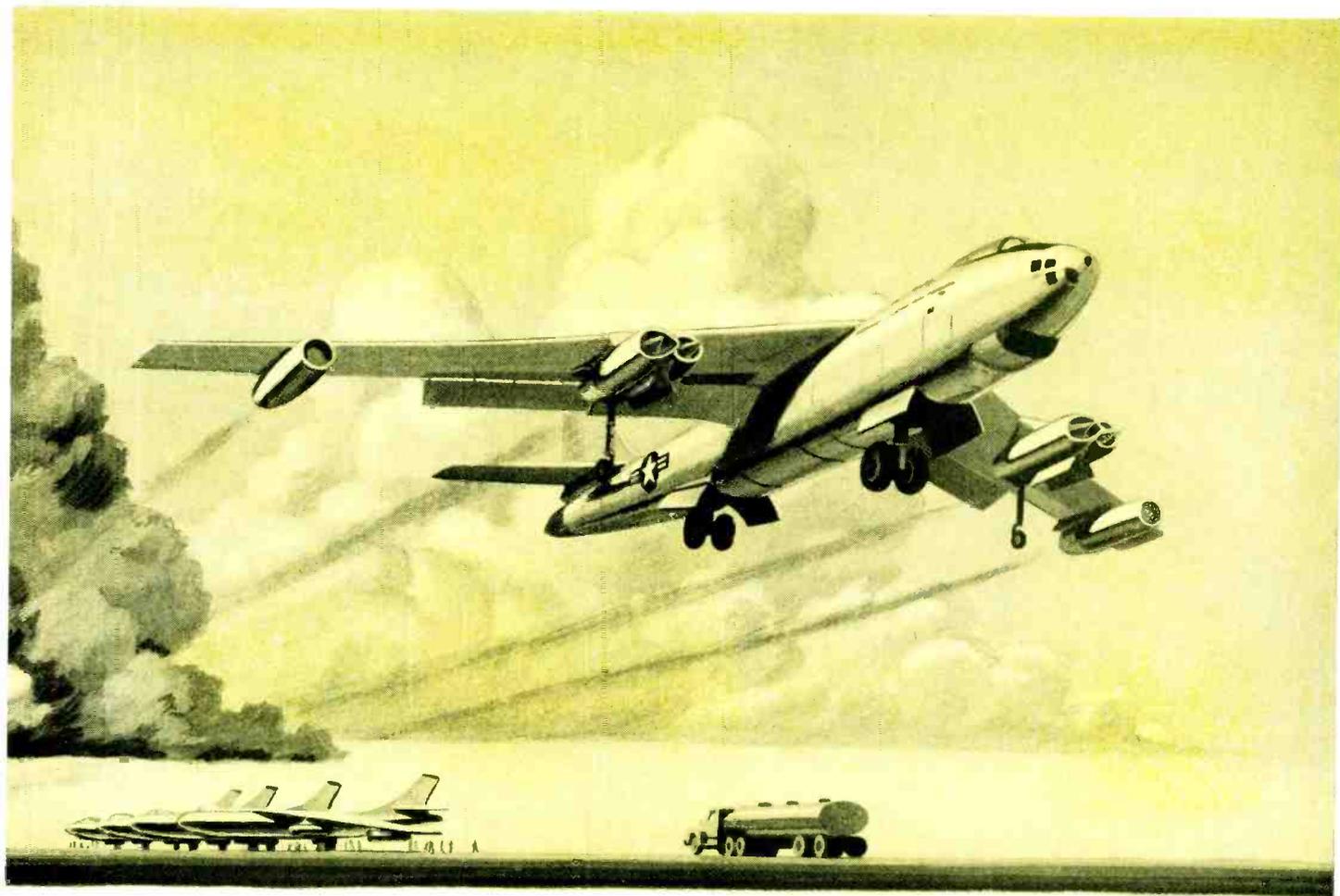
NO OTHER PLASTIC DOES



Servo-motor terminal-rings must have strength, be dimensionally stable and have excellent insulating properties to do their job effectively. PLASKON Alkyd Molding Compound meets all of these requirements and, thereby, contributes to the outstanding quality of the Kearfott units.



Matching end-cap and cover of synchro unit are made with extremely close tolerances in order to fit together exactly. PLASKON Alkyd is one of the few materials with sufficient strength in small sections to be acceptable for this application.



SO MANY JOBS SO WELL!

Highly exacting electronic devices are an old story to Kearfott Company, Inc., a leading manufacturer of miniature remote-control systems for aircraft and industry. One of Kearfott's synchro units (the smallest of its type on the market) is only $\frac{3}{4}$ " in diameter. This unit requires components made of a material with unusual talents. These include: 1. great strength and dimensional stability 2. arc-resistance and dielectric strength 3. resistance to humidity, fungus, shock and vibration.

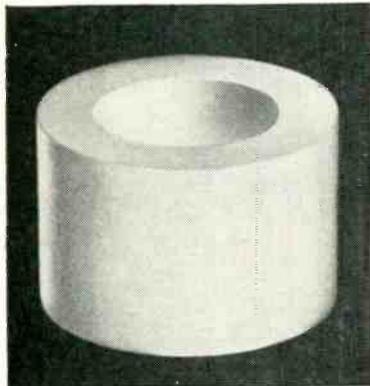
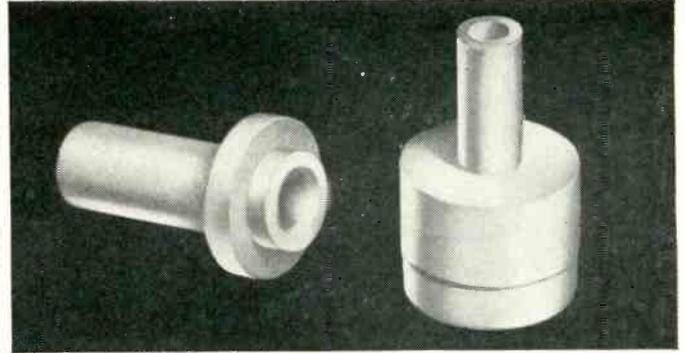
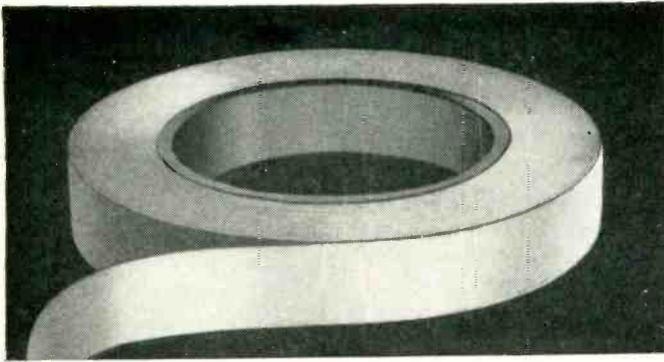
After much experimentation, reinforced PLASKON Alkyd Molding Compound was found to be the *one* material that had all the required properties. It has replaced *all other plastic materials* in this application.

In motor housings, end forms, brush holders and blocks where strength, dimensional stability and insulating properties are essential, PLASKON Alkyd has proved itself to be indispensable. Why not find out more about this unique material? Write today for complete technical data on our glass or mineral-filled Alkyd formulations.



For further information on PLASKON Plastics and Resins, address
BARRETT DIVISION, Allied Chemical & Dye Corp.,
40 Rector Street, New York 6, N. Y. HA 2-7300.

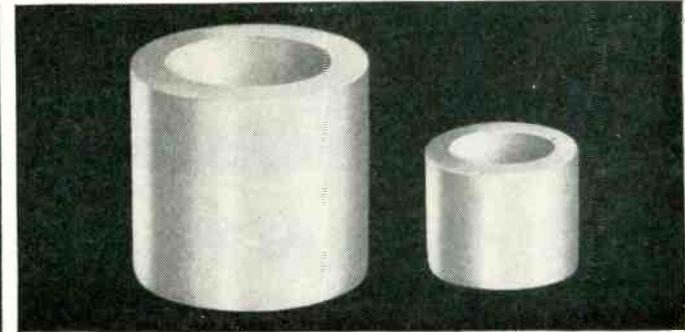
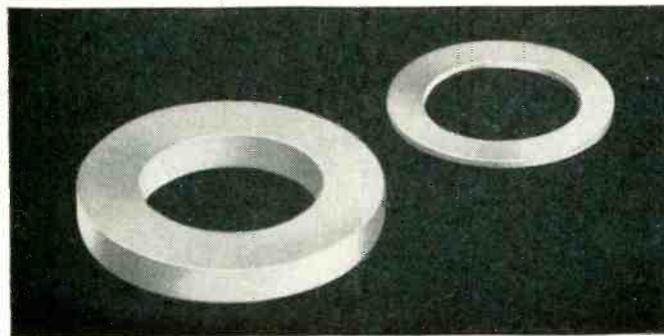
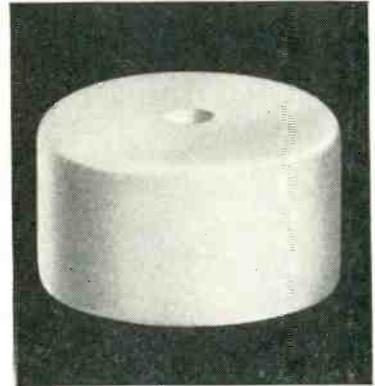




**TRY SOLVING YOUR
TOUGHEST PROBLEMS**

WITH

R/M Teflon*



Thousands of engineers have found that "TEFLON" has what it takes to solve some really tough problems in the electronics and electrical manufacturing fields. They have also found R/M, with its unmatched skill, experience and facilities, a tremendous help in solving those problems. For R/M has been working with this plastic ever since it first was produced. If you have a problem the chances are good that R/M has encountered it and already worked out a solution.

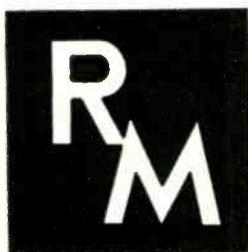
The several different products pictured above indicate R/M's versatility in "TEFLON" manu-

facture. We can fabricate parts to your own specifications or supply you with "TEFLON" in the form of rods, sheets, tubes or tape. For further information, write today.

PROPERTIES OF "TEFLON"

High dielectric strength • Moisture absorption zero • Unaffected by weather • Excellent heat stability up to 500°F. in continuous operation • As tape leaves no carbon residue along discharge path • High impact resistance • Nonadhesive • Stretches easily • Tensile strength 1500-2500 psi.

**Du Pont's trade-mark for its tetrafluoroethylene resin*



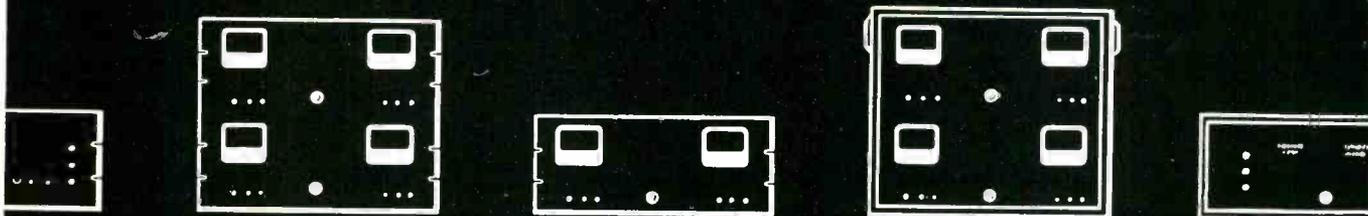
RAYBESTOS-MANHATTAN, INC.
ASBESTOS TEXTILE DIVISION, MANHEIM, PA.

FACTORIES: Manheim, Pa. • Bridgeport, Conn. • No. Charleston, S.C. • Passaic, N.J.
Neenah, Wis. • Crawfordsville, Ind. • Peterborough, Ontario, Canada
RAYBESTOS-MANHATTAN, INC., Asbestos Textiles • Packings • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Rubber Covered Equipment • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Bowling Balls

Four More...



Eight Ways...



NJE has added four more basic ranges to the most complete power supply line in the industry.

Each one is the result of dozens of custom inquiries, indicating a need for such a stock model.

Each is available eight ways—as always—rack, rack-with-meters, cabinet, cabinet-with-meters, and similarly in our 4-way "duals", to double the range in parallel, series-aiding, series-opposing and isolated modes.

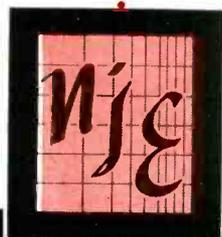
Each exemplifies the clean, conservative design and mass-production economy you have come to identify with NJE—the leader in the power supply field.

Model	Regulated Voltage Range Volts DC	Current Range MA DC	Line Regulation %	Load Regulation %	Unregulated Filament Supplies	Price (Rack - No meters)
S-150	200-325	0-200	0.3	0.3	Two - 6.35V @ 3A	\$ 96.00
S-250	100-200	0-200	0.5	0.5	Two - 6.35V @ 3A	\$104.00
S-350	200-325	0-300	0.3	0.3	Two - 6.35V @ 5A	\$137.00
S-900	0-600	0-300	0.3 or 0.5V	0.3 or 0.5V	Two - 6.35V @ 5A	\$225.00

Fixed or variable Bias supplies available. Meters, \$30.00 add'l. Cabinet, \$20.00 add'l.

Write for Catalog S-5

For our complete line of electronic power supplies See electronics Pp. 113-120 **BUYERS' GUIDE**



NJ E CORPORATION

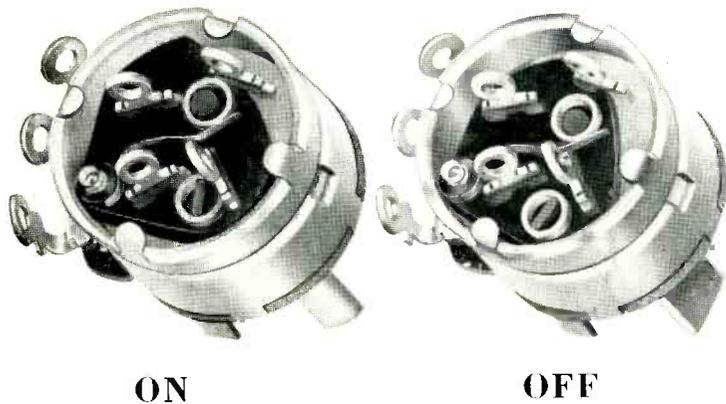
Electronic Development and Manufacturing

COMPETENT ENGINEERING REPRESENTATION EVERYWHERE

345 Carnegie Avenue
Kenilworth, New Jersey

Rapid, complete, competitive custom quotes from 1000 Amperes (low voltage) to 250 KV (low current).

POWER SUPPLIES UNLIMITED



Switch life is greatly increased by this new contact action. Note how "floating" rings of special Mallory alloy make and break the line circuit as the shaft is rotated—providing a continually changing contact surface.

Long-lasting "Floating Ring" Switch* Now Available on Mallory Controls

NEW CONTROL SWITCH WITH PUSH-PULL ACTION



Try this sales-worthy feature in your new set designs. The on-off switch works by push-pull action. Push the shaft and the set turns off . . . pull, and the set turns on at the same volume setting. The set owner doesn't have to re-adjust volume, and the control element lasts far longer because it is moved only for minor volume changes. This switch uses the same type of "floating ring" contacts as the new rotary switch. It is available for use with all Mallory carbon controls.

Serving Industry with These Products:

Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

Parts distributors in all major cities stock Mallory standard components for your convenience.

*Patent applied for

A NEW TYPE rotary switch, embodying unique contact action, is now available on Mallory carbon controls. Make and break is accomplished by spring-snapped motion of rings of special Mallory alloy, with positive self alignment. The rings "float" on pins so they can rotate with each operation.

Extremely long service life, proved on actual tests. The floating action spreads wear and arc erosion around the whole circumference of the rings . . . gives cleaner make and break.

Protection against overload damage. The snap spring which moves the contacts carries no current . . . won't heat and anneal when overloads occur.

Positive "feel". Positive snap action "feel" provides definite assurance of switch operation, with minimum torque requirement.

Available for use with all Mallory carbon controls, the new switch *costs no more* than conventional designs. In combination with high stability, long-wearing, low-noise Mallory resistance elements—in values from 250 ohms to 10 megohms—it gives you unequalled control performance. For full facts, write or call Mallory today.

Expect more . . . Get more from

P. R. MALLORY & CO. Inc.
MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

CROSS TALK

► MECHANIZED PRODUCTION

... History will record 1955 as a year of transition in the electronics industry. This is the year to which engineers of the future will attribute the beginning of mechanized production.

Many of the techniques required for mechanized production have long been in the wood. Nearly thirty years ago a line of radio sets was wired by flowing molten metal into grooved plastic boards; stamped, printed or etched loops, coils and subassemblies are by no means new. Component leads have been semi-automatically bent, clipped or otherwise prepared for assembly for many years. Dip soldering has been extensively used since the war. *ELECTRONICS* published a story about a completely hygienic machine-made radio in '48. In '43 we described an almost-human production tester.

Until now these fascinating techniques have not been too successfully used in combination. Nor is mechanized production involving them yet completely devoid of bugs. An extensive survey of the industry (page 137) indicates, however, that we are well on the road toward a combination of fabrication, assembly and testing methods that can hold the price line despite rising labor costs, insure rapid production of highly specialized apparatus on short notice and increase equipment reliability.

In the past a plurality of proposed approaches to mechanization muddled the waters. Possible methods of "printing" wiring have been as numerous as leaves on the trees. There has been a healthy difference

of opinion as to whether or not component parts themselves should be printed. Several methods of interconnecting parts have challenged the dominion of heat, lead and tin. Builders of assembly machines couldn't make up their minds how far, or how fast, to carry the untouched-by-human-hands torch. Even the ingenious early designers of automatic testers fluctuated between a circuit-by-circuit and an overall-performance check.

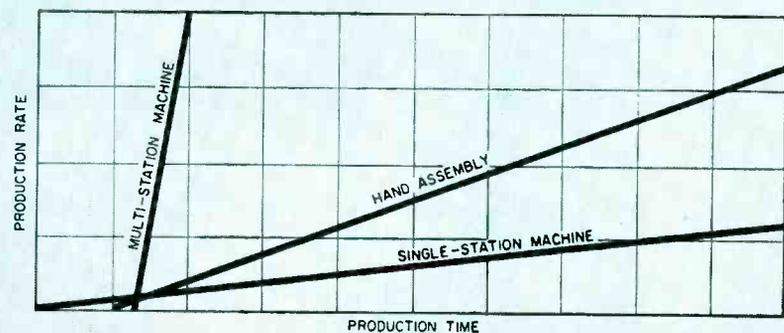
Now the electronics industry has made up its mind about mechanized production with sufficient unanimity to get going. It has finally concluded that regardless of product, or size of run, some sort of mechanization more closely approaching a pushbutton age is necessary.

Etched wiring has at least momentarily achieved almost universal acceptance. Component parts made expressly for semi-automatic or fully automatic insertion domi-

nate planning for the immediate future. Dip soldering is becoming a conventional method of interconnecting parts. One type of assembly machine is built to handle short runs of critically complex equipment while another seems more at home on long runs of radio and tv sets, and there are others betwixt and between. Automatic testers constitute the weakest link in the chain, but the incentive to develop them further is increasing as the other techniques fall into place.

Two important lessons have been learned in the industry's period of gestation on the subject of mechanized production. One, that any attempt to jump from hand operation to fully automatic methods in one fell swoop is likely to fail. Two, that machines and setups and systems must be sufficiently flexible or open-ended to permit the frequent changes that are so necessary in our field.

THREE ASSEMBLY METHODS . . .



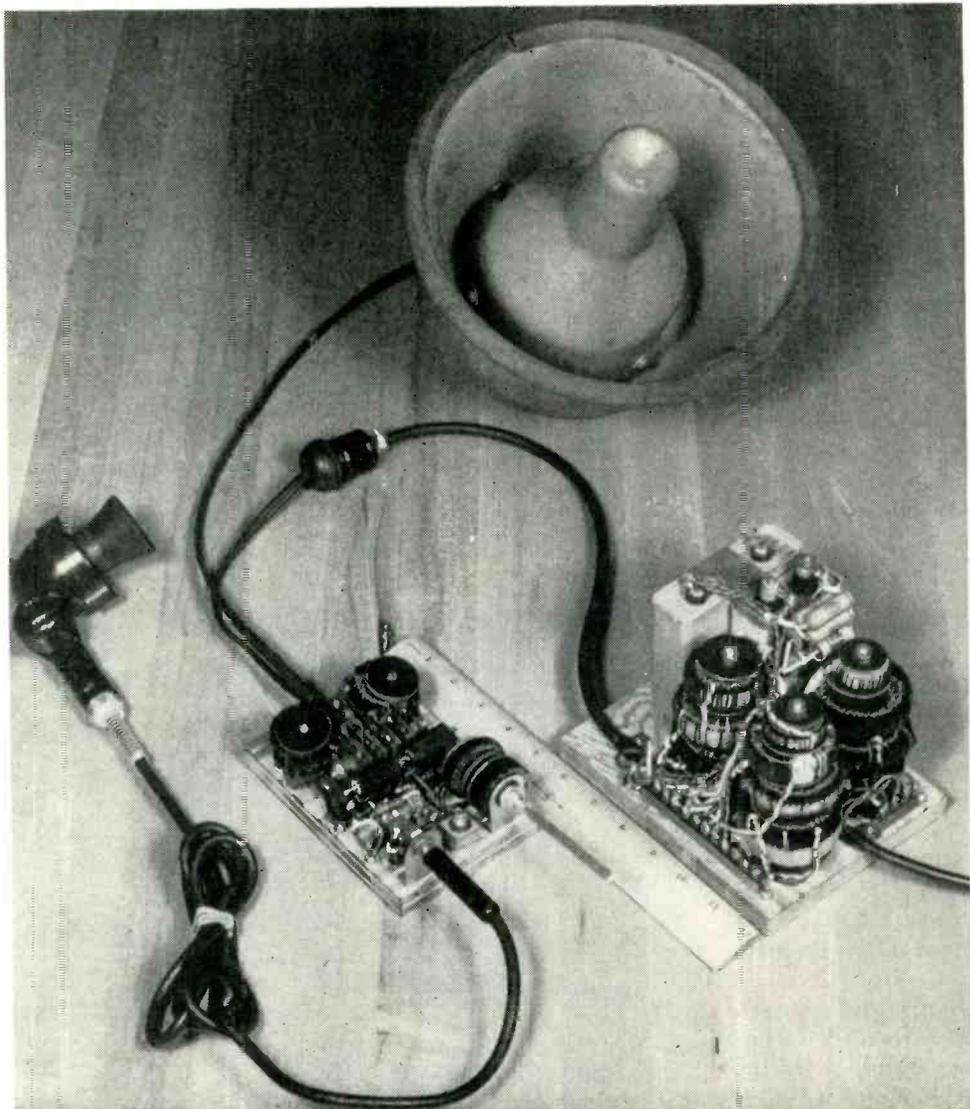
The speed with which a production line inserting parts on wiring boards can get started, the rate at which production can be stepped up and the quantity ultimately obtainable from a given set of facilities depend upon the approach chosen by engineers (page 137)

All-Magnetic

SUMMARY — Three cascaded magnetic frequency triplers provide 10,800-cps carrier from 400-cps line for tubeless audio amplifier with zero warmup time. Potting of entire unit gives ruggedness for aircraft applications

By **J. J. SUOZZI** and **E. T. HOOPER**

*Magnetics Division
U. S. Naval Ordnance Laboratory
White Oak, Maryland*



Experimental model of tubeless audio amplifier. Assembly can be packaged in a unit 5 in. x 5 in. x 6 in.

Audio Amplifier

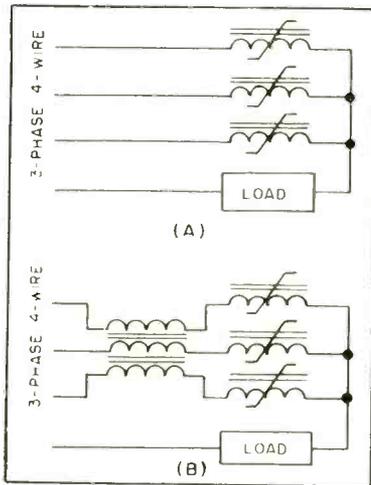


FIG. 1—Basic three-phase tripler (A) and single-reactor tripler (B)

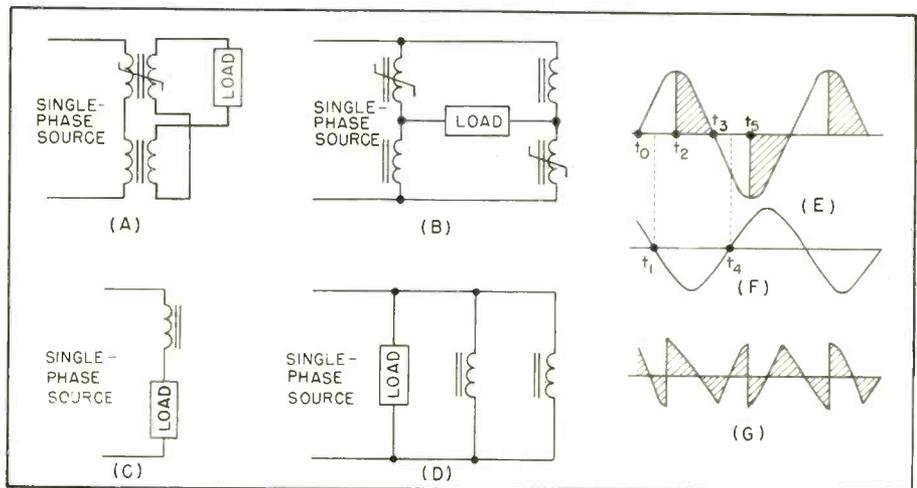


FIG. 2—Single-phase transformer-type tripler (A) and bridge type (B). Waveforms are for equivalent circuits (C) and (D) of bridge circuit

USE of magnetic amplifiers for audio amplification necessitates generation of a carrier frequency at least three times the upper bandwidth limit. Vacuum-tube oscillators and rotating machines are unsuitable for this function because they introduce short life or moving parts, thus losing the major advantages of magnetic amplifiers. Switching transistors associated with saturable reactors are a promising high-frequency source but are still in a developmental stage.

The combination of static magnetic frequency multipliers of improved design with a half-wave bridge-type magnetic amplifier has led to the development of an audio system of low distortion, good bandwidth and practical size.

Magnetic Power Supply

The high-frequency power supply consists of three cascaded frequency triplers of the magnetic-core type.

A carrier of 10,800 cps was chosen to obtain the least amount of frequency multiplication while allowing a sufficient bandwidth to be obtained from a half-wave magnetic amplifier. Higher bandwidth and fidelity could be obtained by using a still higher carrier frequency.

Three frequency triplers are cas-

caded to obtain the carrier from the 400-cps line. The first stage is a three-phase tripler followed by a modified transformer-type and a bridge-type single-phase tripler.

The basic three-phase tripler is shown in Fig. 1A. The modified circuit in Fig. 1B was used in the amplifier. This tripler consists of a single linear reactor with three separate windings allowing a combination of the action of separate reactors and the single-winding reactor depending on the amount of coupling. The output of the tripler can be fed into a tuned circuit to obtain a good sinusoidal waveform. In this case, only a capacitor was needed.

Reactor Design

The design of a basic three-phase tripler as shown in Fig. 1A is

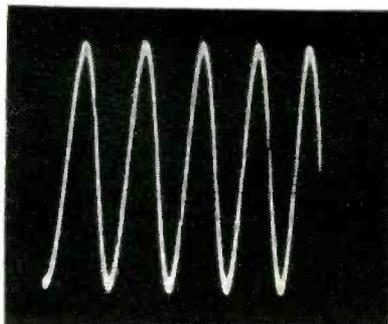


FIG. 3—Output waveform of magnetic frequency tripler

straightforward. Each saturable reactor is designed to fire between 120 and 137 deg depending on whether the core material is sharply saturating or not. If inductance is used in series with each saturable reactor, a firing angle of 120 deg will be safe even with very sharply saturating material, since circulating currents between phases will be minimized.

The number of turns for a given reactor can be computed from $E = 4.44 BNAf \times 10^{-8}$ where E is the rms value of phase voltage (for 120-deg firing angle, use $\frac{1}{3} E$), B is residual flux density in gauss, N is number of turns, A is cross-sectional area of core in sq cm and f is line frequency in cps.

This formula is approximate. It may be necessary to add or subtract a few turns for exactness. The three-phase tripler is capable of operating at efficiencies as high as 98 percent since the only appreciable power losses are in the core of the saturable reactors and in the I^2R losses of the windings. The tripler used in the first stage of the power supply has an overall efficiency of 90 percent.

Single-Phase Tripler

Operation of single-phase triplers depends on the superposition of a sinusoidal and distorted voltage or

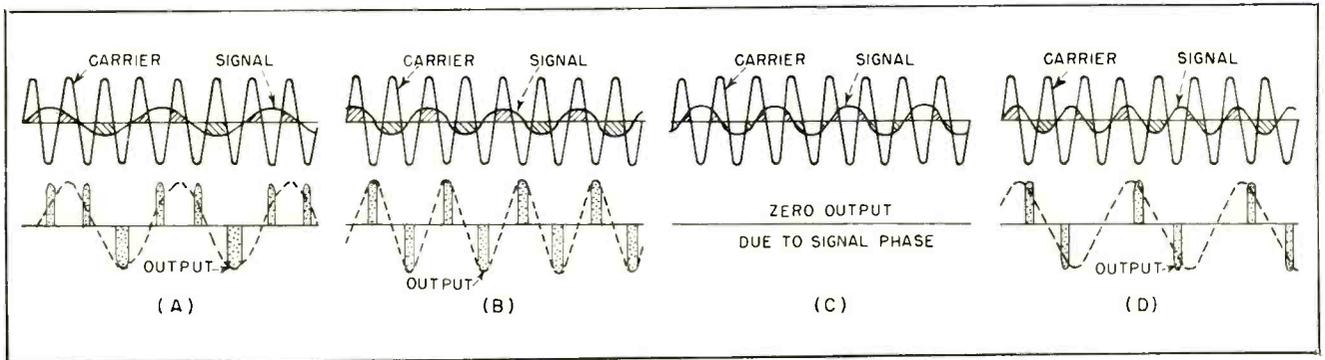


FIG. 4—Distortion effects at signal frequencies one third (A), one half (B) and (C), and two thirds of carrier frequency (D). At half carrier frequency output is reduced depending on phase relationship of signal and carrier

Table I—Reactor and Transformer Winding Data for Frequency Multiplier

	Core			Windings		
	No.	Material	Size in Inches	No.	Wire Size	Turns
SR ₁ SR ₂ SR ₃	1	3/8 × 0.0002 Orthonol tape	1 1/4 i-d, 1 3/4 o-d	1	No. 20	260
SR ₄	1	3/8 × 0.0002 Orthonol tape	1 1/4 i-d, 1 3/4 o-d	1	No. 20	140
SR ₅	1	1/4 × 0.001 Orthonol tape	7/8 i-d, 1 o-d	2	No. 23	130
LR ₁	2	Western Electric No. 478438 or Arnold Eng. No. A-438281-2 Moly-Permalloy Dust		3	No. 20	100
LR ₂	2			2	No. 20	100
LR ₃	1			1	No. 16	100
LR ₄	1			1	No. 16	75
LR ₅	1			2	No. 23	70
LR ₆	2			1	No. 16	30
LR ₇	1	Western Electric No. 476930 or Arnold Eng. No. A-930157-2 Moly-Permalloy Dust		1	No. 16	26
T ₁	1	Western Electric No. 467585 or Arnold Eng. No. A-585079-2 Moly-Permalloy Dust		2	No. 23 No. 23	420 60

current. A linear reactor is used to produce the sinusoidal voltage and necessary phase shift while a saturable reactor produces the desired distorted waveform. These two voltages are combined by the transformer-type circuit of Fig. 2A or the bridge-type circuit of Fig. 2B. Figure 2C and Fig. 2D show the equivalent circuits of the bridge-type tripler.

Assuming the saturable reactor characteristic has a rectangular loop with no width and that the saturated impedance is zero while the unsaturated impedance is infinite, the saturable reactor is unsaturated during time t_0 to t_2 in Fig. 2E and the equivalent circuit of the

tripler becomes as shown in Fig. 2C. During this time, the load voltage is sinusoidal and lagging with a phase angle of $\arctan X_L/R$. This waveform is shown in Fig. 2F but with 180-deg phase displacement due to the circuitry.

From t_2 to t_3 , the saturable reactor is saturated, and the equivalent circuit becomes as shown in Fig. 2D. The voltage across the load is now the line voltage as shown in the shaded area of Fig. 2E. From t_3 to t_4 , the saturable reactor is unsaturated and the equivalent circuit reverts back to that of Fig. 2C. The voltage on the load is once again sinusoidal and lagging the line voltage. This process is re-

peated on each succeeding half cycle yielding the basic output waveform shown in Fig. 2G.

To obtain a good basic waveform on a resistive load, the saturable reactor should be designed to fire at 90 deg. The inductive reactance of the linear reactor should be approximately equal to the load resistance.

The efficiency of the first single-phase tripler in the power supply is 70 percent. To improve waveshape, the efficiency of the last stage of the power supply was reduced to 35 percent.

The overall efficiency of the power supply is 21 percent. The output is 25 watts at 40 volts at a fre-

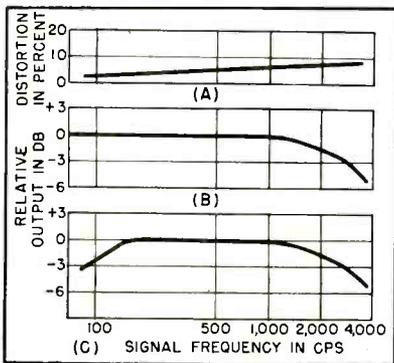


FIG. 5—Amplifier distortion (A) and response (B) with system response (C)

Table II—Reactor Winding for Magnetic Amplifiers

Winding	Wire Size	Turns
N_1	No. 20	130
N_2	No. 20	130, tapped at 50 turns
N_3	No. 20	10

All cores— $\frac{1}{8}$ in. \times 0.001 Orthonol tape $\frac{7}{8}$ in. i-d, 1 in. o-d

phase and magnitude of the effective signal during the control half-cycle.

For signal frequencies below half the carrier frequency, for example 3,600 cps as shown in Fig. 4A, the output is essentially 3,600 cps. At half the carrier frequency, or 5,400 cps, the output is either 5,400 cps as in Fig. 4B, or zero as in Fig. 4C, depending on the phase of the signal with reference to the carrier. For signal frequencies greater than half and less than the carrier frequency, for example 7,200 cps, the output is seen to contain a large component of 3,600 cps (Fig. 4D). This beat frequency between the signal and carrier frequencies is the source of the nonlinear distortion. In addition, for signal frequencies approaching half the carrier frequency, reduced output is obtained depending on the relative phase between the signal and carrier.

The overall frequency and nonlinear distortion of the amplifier working from the frequency multiplier was less than 10 percent over the bandwidth. A plot of distortion versus frequency is shown in Fig. 5A.

The bandwidth of the audio amplifier is zero to 3,000 cps as shown in Fig. 5B.

System Performance

A schematic diagram of the entire audio system is shown in Fig. 6. The input circuit consists of a carbon microphone, transformer and d-c source. The d-c voltage is obtained by rectifying and filtering a portion of the 10,800-cps voltage. Output of the amplifier is fed directly into the voice coil of a permanent-magnet speaker. The bandwidth of the entire system is 90 to 3,000 cps as seen in Fig. 5C.

The physical size of the entire unit can be seen from the photograph. The amplifier and power supply can be packaged in a unit 5 in. \times 5 in. \times 6 in.

Audio output power is 2.5 watts with less than 10 percent distortion over the frequency range. Since no warmup time is required, the system will operate without standby power and the unit need be excited only when voice amplification is desired. Thus a push-to-talk switch could be the on-off power switch.

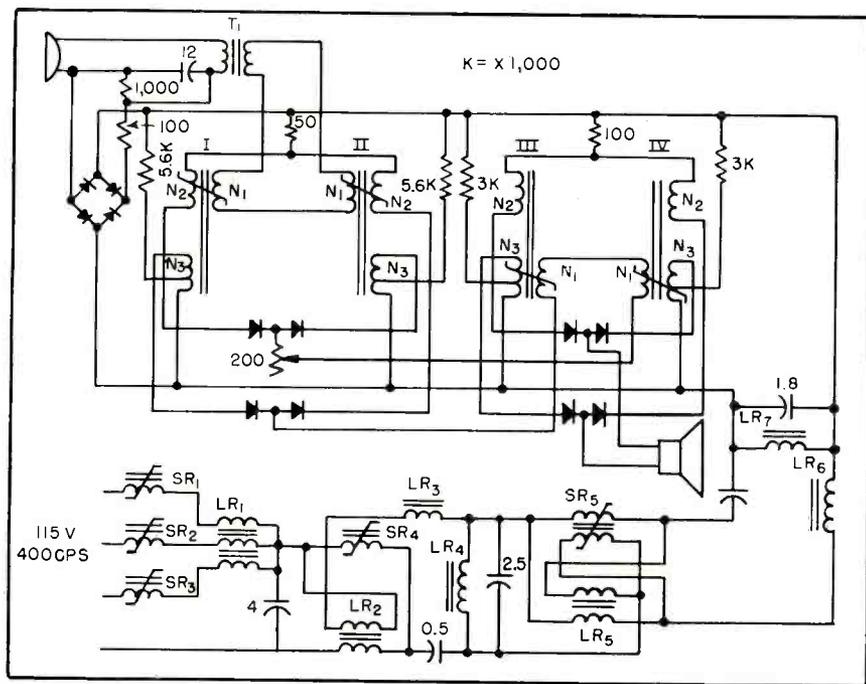


FIG. 6—Circuit of magnetic audio amplifier. Microphone transformer uses same molybdenum core as LR_0 and is wound with 420 turns and 60 turns of No. 23 wire to provide 7-to-1 stepdown

quency of 10,800 cps with harmonic distortion less than 5 percent. An oscillogram of the output waveform is shown in Fig. 3.

Magnetic Amplifier

The magnetic amplifier designed for operation with the high-frequency power supply must have a low power demand since limited power is available. Also, little or no direct-current component must be drawn from the multiplier and the amplifier must have sufficient bandwidth to reproduce satisfactorily audio signals. A two-stage half-wave magnetic amplifier was chosen to meet these requirements. It consists of two saturable reactors per

stage, appropriate selenium rectifiers and other static components. The power gain is about 1,000.

The complicated nature of control in the magnetic amplifier causes both frequency and nonlinear distortion under certain conditions. These effects are shown in Fig. 4.

The magnetic amplifier is controlled during some presetting period. In this case this period occurs during alternate half-cycles of the carrier. The portion of the signal that is effective in controlling the amplifier is indicated by the shaded area. Because the bridge-type amplifier is phase reversible, the phase and magnitude of the output on each half-cycle is determined by the

Transistor Modulator

SUMMARY — Germanium diode bridge and three-stage amplifier employing *pn*p junction transistors converts d-c control signal to reversible-phase a-c. Use in flight trainers involves converting analog computer output into signals for autopilot with minimum expenditure of power and space

By **GEORGE M. ETTINGER***

English Electric Company
Rugby, England

CONVERSION of low-level d-c into reversible-phase a-c is accomplished with minimum expenditure of power and a saving of space by the transistor modulator.

Applications include flight simu-

lators where d-c outputs from analog computers are to be translated into a modulated a-c input for autopilot installations. The modulator is characterized by fairly small drift (less than 25 mv in

three days) and acceptable linearity (dynamic range between drift level and maximum signal of the order of 30 db). No sharply tuned circuits are employed.

Circuit Details

Conversion is effected in a germanium diode bridge modulator circuit which is relatively insensitive to variation of diode parameters since the balance point is determined essentially by the ratio of fixed ohmic resistances rather than by the ratio of diode resistances.

The modulator bridge feeds a three-stage *pn*p junction transistor amplifier using grounded emitter connections. Depending on required amplifier output voltage, the amplifier load may be transformer coupled or R-C coupled.

Figure 1 shows the complete circuit of the instrument. Four GEC type X55/1 high-back-resistance germanium diodes are connected in a bridge. A shielded transformer provides excitation of less than 1 volt at 400 cps although excitation at other frequencies is possible.¹ Balance of the resistance bridge shown shunting the diode bridge of Fig. 1 is adjusted by a 25,000-ohm potentiometer.

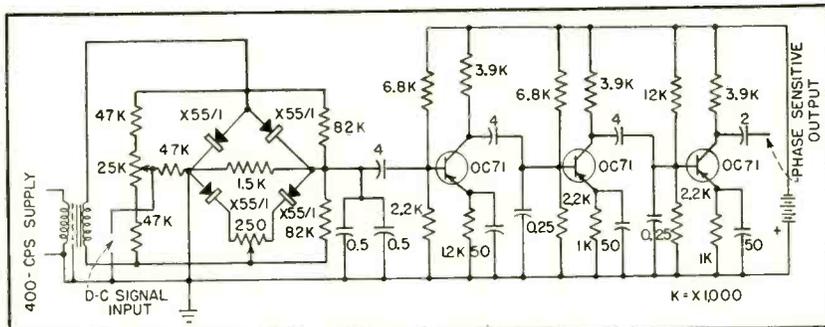


FIG. 1—Modulator uses full-wave germanium diode bridge and three-stage transistor amplifier

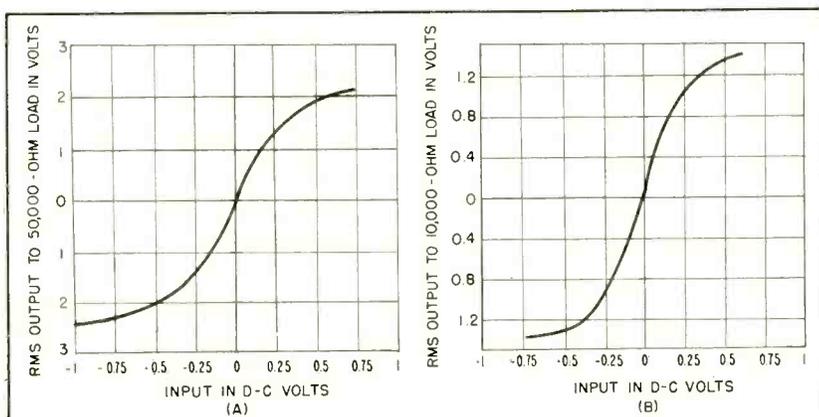
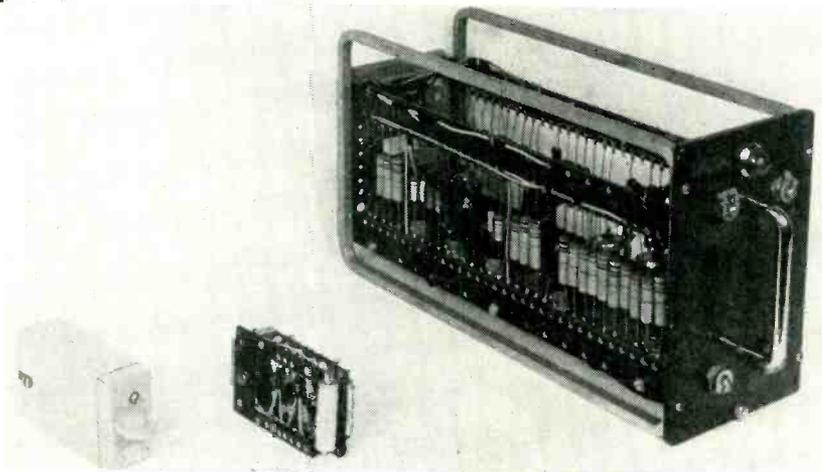


FIG. 2—Transfer characteristics of modulator working into a 50,000-ohm load (A) and 10,000-ohm load (B)

* This work was done at Air Trainers Ltd., Aylesbury, England.

for Flight Trainers



Two views of transistor modulator (left) and electron-tube unit which it replaces

During the nonconducting half-cycle the d-c input signal is connected in series with the bridge load. When the diodes conduct, the resistance bridge is short-circuited. A 250-ohm potentiometer is provided to balance the rectifier forward resistances. Harmonic currents generated in the absence of d-c input are attenuated by two 0.5- μ f capacitors which shunt the bridge load. Where drifts of the order of ± 10 mv are acceptable, it is unnecessary to select specially balanced diodes.

Bridge output impedance is chosen to be of the same order of magnitude as the input impedance of the first transistor stage. The impedance could be increased considerably by connecting a large unbypassed resistor in series with the emitter of the first stage.² In the present circuit, the amplifier input resistance totals just over 1,000 ohms.

Large emitter bypass capacitors are provided in each amplifying stage. These are necessary not so much to maintain high gain at the operating frequency of 400 cps but rather to minimize phase shift. The manufacturer's rated dissipation of 6 milliwatts for the OC71 junction transistors is not exceeded under any operating conditions, including those where amplifier power

supply voltage changes by ± 20 per cent.

Conversion gain (defined as rms voltage output into a 50,000-ohm transformer-coupled load divided by d-c input voltage from a 20,000-ohm source), is six. Working into a 10,000-ohm R-C coupled load conversion gain is four. Transfer characteristics are shown in Fig. 2.

Drift was equivalent to 12 mv d-c input over a three-hour period and 25 mv over 68 hours. Maximum output of 2 volts rms into 50,000 ohms was obtained for 400 mv input, giving a dynamic range between drift input and full input of the order of 30 db. Limiting occurs in the last transistor stage. Dynamic range measured to the collector of the second transistor is about 45 db.

The modulator is relatively insensitive to changes of excitation voltages. Changes equivalent to ± 10 -mv input variation are caused by ± 10 -percent excitation voltage change or ± 20 -percent excitation frequency change. Conversion gain is substantially unaffected by ± 30 -percent excitation voltage change, and the transistor amplifier gain varies about ± 1 db for ± 30 -percent change of collector supply voltage. Amplifier power supply is -9 volts d-c at 7 milliamperes.

Phase shift between the second-

ary of the excitation transformer and the amplifier output is 60 degrees at 400 cps. The phase slope is approximately 0.8 radians per octave at that frequency.

Conclusions

It appears practicable to operate the last transistor stage as a phase sensitive detector for certain servo applications where d-c output is required. To obtain the power necessary to drive servo motors, the transistor amplifier output may be fed to a half-wave bridge magnetic amplifier.^{3,4,5}

Drift level of the transistor modulator is higher than that of magnetic amplifiers.^{6,7,8} However, in contrast to magnetic amplifiers, the transistor amplifier is relatively insensitive to changes of excitation frequency and has an inherently greater bandwidth.

REFERENCES

- (1) *Electrical Engineering*, 72, p 1,137, Dec. 1953.
- (2) R. F. Shea, *Electrical Engineering*, 73, p 365, April 1954.
- (3) G. F. Pittman, *Proc Nat Electronics Conf*, 9, p 70, 1953.
- (4) H. H. Woodson, C. V. Thrower and A. E. Schmid, *Proc Nat Electronics Conf*, 8, p 158, 1952.
- (5) G. M. Ettinger, *Electrical Review*, 155, p 348, Sept. 1954.
- (6) G. M. Ettinger, "Magnetic Amplifiers", Chapter IV, John Wiley & Sons, New York, 1953.
- (7) H. S. Sack, R. T. Beyer, G. H. Miller and J. W. Trischka, *Proc IRE*, 35, p 1,375, 1947.
- (8) W. A. Rote, *ELECTRONICS*, 26, p 170, Dec. 1953.

Ultrasonic Phase Meter

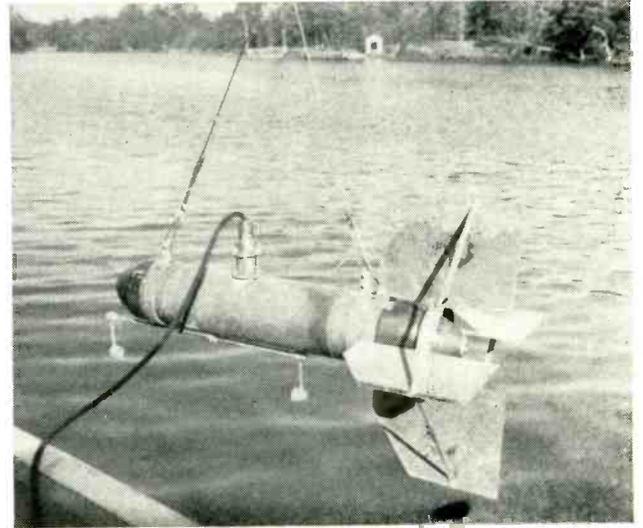
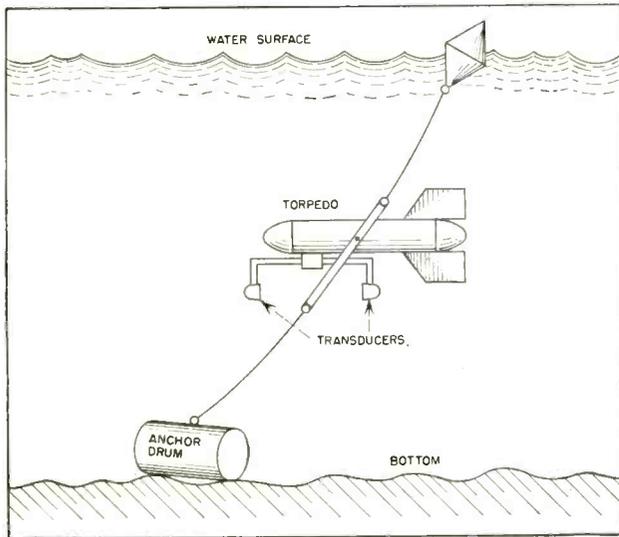


FIG. 1—Arrangement of velocity-measuring equipment under water. Torpedo unit is shown at right prior to immersion. Once every week, anchor drum is raised to surface to service equipment mounted inside

SUMMARY — Magnitude and direction of subsurface water currents at remote locations are automatically measured and recorded by instrument incorporating phase measurement circuit. Meter indicates phase unambiguously over range of 0 to 360 degrees

IN TENDED for use in marine research, an improved phase-meter circuit has been developed as a part of an instrument for measuring water velocity with ultrasonic waves.¹

The complete instrument consists of two main units. The transducers are attached to a torpedo-shaped enclosure which contains a phase measuring circuit, magnetic compass and transfer relay. The other unit is a large drum which contains a storage battery, power supplies, control circuits, indicators and recording camera.

Figure 1 shows the arrangement of the equipment in the water. The large drum rests on the bottom and acts as an anchor. One end of a steel cable is attached to the drum and the other end is supported at

By KEEFER S. STULL, JR.

*The Johns Hopkins University
Baltimore, Maryland*

the surface by a buoy with the torpedo attached at the desired depth of measurement. An 8-conductor cable also runs between the drum and the torpedo. The torpedo is mounted in a gimbal so that it is free to align itself with the current.

Basic Ultrasonic System

Figure 2 shows two submerged ultrasonic transducers separated by distance D . Transmitter T sends out continuous sine waves to receiver R . The wavelength λ can be expressed as $\lambda = (v + V)/f$ where f is ultrasonic frequency, v is veloc-

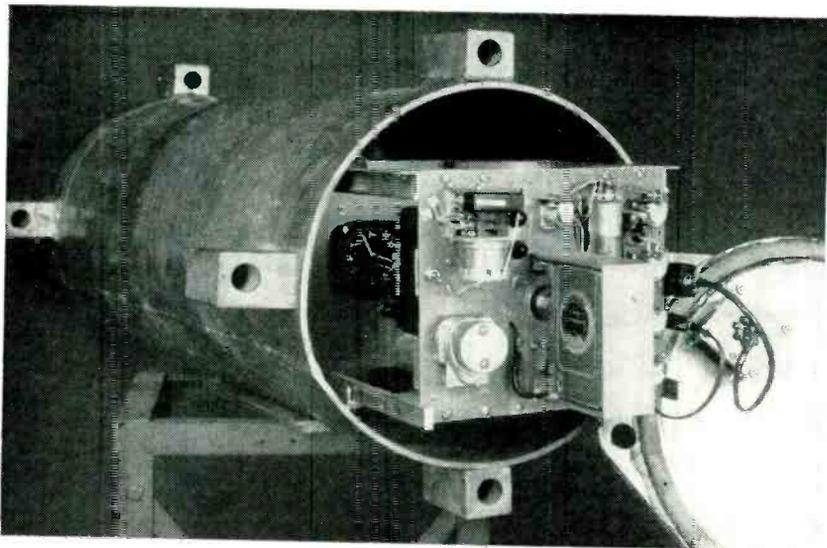
ity of propagation through still water and V is the component of water velocity in the direction from T to R . Letting N be the number of wavelengths between T and R

$$N = D/\lambda = Df/(v + V) \quad (1)$$

In practice, D should be at least 1 foot to obtain a sufficient sample of the true water velocity unobstructed by the transducers, f should be greater than 100 kc to permit small transducer size with narrow beam width and $v \cong 5,000$ ft per sec; therefore, N must be greater than 20.

If the received signal is compared to the transmitted signal, a phase difference of $2\pi N$ will exist between them, but since most phase meters can only measure angles less than 2π , the measured phase difference will be $2\pi (N - n)$ where

Measures Water Velocity



End view of anchor unit shows timers, control circuits, indicating meters and recording camera. Storage battery is at opposite end of drum

n is an integer such that $0 \leq (N - n) < 1$. This restricts the maximum measurable change in N to unity, if phase ambiguity is to be avoided.

With this instrument it is desired to find V in the range from 0 to 5 ft per sec by measuring phase. Since $N > 20$, small changes in N due to changes in parameters D , f and v will be magnified percentagewise more than 20 times in terms of $(N - n)$.

Variations in temperature, depth and salinity of the water cause changes in v of approximately 0.1 percent per degree F, per 300 ft of depth and per 0.1-percent change in salinity, respectively. Therefore, expected changes in v will com-

pletely obscure the desired indication of V . The magnified effect of parameter variations can be eliminated as follows. Normally D , f , v and V vary so slowly that they may be considered as constant for a period of a few seconds. Then, if T and R are reversible and a measurement is made in each direction within a few seconds, all the quantities on the right side of Eq. 1 will have the same value for each direction, but the sign of V will change. This will give a new value, N' , of N in the reverse direction

$$N' = Df/(v - V) \quad (2)$$

Subtracting Eq. 1 from Eq. 2 and letting $N_a = N' - N$

$$N_a = 2VDf/(v^2 - V^2) \quad (3)$$

Solving Eq. 3 for V and simplifying

$$V \cong KN_a \quad (4)$$

where $K = v^2/2Df$

If the phase meter has a scale of 0 to 1 corresponding to phase angles of 0 to 2π , then N_a is the difference obtained on subtracting the meter reading with T to R in the direction of V from the reading in the reverse direction or 1 plus this difference, if the difference is negative.

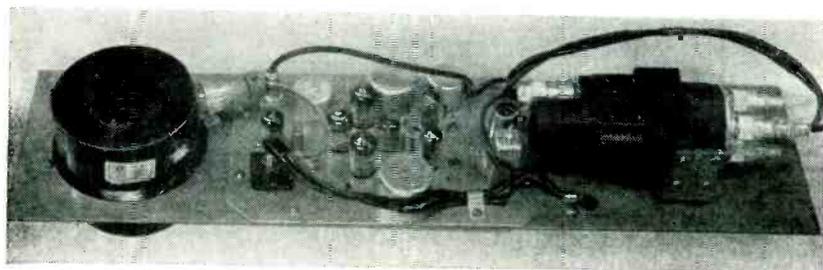
The values chosen for this instrument are $D \cong 1.8$ ft and $f = 1$ mc; therefore, $K \cong 6.95$ ft per sec.

Phase-Meter Circuit

To measure the phase relation of the transmitted and received ultrasonic signals the unit had to be small, consume little power and indicate phase unambiguously from 0 to 360 degrees. A special requirement was that one lead to the indicating meter had to be common with some other necessary lead to reduce the number of wires in a connecting cable. The basic operation of the circuit can be explained in terms of the block diagram of Fig. 3.

The two transducers are connected through a 24-volt motor-driven coaxial transfer switch so that the direction of transmission may be reversed. The 1-mc crystal-controlled transmitting oscillator drives one of the transducers which sends out ultrasonic waves toward the other.

The electrical signal from the receiving transducer is amplified and



At left is remote-indicating magnetic compass, which gives orientation of torpedo and therefore water-current direction. Phase-meter chassis is at center and motor-driven coaxial transfer switch at right. Entire unit mounts in torpedo

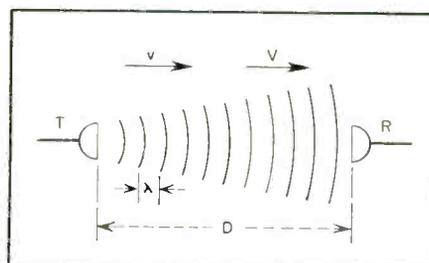


FIG. 2—Ultrasonic-wave path between two submerged transducers. Transmitter T sends continuous sine waves to R

mixed with the signal from a 0.992-mc crystal-controlled heterodyne oscillator. The mixer circuit output is tuned to the difference frequency of 8 kc. A sample of the transmitted signal and the oscillator signal are fed into another similar mixer to obtain another 8-kc signal.

Changes in phase between the 1-mc received and transmitted signals produce the same changes in phase between the two 8-kc signals. These are fed into two identical pulse-forming circuits which produce a short trigger pulse for each cycle of the respective 8-kc sine waves. Phase changes now appear as varying time between trigger pulses in the two channels.

Switching Circuit

A 1-ma constant-current source is turned on by the trigger pulses from one channel and turned off by the trigger pulses from the other. Therefore, the output of the switching circuit will consist of current pulses of 1 ma amplitude, with a length which varies linearly with phase and with a repetition rate of 8 kc. These pulses pass through a 1-ma d-c meter that indicates the average current, which is a linear function of pulse length. Therefore, the full-scale range of the meter represents a 360-degree range of phase between the 1-mc received and transmitted signals.

This circuit is not required to measure the absolute phase relation, but only the changes in phase when the direction of transmission is reversed. Therefore, residual phase shifts in any part of the circuit are not important, even if they vary slowly in respect to time. If the transducers have different phase characteristics when transmitting than when receiving, a fixed phase error will exist at all velocities; however, this error is easily measurable at zero velocity. Therefore, a given water velocity will produce a known difference in meter readings at any time, but the absolute meter readings will drift with respect to time due to changes in residual phase shifts and changes in water temperature, pressure and salinity.

Tube heaters are supplied from a 24-volt battery. Plate-supply voltage is obtained from a dynamotor.

The battery voltage may vary from 28 volts to 20 volts under normal operation causing excessive variation in dynamotor output voltage. Since the switching circuit requires a well-regulated voltage, a series-tube regulator is used to stabilize the plate-supply voltage of all the tubes.

Circuit Details

The complete diagram is shown in Fig. 3.

The 1-mc transmitting oscillator, V_{11} , is an electron-coupled Pierce circuit. Its plate is capacitively coupled to one of the quartz transducers through several feet of coaxial cable and the transfer relay.

The total plate-to-ground capacitance is resonated with a slug-tuned inductor to give a high load impedance for maximum driving voltage on the transmitting transducer. Similarly, the receiving transducer is connected to the grid of V_{21} through coaxial cable and the relay, with the circuit capacitance tuned out by an inductor to give parallel resonance for maximum grid voltage.

The transducers are disks of X-cut quartz, $\frac{7}{8}$ inch in diameter, ground for thickness-vibration resonance of 1-mc, with silver electrodes fired on both surfaces. They are mounted in streamlined brass holders with one surface exposed to the water. Radiation beam width is approximately 12 degrees.

An important design problem was to minimize all stray coupling between the 1-mc transmitting and receiving circuits. The phase of the received signal varies with water velocity, but the phase of leakage signals does not vary; therefore,

the vector sum of the two signals, which is the voltage applied to the grid of V_{31} , will have a phase error that varies with the phase of the received signal.

Good shielding and decoupling are required to reduce this error, but the critical point in the circuit is the transfer switch where the transmitting and receiving paths must be in close proximity. Therefore, this switch must be a high-grade coaxial type with very low crosstalk.

Tuned-pentode amplifier V_{22} builds up the received signal for injection into the mixer grid of V_{41} . A sample of the transmitted signal is coupled into the mixer grid of V_{31} . The first three elements of V_{31} and V_{41} are connected in parallel in an electron-coupled Pierce-oscillator circuit operating at 0.992 mc.

The plate circuits of the mixer tubes are tuned to the difference frequency of 8 kc and are directly coupled into multiar circuits² made up of V_{6A} , V_{6B} and of V_{7A} , V_{7B} respectively. The multiar circuits regenerate from conduction to cutoff at the exact time the respective 8-kc sine waves from the mixers cross their a-c zero axes (B+ potential) going negative. This produces a sharp-rising-step voltage across the respective plate-load resistors of V_{6A} and V_{7A} . These steps are differentiated to form short positive pulses which are applied to the grids of V_{6B} and V_{7B} .

Cathode follower V_{6B} and plate-output amplifier V_{7B} have their respective cathode and plate tied together and connected to capacitor C as a common load. Both tubes are normally biased just beyond cutoff by a resistance voltage divider from B+. Since these two tubes are the only source of charge for C , except for grid current in V_{8A} and leakage, the voltage across C will remain fixed at the value obtained from its last previous charge so long as V_{6B} and V_{7B} are cut off.

When a positive pulse is applied to the grid of V_{6B} , a short pulse of cathode current flows which charges C and raises the voltage at the grid of V_{8A} . When a positive pulse is applied to the grid of V_{7B} , a short pulse of plate current flows which discharges C and lowers the voltage at the grid of V_{8A} . The maximum

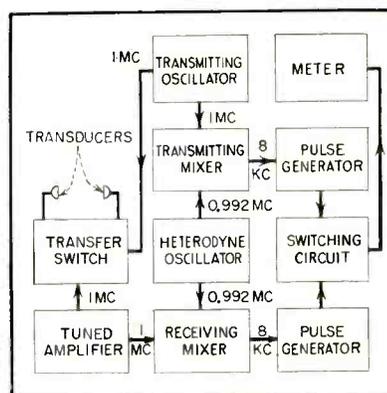
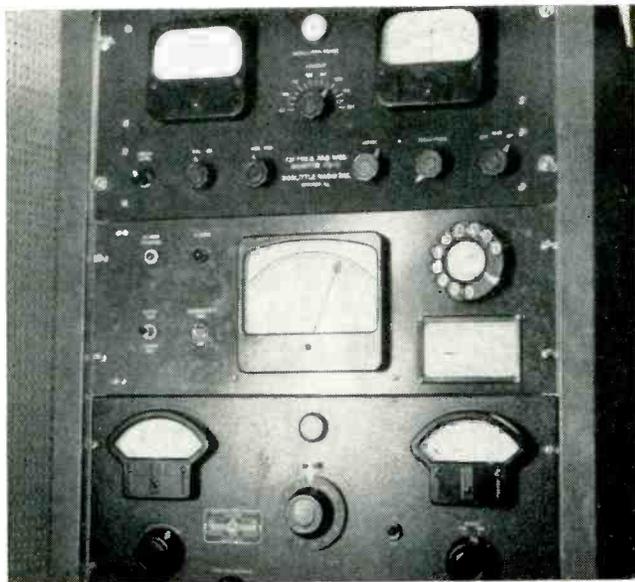
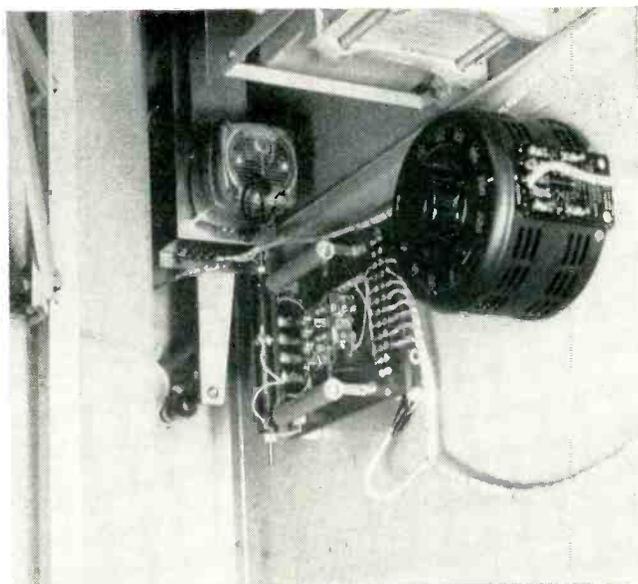


FIG. 3—Phase-meter system



Control point at studio selects desired function with dial impulses (center right) and meters read telemetered information from transmitter



Typical motorized control added to 10-kw f-m transmitter makes remote tuning from studio possible. Plate current metering shunt is below motor

Pulsed Tones Control A-M

SUMMARY — Complete remote operation of two broadcast transmitters over a two-wire line includes functions of alarm, metering and control. Audio tones of 1,000; 2,100; 2,200; 2,300 and 2,600 cycles used in conjunction with telemetering and pulse-counter equipment permit tuning from studio six miles distant

By **HERBERT MICHELS**

*Chief Engineer
Radio Station WHCU
Cornell University
Ithaca, N. Y.*

INSSTALLATION of a broadcast remote control system has been completed recently at WHCU whereby complete control of a 1,000-watt a-m transmitter and a 10,000-watt f-m transmitter atop Mt. Pleasant is achieved from the studio-control point in downtown Ithaca, six miles distant.

In determining the basic method of remote-control for the transmitters several conditions peculiar to the existing installation had to be considered. These include the

availability, reliability and cost of telephone-line circuits and the possibility of future microwave interconnection between the studio and transmitter sites. Also considered were the expansion possibilities of the relative systems as well as equipment reliability and long-term operating costs.

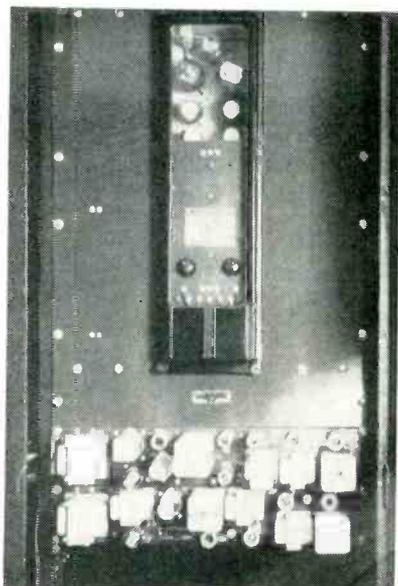
Two-Wire Line

In the system used, all control and metering information is carried over a single audio transmission circuit as indicated in Fig. 1. Control information is sent from the control point to the transmitters in the form of three fixed-frequency keyed audio signals. Returning metering information is also carried

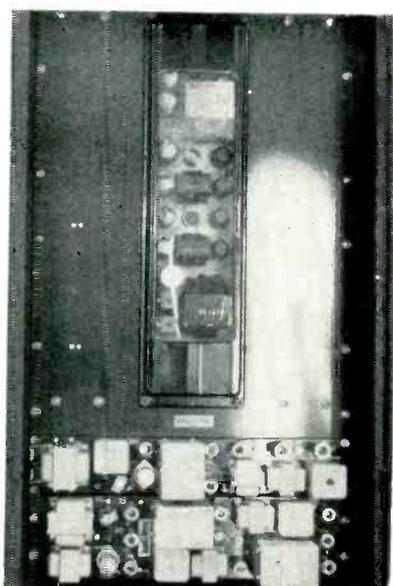
over the same control channel in the form of a fixed-frequency keyed audio signal.

The various control and metering frequencies are shown on the block diagram. Selection of these frequencies was determined by the type of audio transmission circuit available and optimum tone-generator and tone-receiver performance. Harmonic and beat-frequency interference were also considered.

In any broadcast remote-control system, transmitter control and metering circuit selection is a basic requirement. It is accomplished in the system at WHCU by a telephone-dial pulse generator at the control point and a stepping-relay pulse-counting unit at the trans-



Studio equipment for remote control includes telemetering receiver, duplex signaling unit and dual transmitter



Transmitter equipment employs telemeter device to send back voltage or current values.

and F-M Stations

mitter. Pulses are sent from the control point to the transmitter site as 2,300-cps interrupted tone.

The basic tone-generator circuit is shown in the lower part of Fig. 2; this is a section of the Hammarlund duplex signaling unit. The oscillator cathode is keyed to ground by the telephone dial. Oscillator frequency is adjusted by variable inductor L_1 ; second harmonic suppression is achieved by the push-pull oscillator circuit arrangement and circuit balancing control R_1 .

Audio signal output is capacitance coupled to the grids of buffer amplifier V_6 . The plate circuit of V_6 is connected to feed the telephone line through the line bridging transformer and attenuator network.

Output bridging is required, since other circuits are also connected to the same telephone line to achieve the full complement of control and metering facilities.

At the transmitter site, the 2,300-cps tone is accepted by the receiver section of a signaling unit. The signal is first amplified by V_1 (Fig. 2) to a level sufficient for presenta-

tion to the band-pass filter. The filter employs a triple-tuned circuit arrangement using three high-Q toroidal inductors. A design re-

quirement of this filter is a minimum of 35-db attenuation to the adjacent channel, separated 100 cycles.

A second amplifier V_2 restores the filter-attenuated signal-voltage level and provides sufficient output to feed V_3 the signal rectifier. The positive rectified and filtered voltage is applied to the grid of relay tube V_4 .

Relay K_1 , its coil in series with the plate voltage supply of V_4 , will energize as a rectified positive voltage is supplied from the signal rectifier. Contacts on K_1 provide pulses, corresponding to those generated by the studio telephone dial, to a pulse-counting unit.

Dialing System Operation

The pulse counting unit in Fig. 3 is basically a stepping relay K_{13} with associated slow release relays K_{11} and K_{12} . The relay operation is sequential. With the first dialing pulse K_{11} energizes through contacts of the receiver relay. Relay K_{12} and the rotor coil of K_{13} energize on the first pulse space through contacts of K_{11} and the receiver relay; K_{13} advances one step.

After the first space is completed, K_{11} and K_{12} are still energized (since they are slow-release relays) and each succeeding pulse space ad-

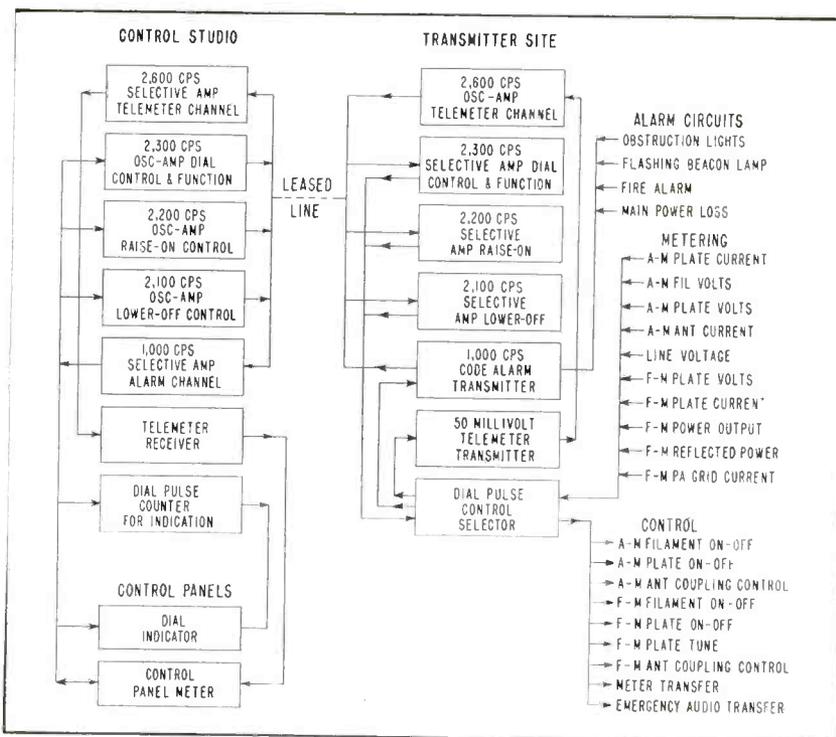


FIG. 1—Operation of remote-control system is illustrated by block diagram

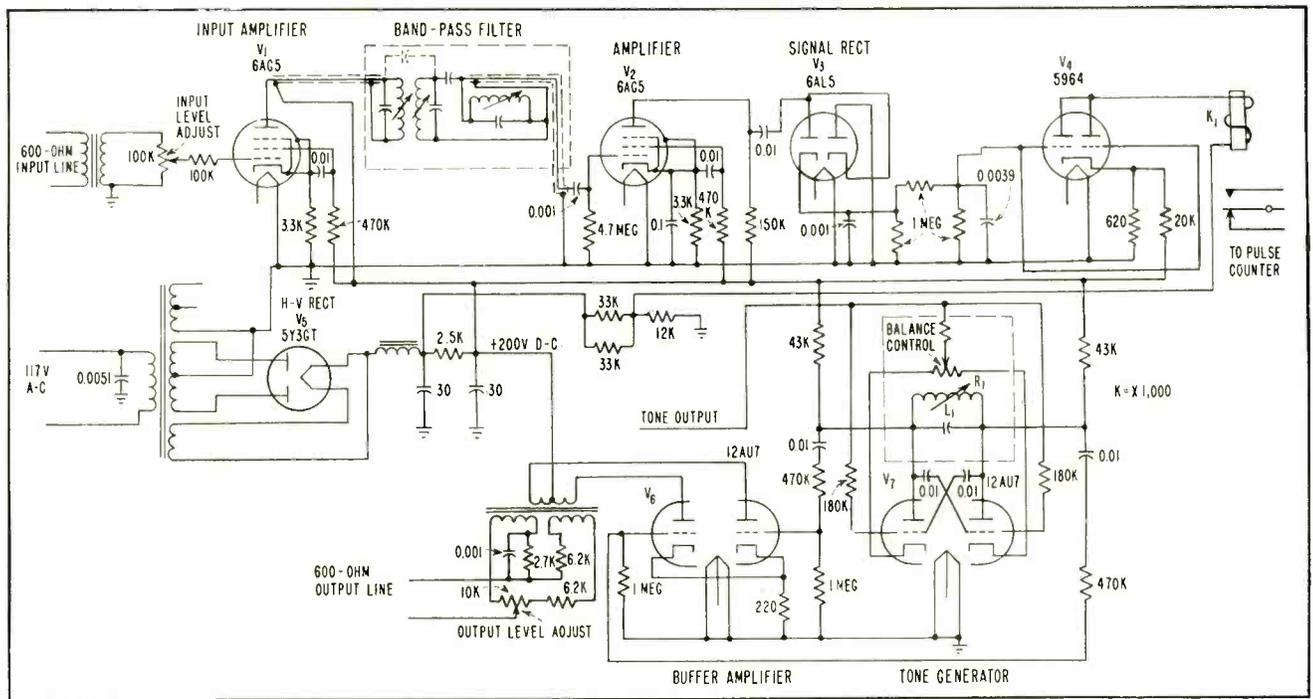


FIG. 2—Tone signaling generator and associated circuits below and receiver above. Band-pass filter component values are chosen for operating frequency permitting common circuitry for all channels

vances K_{13} one step. With the last space (sustained) K_{11} first de-energizes, (K_{12} is held energized somewhat longer by RC circuit R_1 and C_2) and thereby connects the contact arm of K_{13} to ground through R_2 and contacts of the receiver relay. The K_{13} wiper arm energizes the selected control relay (K_2-K_{10}). Next K_{12} de-energizes, which connects power to the K_{13} release coil (through the K_{13} off-normal contacts, contacts on K_{13} , contacts on K_{11} and contacts on the receiver relay). The wiper arm of the stepper, K_{13} , then returns to zero and is ready for the next dialing operation.

Control Relays

Each control relay (K_2-K_{10}) has two sets of holding contacts connected in a series arrangement with all of the other control relays; therefore, as each control relay becomes energized by K_{13} , the previously energized control relay de-energizes.

In addition to the two sets of holding contacts on the control relays, there are three other sets of relay contacts utilized. These connect the desired metering voltage, or current to the telemetering system for transmission back to the control point and connect the RAISE

(or ON) control function to the desired transmitter circuit for control. They likewise connect the LOWER (or OFF) control function to the desired transmitter circuit for control.

The method of obtaining remote RAISE-LOWER control is similar to the described circuit-selection method. Basically, a spring-return key switch at the control point controls the ON-OFF condition of two tone generators. Suitable tone receivers at the transmitter site provide a completed d-c circuit path through the dial-selected control relay to the circuit under control.

Referring to the basic block diagram, when the RAISE-LOWER key is pressed to RAISE, the 2,200-cps tone generator is turned on and the tone is transmitted over the telephone line. When the RAISE-LOWER key is depressed to the LOWER position, the 2,100 cps tone generator is turned on. The LOWER control signal is thereby transmitted.

The circuitry of the RAISE and LOWER tone generators is similar to that of the generator provided for the dial-circuit selection system illustrated in Fig. 2; however, instead of a telephone-type dial, a simple spring-return key switch is used.

At the transmitter site, the RAISE

and LOWER tone signals are received by means of circuits identical to those in the tone receiver.

Telemetering System

In planning the WHCU system, it was decided to provide continuous metering. For instance, changes in the metered values at the transmitter are immediately indicated at the control point without appreciable time delay. By contrast, in a sampling system a 5-second delay would be encountered.

This provision was primarily incorporated to permit remote motor tuning of the f-m power-amplifier plate and output coupling circuits during winter antenna-icing conditions. The telemetering method selected is also completely independent of day-to-day changes in control line characteristics as well as tube aging.

Basically, the telemetering system comprises a Westinghouse IT-1 telemetering transmitter. This device linearly converts an input voltage between 0 to 25 millivolts into a train of square waves with a frequency rate between 15 and 35 cycles depending upon the input voltage applied. These square waves then control the ON-OFF condition of a 2,600-cps tone generator. The result is a 2,600-cps tone, keyed on

and off at a repetition rate corresponding to the voltage being telemetered.

The telemetering transmitter shown in Fig. 4 performs the following functions. Metering voltage is applied to the input terminals. This voltage is first converted by chopper into a 60-cycle voltage and amplified by a three-stage amplifier V_2, V_3, V_4 . The amplifier output is utilized to control d-c bias voltage supply stage V_5 . This controlled bias voltage determines the frequency of relaxation oscillators V_6 and V_7 .

Multivibrator V_8 divides the 30-70-cps oscillator frequency to the 15-35 cps range. Output from amplifier V_{10} is applied to the coil of the output keying relay. Thus, an input voltage applied to the telemetering transmitter input terminals results in an increase in output square wave frequency.

The 15 to 35-cps output, while in itself containing the metering information, is not in a form convenient for reliable transmission over a telephone circuit. The square-wave output of the transmitter is therefore connected to key on and off a 2,600 cps subcarrier generator.

Subcarrier Generator

The 2,600-cps telemetering subcarrier generator is similar to the typical control-circuit tone generator. The telemetering subcarrier is applied to the same telephone line circuit carrying the control signals. Highly selective filters are employed in the control-circuit tone receivers, which provide more than 50-db rejection to the nearest channel.

No interference is encountered even though there is a 30-db signal-level differential between the outgoing 2,600 cps telemetering subcarrier and the line-attenuated incoming 2,100 to 2,300 cps signals.

At the control point, a highly selective subcarrier receiver, similar to that of Fig. 2, is employed; the output 15 to 35-cps square waves are applied to the input terminals of a telemetering receiver.

A telemetering receiver, shown in simplified form in Fig. 5, converts the 15 to 35-cps input into a direct-current output. This is accomplished by a capacitor-charging arrangement wherein the average

direct charging current of two capacitors is indicated on a d-c meter.

Two capacitors, C_1 and C_2 , are connected so that when V_1 draws current, C_1 will start to charge and when V_2 draws current, C_2 will likewise begin to charge. Tube V_3 is connected so that when it operates, C_1 will discharge and similarly, when V_4 operates, C_2 will be discharged.

The input 15 to 35-cps signal is applied to control grids of V_1, V_2, V_3 and V_4 , which are biased to cutoff. When V_1 receives a positive signal on its grid, C_1 starts to charge. When the input signal swings nega-

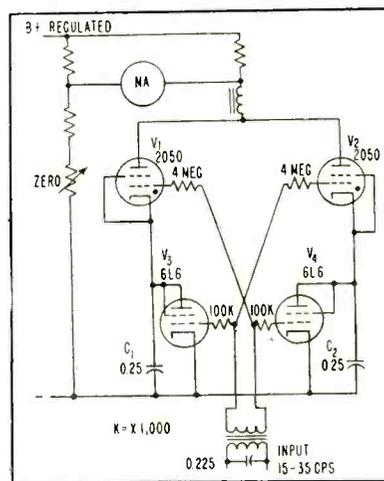


FIG. 5—Simplified telemetering receiver gives direct meter reading

tive, charging of C_1 stops and V_3 , its grid connected out of phase with V_1 , conducts heavily causing C_1 to discharge rapidly to zero. The action of C_2, V_2, V_4 is similar and occurs on alternate half cycles.

The total average charging current to the capacitors increases linearly as the number of charges per second increase. Hence, the metering information transmitted as an audio frequency is read as a d-c value on the milliammeter in series with the capacitor charging supply.

Since 15 cps represents zero indication on the meter (35 cps represents full scale) some capacitor charging current will exist for a zero indication and a suppressed spring meter would normally be required. However, a d-c bridge circuit is employed to balance out the current to the meter so zero voltage is applied to the meter when a

15-cps signal is received by the telemetering receiver. This permits the use of a conventional type meter.

Of prime importance in selecting a method of remote control, were the system expansion possibilities. Future planning at WHCU may include additional equipment to be remotely controlled at the present a-m/f-m transmitter site. Therefore it was important to select a basic system that could be expanded in control and metering functions without incurring excessive expense in control equipment or requiring more than the single leased telephone circuit presently employed for control.

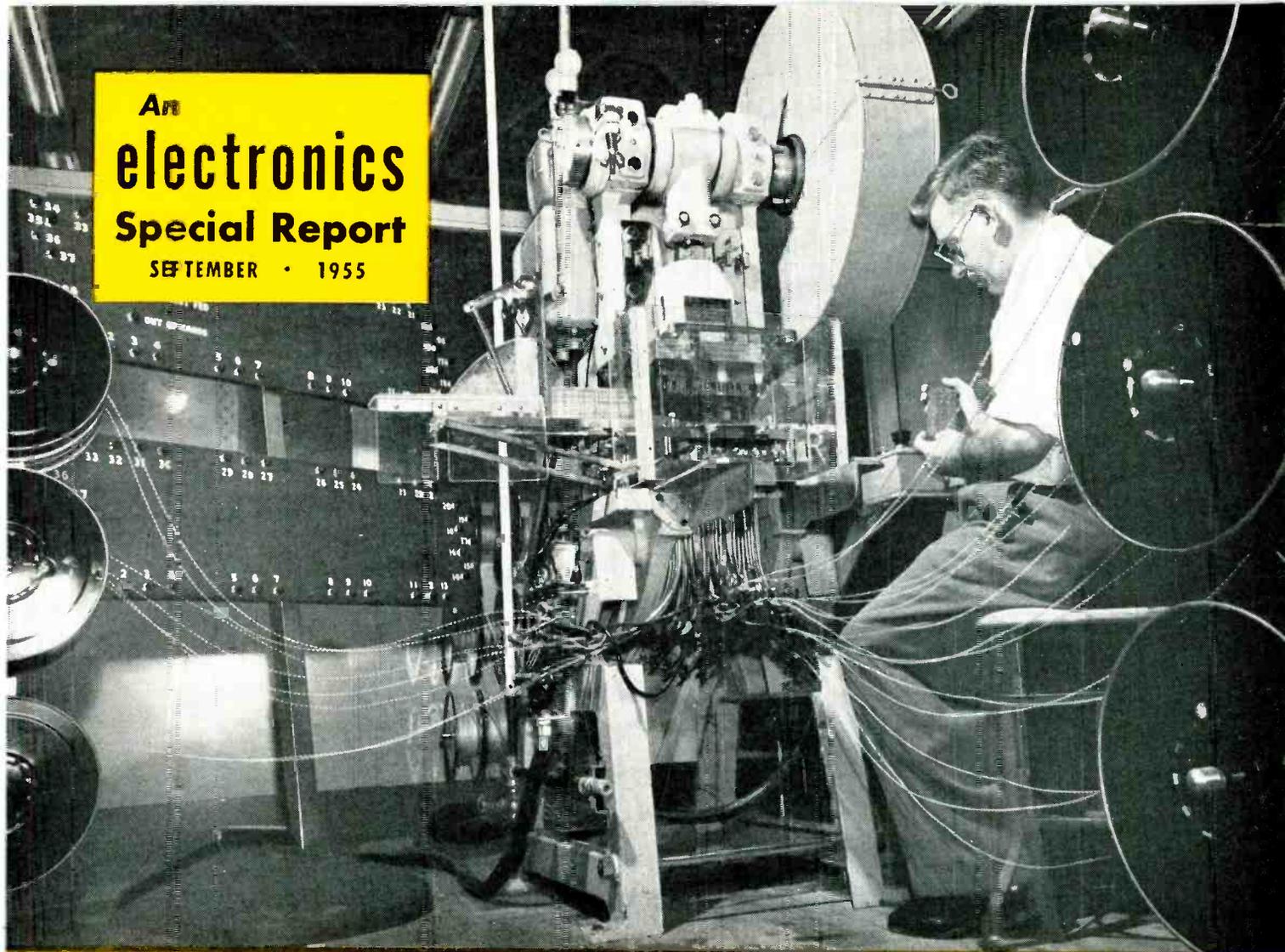
With the system in use, a total of nine basic control positions is available; each position has one metering circuit and two control circuits. Dial position 1 is employed for alarm reset. To expand the present system for 18 full positions of metering and control, the addition of one tone generator at the control point and one tone receiver and one pulse counting unit at the transmitter site would be required. The additional equipment may be added without taking the existing control system out of service for more than a few hours and no additional line facilities will be required.

Fail-Safe Provision

An FCC requirement in all remote-control installations of broadcast transmitters is that the equipment be entirely fail-safe. In other words, should any abnormal condition develop with the remote control system in which control of the transmitters is lost, the transmitters must shut down automatically. This feature is provided by relay K_{14} in the pulse counting unit (Fig. 3).

The fail-safe relay is normally held energized by the continuous 2,300-cps dialing tone sent from the control point. A time delay is incorporated in the coil circuit so that short dialing pulses will not de-energize K_{14} . However, an interruption of the 2,300-cps tone of more than 1 second will permit the relay to de-energize. Contacts are connected to energize the plate-off relays in the transmitters under control.

An
electronics
Special Report
SEPTEMBER • 1955



MECHANIZED PRODUCTION of Electronic Equipment

By **JOHN MARKUS**
Associate Editor

©McGraw-Hill Publishing Company

	Page
1. ETCHED WIRING	138
2. COMPONENT PREPARATION	141
3. MACHINE ASSEMBLY	147
4. DIP SOLDERING	157
5. AUTOMATIC TESTING	159

1. ETCHED WIRING

Mechanization begins with mechanized wiring. Today this is etched wiring, but there are indications that plated wiring is coming up fast. In producing etched wiring boards, new techniques speed up drafting and new machines serve for photographing and etching

MECHANIZATION of electronic production facilities is something to be taken in logical steps rather than all at once.

The first step is mechanization of the wiring process, generally achieved by product redesign for use of etched or plated wiring and manual dip soldering. This is the biggest step, and therefore gives the greatest gains in terms of improved product reliability and lower production costs. Etched wiring is thus the logical subject for the first section of this survey of the status of mechanization in the electronic industry. Before going into etched wiring in detail, however, a preview of the remaining sections of the article will be given for orientation.

Etched wiring calls for terminations that are all at the same end of a component. Since the commonest components have axial leads, this necessitates preliminary cutting and forming of leads in most cases. The use of machines for component preparation is therefore the second step in going to mechanized production.

The logical substitute for hand insertion of components in etched wiring boards is the use of machines for such assembly work. This, then, is the big third step in

mechanizing an electronic production line.

The next two logical steps go together—the use of machines to prepare components for automatic handling, and the use of machines to assemble the components on the wiring boards. There are many interim steps involving various combinations of manual and automatic assembly, many of which are even more ingenious than the huge assembly machines themselves.

Automatic dip soldering comes fourth, to take the output of an assembly machine directly without human handling. Some firms have chosen to jump directly to this from etched wiring and use manual loading while exploring the economics of steps 2 and 3.

Last is automatic testing, independent of all the others and yet equally capable of cutting production costs.

These five steps are covered separately as the major sections of this report. Together they give a stop-action picture of an industry that is going ahead fast on the road to mechanization. Individually the sections show what is going on in representative plants of all sizes and types. As in any industry in transition, the individuality of thinking among engineers is everywhere evident.

DEFINITIONS

printed wiring General term for a wiring pattern reproduced on a wiring board by any process, to provide point-to-point electrical connections or shielding. These reproduction processes are usually etching or electroplating rather than true printing.

printed component A component formed directly on a wiring board, such as a printed inductor, resistor or capacitor.

wiring board An insulating board having printed wiring.

printed circuit General term for a combination of printed wiring and printed or conventional components on a wiring board, providing one or more complete paths for electric current.

etched wiring A type of printed wiring formed by chemical removal of unwanted metal from a clad laminate serving as a wiring board.

plated wiring A type of printed wiring formed by electroplating the desired pattern of printed wiring onto an insulating base.

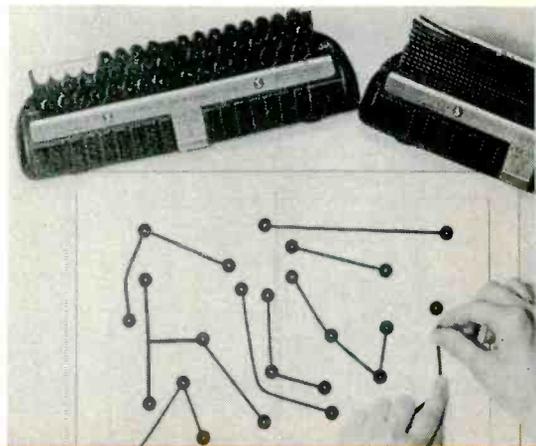
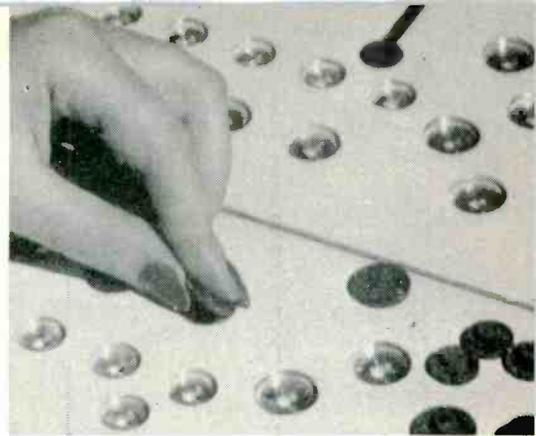
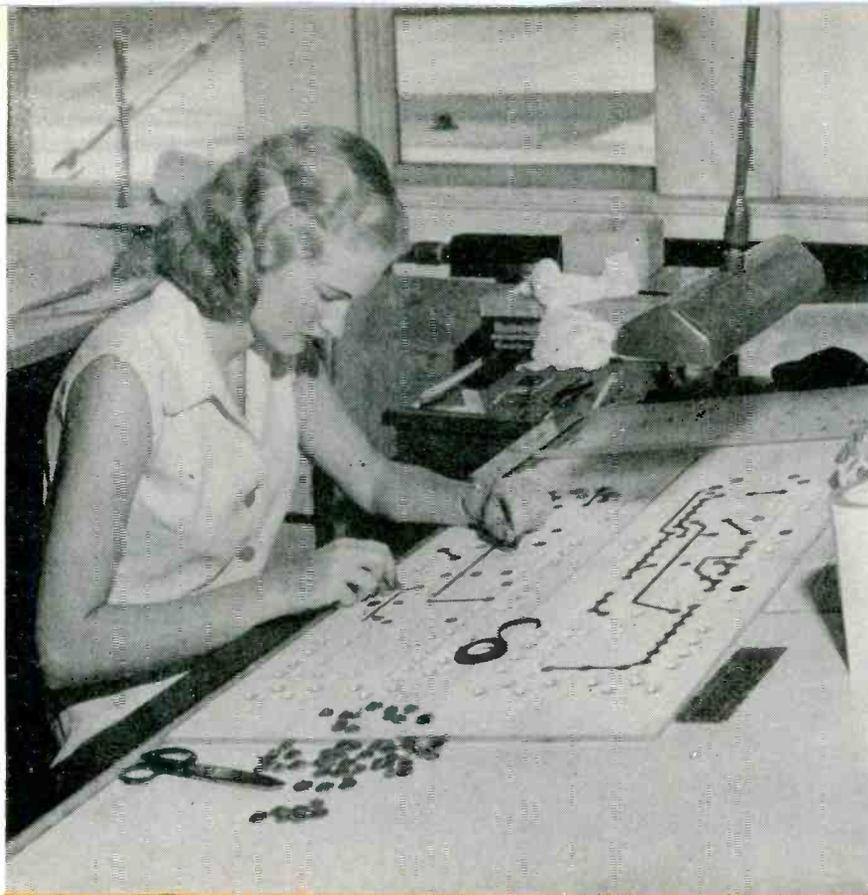
assembly machine A machine used for inserting components in wiring boards.

in-line assembly machine An assembly machine in which insertion heads arranged in a line each insert one component as a wiring board is moved from station to station by a conveyor or other transport mechanism.

single-station assembly machine An assembly machine in which all insertion of components is done at a single station, to which boards are fed or through which boards are circulated.

station The location on an assembly machine at which a wiring board is stopped for insertion of one or more parts.

insertion head The mechanism used at a station to insert a component in a wiring board. This generally includes an automatic feed mechanism, along with cutting, forming and clinching tools in the case of axial-lead components. On some assembly machines, a station may have two or more insertion heads.



MECHANIZED DRAFTING—No ink is used. Narrow black masking tape, available in rolls or strips, serves for wiring and black disks for terminal circles. At Photocircuits, aluminum sheet has holes at all possible terminal positions on IBM radar computer boards, for covering with white tape or filling with black plastic disks as required. Brady disks at center right are used on drawing paper

Machine assembly on etched wiring boards inherently leads to standardization of board sizes and positions of punched holes. This in turn permits mechanization of drafting procedures.

Mechanized Drafting. Photocircuits Corp. uses masking tape and black plastic disks with a white aluminum sheet to produce four-times-size master drawings for standardized radar computer boards used by IBM. At each possible terminal position, holes are drilled halfway through the aluminum for the disks. To prepare a master drawing, 0.18-inch-wide black masking tape is run between the desired black holes on the board, and unwanted holes are covered with white masking tape.

With drawing paper or glass cloth, self-sticking black terminal circles and connector strips made by W. H. Brady Co. can be used in place of ink. The disks come in a variety of sizes and have a white inner hole for centering. Strips come in $\frac{1}{8}$ and $\frac{1}{4}$ -inch widths to give a choice of reduction ratios and etched wiring widths. The strips can be pressed in place either straight or curved.

Less mechanized but equally time saving is IBM's drafting technique involving transparent overlays. Here a twice-size master drawing contains solid black circles at all possible hole locations. The required circuit lines are drawn with pen and ink on a transparent overlay, and the combination is photographed. Undesired holes are then opaqued out on the resulting negative.

Motorized Copying Camera. Uniform illumination of large master drawings on a copying camera is achieved at

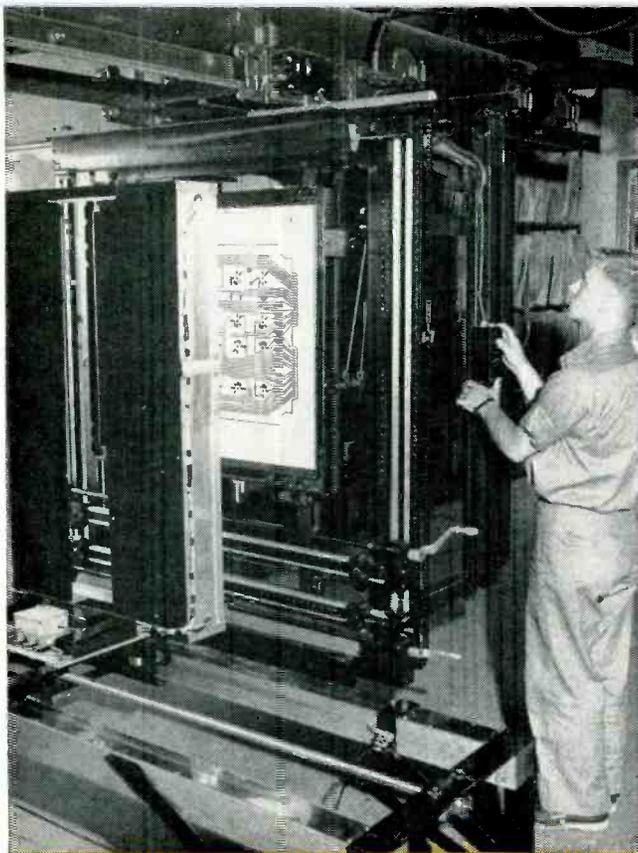
Photocircuits by mounting two fluorescent lamps vertically on a carriage that is moved across the camera field by an electric motor. The lamps are spaced about 6 inches apart and are completely masked with black on the side facing the camera, except for the vertical slit between the lamps. The camera sees the drawing only through this slit, so that the negative is exposed panoramically from one end to the other as the light source moves across the copy mounted on the vertical board.

Printing the Resist. The final-size negative is used directly to photoprint the acid-resisting pattern when runs are short and where extreme precision is required, as when printing multi-turn coils directly on the wiring board.

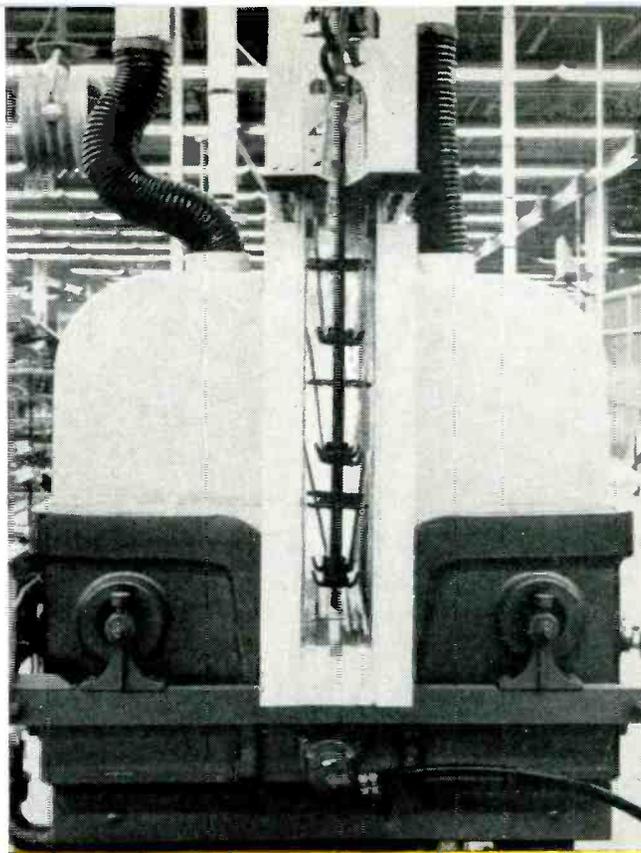
More commonly the negative is used to make a silk-screen pattern, generally on 200-mesh stainless steel rather than silk. This in turn is used in a printing frame to place on the copper-clad phenolic laminate a heavy deposit of acid-resisting ink in the desired wiring pattern, free of pinholes. Screen printing is most economical for long runs, and will reproduce reasonably fine lines adequately.

In most plants screen printing is done conventionally in manual setups wherein the operator lifts the hinged screen to insert a board, then lowers the screen and moves the ink-bearing squeegee across. Emerson and Radio Receptor have semi-automatic machines that are manually loaded but have air cylinders to bring the board up to the screen and move the squeegee across. Others use air cylinders to move the screen up and down.

Use of the negative to make an offset printing plate for applying the resist on a printing press shows promise. Sev-



MOTORIZED CAMERA—Uniform illumination is obtained at photocircuits by moving vertical fluorescent lamps during exposure, with camera seeing drawing through slit between lamps



ETCHING MACHINE—Input end of new Westinghouse machine which gives automatic etching and rinsing of wiring boards as they are moved through by carrier frame on conveyor

eral manufacturers actually have such presses in their plants for experimentation. The chief problem is getting a sufficiently thick layer of acid-resisting ink on the boards. Some insist that two impressions would be needed to achieve this, while others hope to achieve buildup by dusting the first impression with powdered asphalt and then fusing.

Drying Machines. Baking of the resist is achieved automatically in many plants simply by running a conveyor belt over the top of a long table, with a Calrod or infrared-lamp oven straddling a part of the belt. At Methode Mfg. Corp., this setup is used to dry finished boards after they have been sprayed with a protective coating to prevent oxidation of the etched copper.

Etching Machines. A mechanized etching machine for wiring boards has just been placed in operation by Westinghouse. After the resist is screen-printed on sheets of four boards, the sheets are set into metal carriers that hang from a rotating-spiral overhead conveyor line. This advances the boards at a uniform slow speed through the etch and rinse compartments of the machine.

In the etching chamber, motor-driven rotating paddles below the boards on both sides throw up the ferric chloride etchant in a fine spray that gives fast and uniform etching. The conveyor speed is adjusted as required to give complete etching without undercutting.

After etching, the boards pass between spray rinse jets, then emerge for air drying before unloading. The resist is removed later in a vapor degreaser.

RCA expects to have an automatic etching machine in

operation this summer. The boards will be immersed for a constant time interval in a solution of ferric chloride that is kept in violent agitation by powerful pumps in the tanks. The amount of solvent used with the ferric chloride will serve as the variable for controlling the etching process.

Tinned Etched Wiring. An alternate method of producing an etched wiring board involves applying the resist in the reverse of the desired pattern, plating the exposed copper with solder, then removing the resist and etching out the newly exposed copper with an etchant that does not attack the solder. The resulting tinned wiring gives better dip soldering, though at higher cost.

When plated-through holes for leads are required, holes are drilled or punched beforehand and the inside surfaces of the holes are coated with conducting material. Solder then plates in the holes as well as on the wiring.

Plated Wiring. Several firms deposit all wiring by electroplating. Chief problem to date is that of getting good adhesion to the phenolic. Research now under way shows promise of solving this. Since no copper is wasted during plating, the technique may well supersede etching some day. As yet there is no economical way to recover the etched-out copper.

One firm is reported to be using an almost entirely automatic plating machine that starts with punched boards. The surface of the board is cleaned and roughened, a coating of colloidal graphite is applied, the resist is screen-printed over this, 1 to 3 mils of copper is plated over the graphite to form the desired wiring pattern, and the resist and coating are then washed off by the machine.

2. COMPONENT PREPARATION

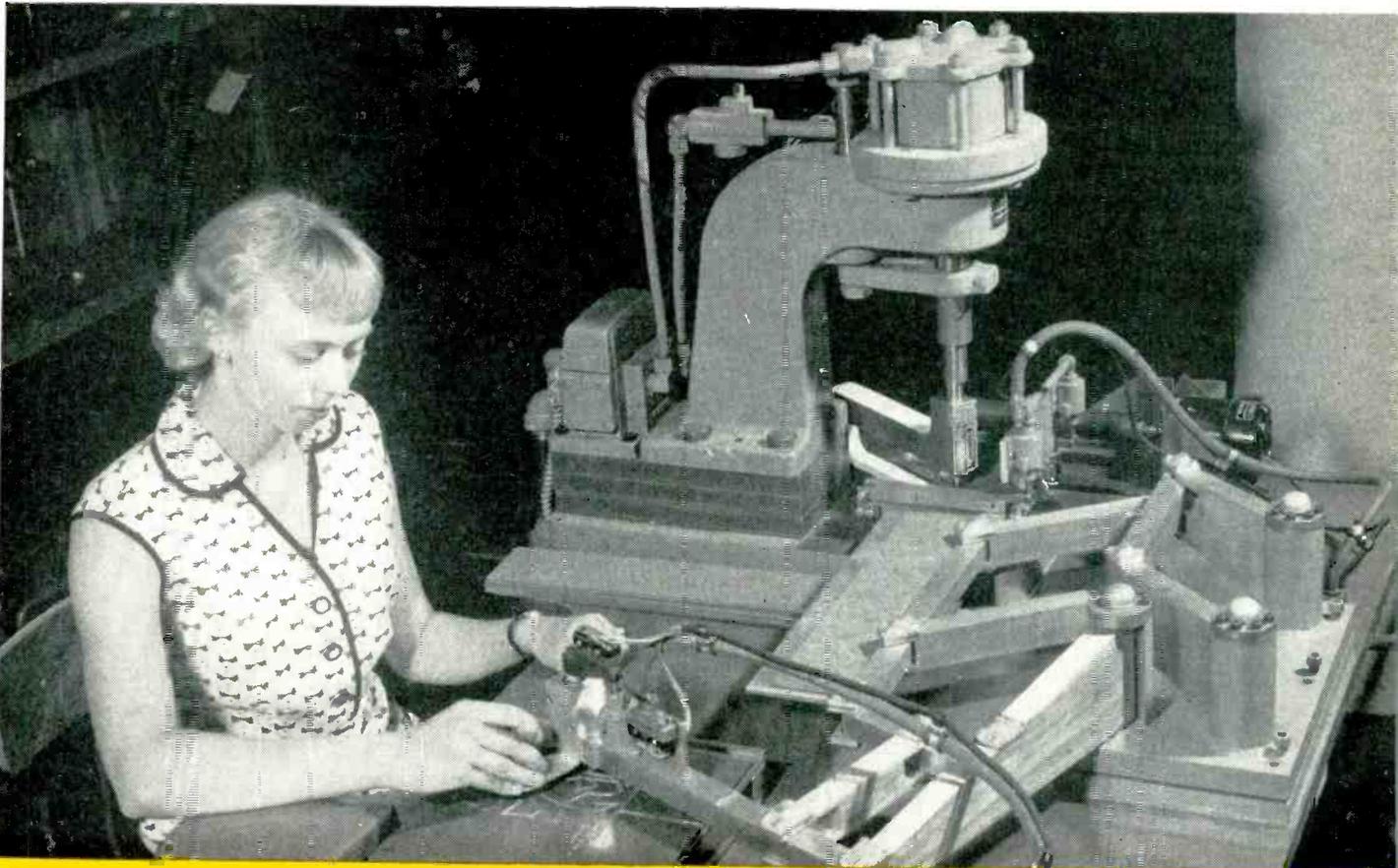
Mechanized wiring calls for a new look in components, with all terminals or leads suitable for manual or automatic plug-in assembly on etched boards. New machines here do the preliminary punching or drilling of boards, lead cutting, magazine loading and belting

Many different sizes of holes must be punched or drilled in wiring boards before assembly can begin, to accommodate leads, terminals and plug-in components.

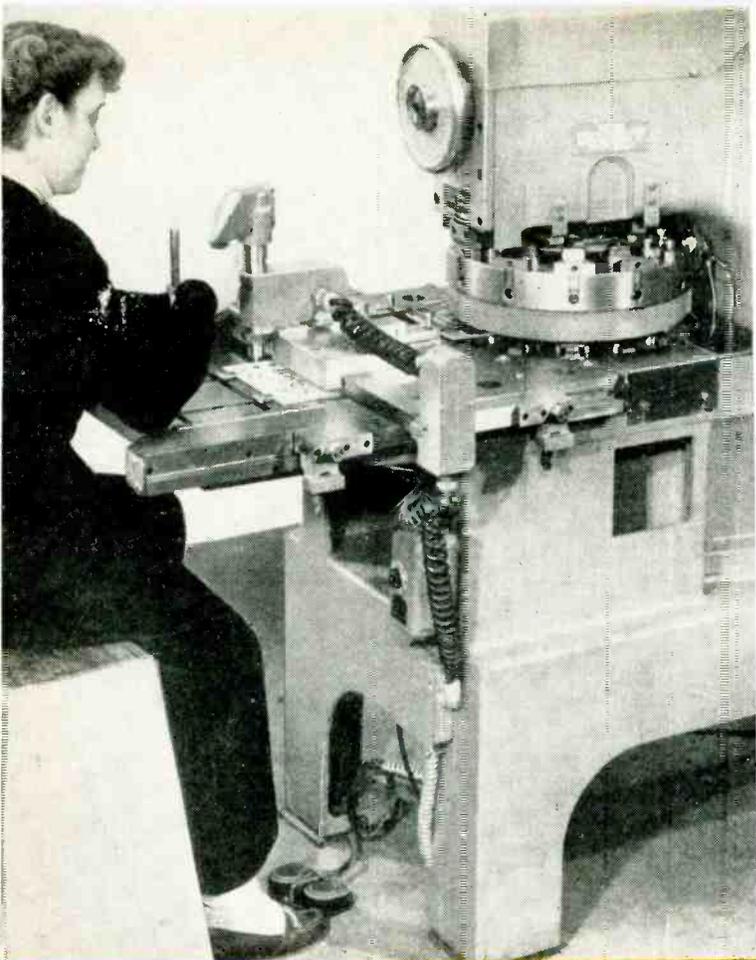
One-Shot Presses. For large runs of radio and tv boards, huge presses are used to punch all the holes at once after preheating the phenolic to prevent cracking. Even with manual handling of boards, Methode achieves an average rate of 500 pieces per hour in punching etched boards with one-shot compound perforating and blanking dies on such a press. With this high production rate, the complexities of automatic feed offer little attraction at present.

Board Sizes. Several small wiring boards are generally preferable to one large board in a tv set. As board size increases and the number of holes goes up, it becomes more and more difficult to strip the XXXP phenolic punched board off one-shot dies without breakage. Second, errors in registration due to the need for heating before punching are less serious on small boards. Thus, in current tv chassis designs, Westinghouse has two boards, Admiral three and RCA five.

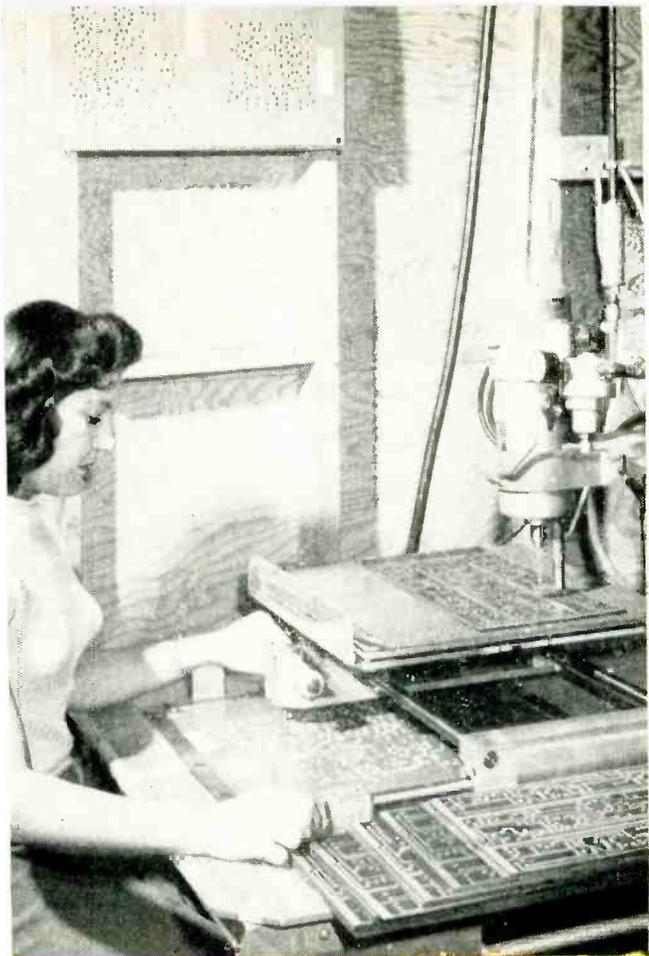
Hole Sizes. There is little agreement as to optimum hole sizes for leads in etched wiring. The tightest fit currently



PUNCHING MACHINE—Etched boards, in long strips, are locked in holder of pantograph device that moves as operator guides stylus through track in phenolic template. Punch is triggered automatically each time the stylus drops into a template hole and makes contact with metal table underneath. Built by Stramberg-Carlson, setup gives up to 120 holes per minute. Punched-tape control is now being built



PUNCHING MACHINE—Wiedemann turret punch press for etched wiring boards also uses control stylus and template, but gives choice of hole sizes for sockets and other parts as well as leads



DRILLING MACHINE—DuMont's stylus-template-pantograph arrangement drills up to 75 holes a minute, using a compressed-air motor and air feed. Etched boards can be up to 16 x 18 in.

used is a 0.039-inch hole for the 0.032-inch wire used on resistors and jumpers. For this same wire, others will go up to 0.060 or even 0.070 for the hole. The larger the hole with relation to the lead, the easier it is to insert manually and the more reliable is automatic insertion.

A complete rollover clinch permits larger holes because the end of the lead bites into the etched wiring, giving a good soldered connection there even though the solder bead does not fill the hole. In contrast, Westinghouse uses a fairly large hole with no clinch whatsoever and achieves excellent dip-soldering results. Smaller hole diameters invariably minimize dip soldering troubles.

Template-Guided Punch. For short runs of etched wiring boards, Stromberg-Carlson is punching holes one at a time at a production rate of up to 120 holes per minute. The operator merely places the board in a holding device and then moves a stylus through a track in a master template. Each time the stylus reaches a hole in this track corresponding to the location of a hole in the finished piece, the stylus drops in and triggers the punch. The stylus is then automatically retracted so that it can be moved on to the next position. The punching sequence take only a fraction of a second, so that there is no noticeable pause at the holes as the operator moves the stylus along the groove.

The perforator can punch holes ranging from 0.030-inch to 0.125-inch in $\frac{1}{16}$ -inch XXXP paper-base phenolic with copper lamination. Punching is done at room temperature. The hole size most commonly used is 0.042-inch.

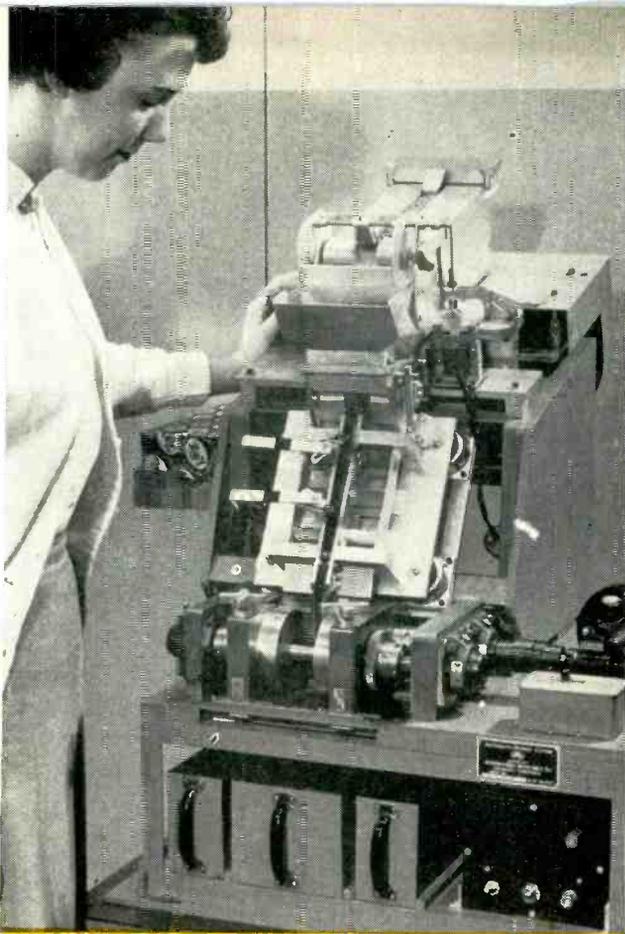
Maximum excursion on a given board is 5 inches. The perforator is now being used primarily for military communication equipment production.

The template is twice the size of the finished board to give increased accuracy. Preparation of a new template requires from 2 to 8 hours, depending on its complexity, but setup time is only 10 minutes. Registration is with reference to two adjacent sides of the wiring board, pressed against pins and the side plate of the holding device.

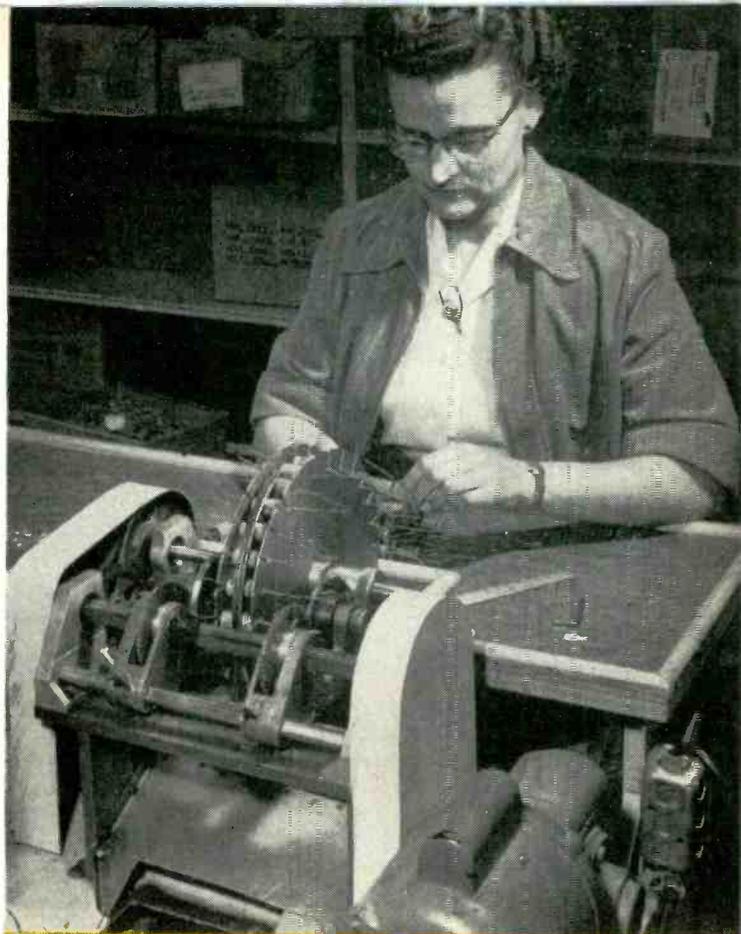
Construction of an electronic control for the perforator, operating from a loop of standard 8-hole Flexowriter tape, is now well under way. When used in conjunction with an automatic loading device, this will make the perforator entirely automatic. Four of the holes on the tape serve for positioning control of one axis and the other four serve for the other axis. Points to be punched are located to 0.005 inch.

Template-Guided Turret Press. A new Wiedemann turret punch press designed specifically for high-speed piercing of wiring boards has an operating rate of 80 to 120 holes per minute. The operator loads a board into the holding fingers of the machine, then moves a hole locator over a color-coded template. The press trips automatically each time the locator is positively engaged in a template hole.

When all holes of one size are punched, the operator touches a foot switch to swing the next color-coded punch into position automatically, then proceeds to place the locator in each template hole of that color in turn. A



LEAD CUTTER—Boxes holding 2,500 axial-lead resistors are automatically unloaded into chute of IRC machine, for cutting leads to correct length at rate of 30,000 resistors per hour



LEAD CUTTER—Motor-driven shearing blades and ferris-wheel feed on RCA machine solve problem of cutting limp, bent leads of heavily waxed tubular paper capacitors

thermostatically controlled heating element in the table of the machine maintains the desired punching temperature in preheated laminated boards. Punching accuracy is within 0.005-inch tolerance for hole sizes ranging from the smallest lead holes up to $4\frac{1}{2}$ -inch openings.

Template-Guided Drill. The DuMont semiautomatic Pantodrill for small runs of wiring boards will turn out a 150-hole board in about 2 minutes, working from a phenolic template that can be prepared in about 30 minutes. Accuracy of positioning is within 0.002 inch.

With the template in position, the operator places a board up to 18 inches long over two positioning pins on the table of the machine, directly below a drill press driven by a Dumore air motor. The board table is free to move in a horizontal plane and is attached to a tracing stylus by means of a pantograph linkage. When the operator guides the stylus to a hole and pushes it down against spring loading, contact with the metal underneath completes a control circuit that serves to lock the table and initiate downward movement of the drill press. A pressure-sensitive feed controlled by compressed air automatically adjusts drilling speed to the characteristics of the material being drilled. With drilling, there is no need to preheat phenolic boards to prevent chipping and cracking.

When hole locations are controlled by a template, there is no need to place holes on a predetermined grid structure, as is necessary with a programmed machine. The only tooling cost for a change in design is the template material plus 40 minutes labor for drilling the template.

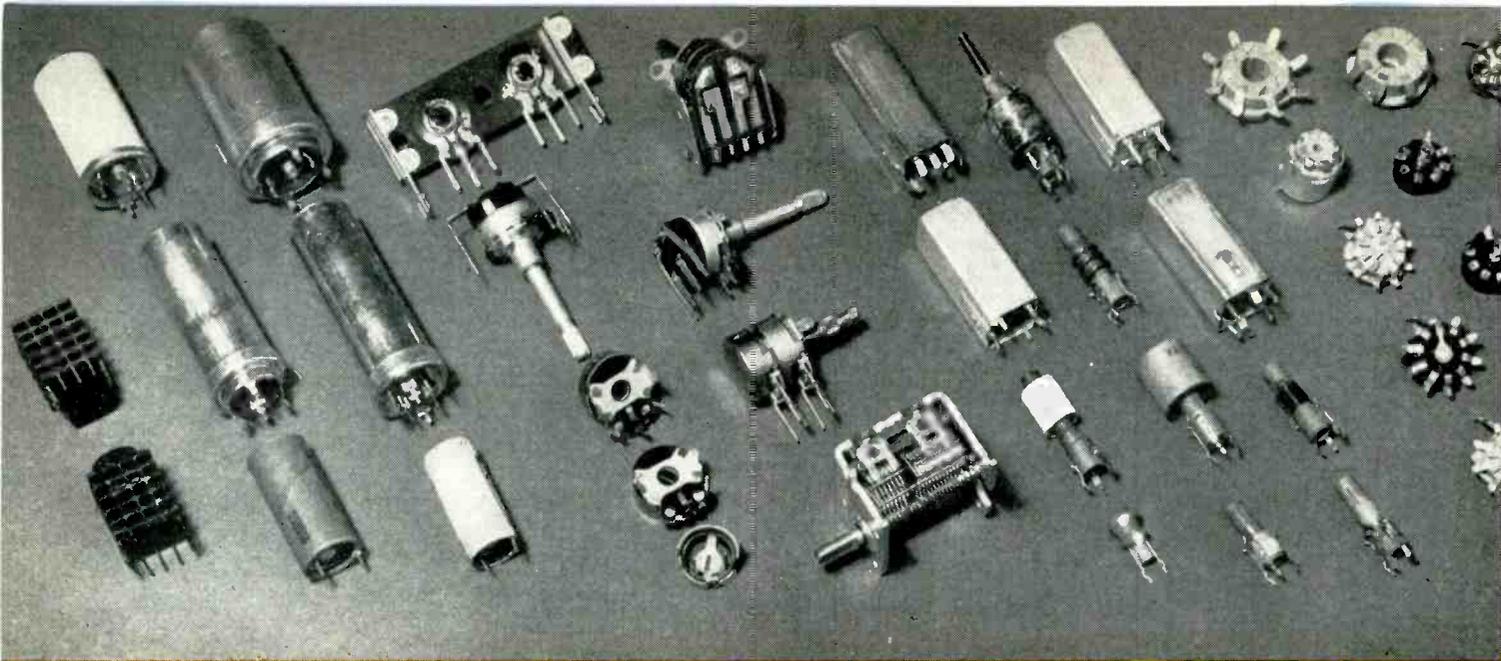
The two guide holes must be punched or drilled in the boards beforehand with precise positioning.

Punched-Tape Press Control. A programmed punching machine announced by RCA operates under the control of punched paper tape to perforate 0.052-inch holes at 0.10-inch grid intersections. Even though producing one hole at a time, the machine will in 45 seconds produce any desired combination of holes in any number of circuit patterns on boards up to 6×17.6 inches in size. The production rate is 60 boards per hour, including loading and unloading. Only one operator is required.

Preparation of a control tape for a new design requires approximately 4 hours. Once the control tapes are available, changeover of tapes takes only about 6 minutes.

An automatic punch press developed by GE for the Signal Corps also places holes in wiring boards under punched-tape electronic programming control. This machine has a motor-driven rotating head containing a variety of punch sizes, and a movable board-holding platform capable of positioning in two directions on a horizontal plane under action of a combination of air and hydraulic cylinders. The air cylinder is used to position the platform rapidly in approximately the correct location. A hydraulic cylinder then takes over for precise positioning to 0.001 inch.

Lead Cutters. A completely automatic lead cutter developed by IRC will cut leads of carbon resistors to desired lengths at rates up to 30,000 resistors per hour;



NEW LOOK IN COMPONENTS—Etched or plated wiring boards call for plug-in terminations, with either plug-in or snap-in mounting tabs for larger components. Sockets are designed for insertion in single large punched holes or for stand-off mounting in individual terminal holes. Biggest change in appearance occurs in potentiometers. Small axial-lead resistors, capacitors and diodes require no change, since their leads can

the operator merely loads standard packages of 2,500 resistors and removes the tote box as it becomes filled with cut components.

The carton-unloading mechanism utilizes a combination of a shaking motion and gravity to push resistors over the edge of the box each time a gate opens in response to a photoelectric feed control system. The resistors move transversely down a chute, with bodies parallel and touching. At the bottom, their leads pass between two pairs of rotating cutters that can easily be set to give any desired equal or unequal lead lengths.

Many different semiautomatic lead cutters are in use. Usually the operator loads the components one by one between teeth of a ferris wheel or sprocket chain, for transport through rotating lead cutters or motor-driven chopping blades. Magazine feed is used with chopper blades driven by a continuously cycling air cylinder in another setup, where the cut components drop directly into assembly-line tote boxes. Some setups form the leads also, for manual insertion.

Magazine Loader. The component preparation machine developed by General Mills is automatic in operation once the axial-lead units are placed in its hopper. The machine feeds them one by one into a transfer wheel where the leads are straightened and cut to length. For components which are to be mounted off the wiring board (as required for IBM's radar boards), the machine also places wrap-around sleeves on the leads. The prepared units then slide down into a waiting magazine. After each magazine is filled, the machine indexes to the next empty magazine until eight are filled.

New Look in Components. Redesign of terminations for hand assembly in wiring boards is the first step by component manufacturers to meet the new demands of the electronic industry. This has largely been achieved already, as can be seen in the product lines of such representative

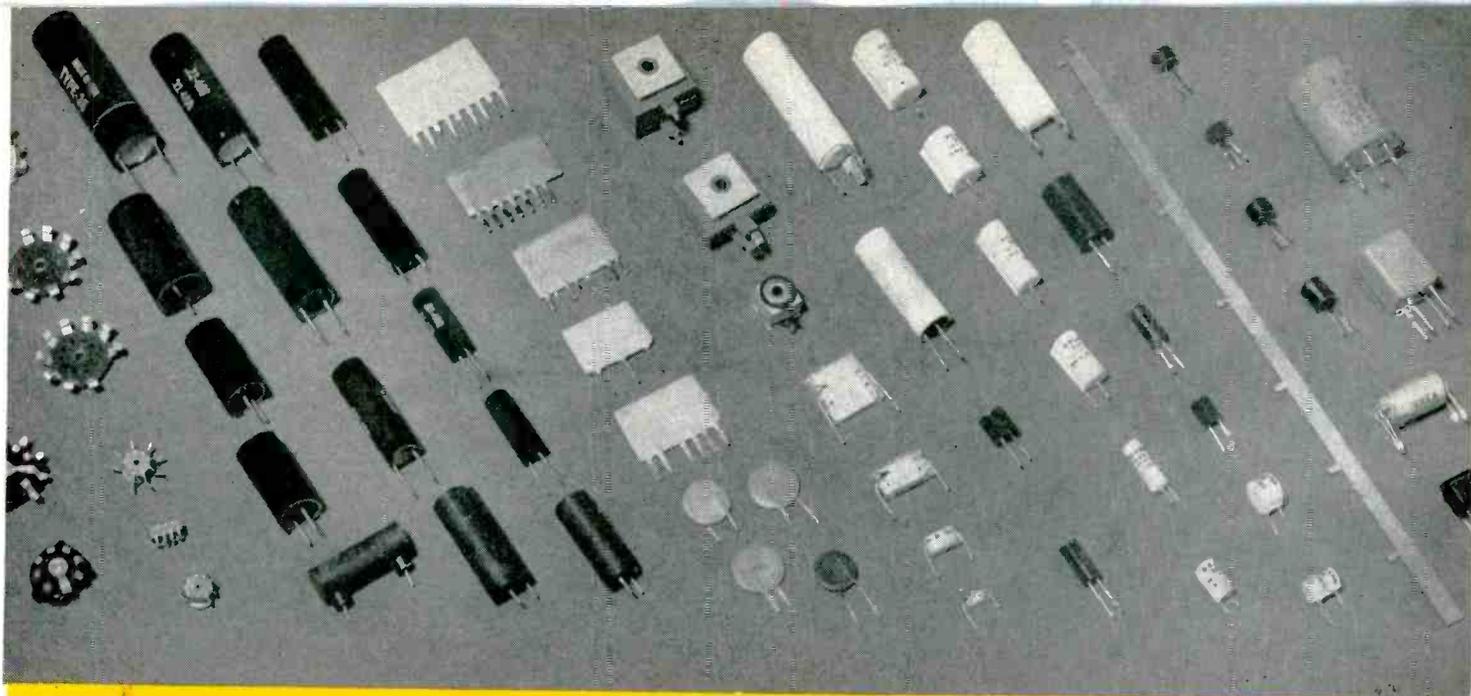
manufacturers as Aerovox, Astron, Centralab, Chicago Condenser, Chicago Telephone, Cinema Engineering, Clarostat, Corning, Eastern Precision Resistor, Elco, Mallory, Methode, Radio Receptor, Sangamo, Sarkes Tarzian, Sprague, Stackpole, Standard Coil, Sylvania and UTC, as well as many others.

Next will come modification to meet the requirements of automatic assembly machines. In many cases the existing designs with single-ended terminations are already usable. For others, particularly sockets, electrolytics and i-f transformers, it will be necessary to add flats, tabs, slots, off-center holes or appropriate terminal positioning to permit orientation by assembly machines. Attention must also be given to the problems of belting or magazine loading. Terminals will have to be straighter and more precisely positioned. Final designs will have to be worked out by component and machinery manufacturers in cooperation with RETMA and other industry standardization committees.

Terminations for wiring boards are likewise in a state of transition at the moment. Radio and tv manufacturers use a variety of individual terminals staked into boards for interconnecting purposes, as also do many military and industrial electronic manufacturers. The latter two also use multi-terminal connectors such as are made by Amphenol, Continental Connector Corp. and Elco, which permit plug-in and removal of the entire board at will.

Several manufacturers have inserted i-f transformers automatically on an experimental basis. Development of insertion heads for these is well under way, with loading from tape-belted single-sided reels or from magazines. A 20-inch reel would hold about 400 average transformers, enough to feed a machine head for about 20 minutes.

A survey by Automatic Mfg. Corp. indicated that 17 firms were now inserting i-f transformers manually in wiring boards but will probably use machine insertion later. Three firms plan to start and continue with manual insertion, while two plan to start with machine insertion in



be cut and formed beforehand or at time of insertion. Except for greater uniformity in lead position, disk capacitors also retain their familiar look. Long metal strip is stiffener that plugs into center pins of in-line sockets to prevent large Westinghouse preenc ic board from warping during dip-soldering. At right of strip (upper right corner) are pulse, audio and transistor transformers

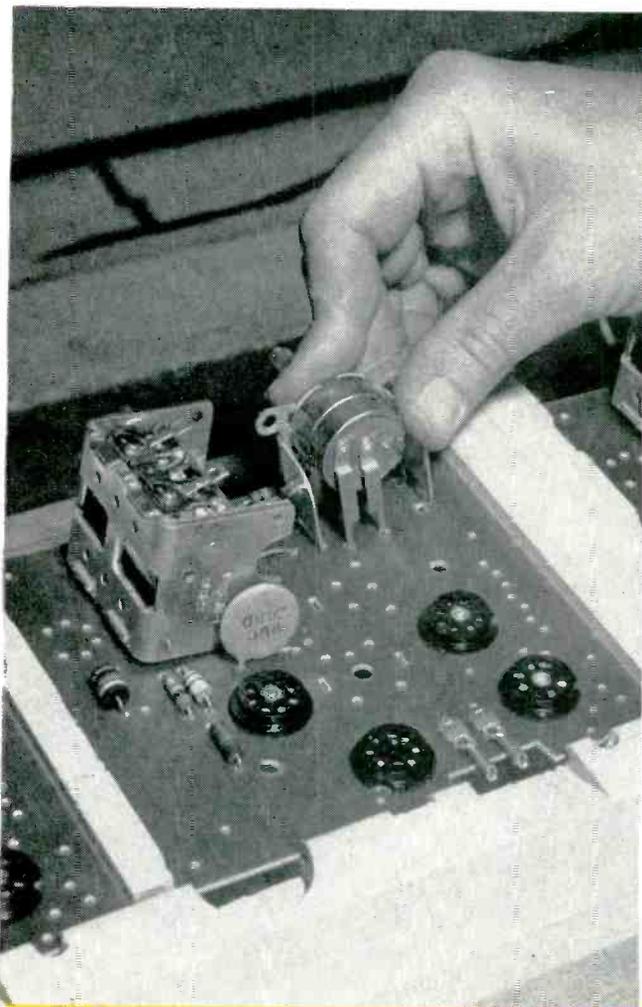
etched wiring boards for radio and television receivers.

The chief requirement for coil terminals is that they be stiff enough to stay straight during normal handling, without toe-in. Snap-in terminals are favored by some, while others are satisfied with straight terminals and snap-in mounting lugs that hold the transformer on the board until it is soldered. Still others favor long, thin terminals that can be clinched after insertion the same as with pig-tail leads.

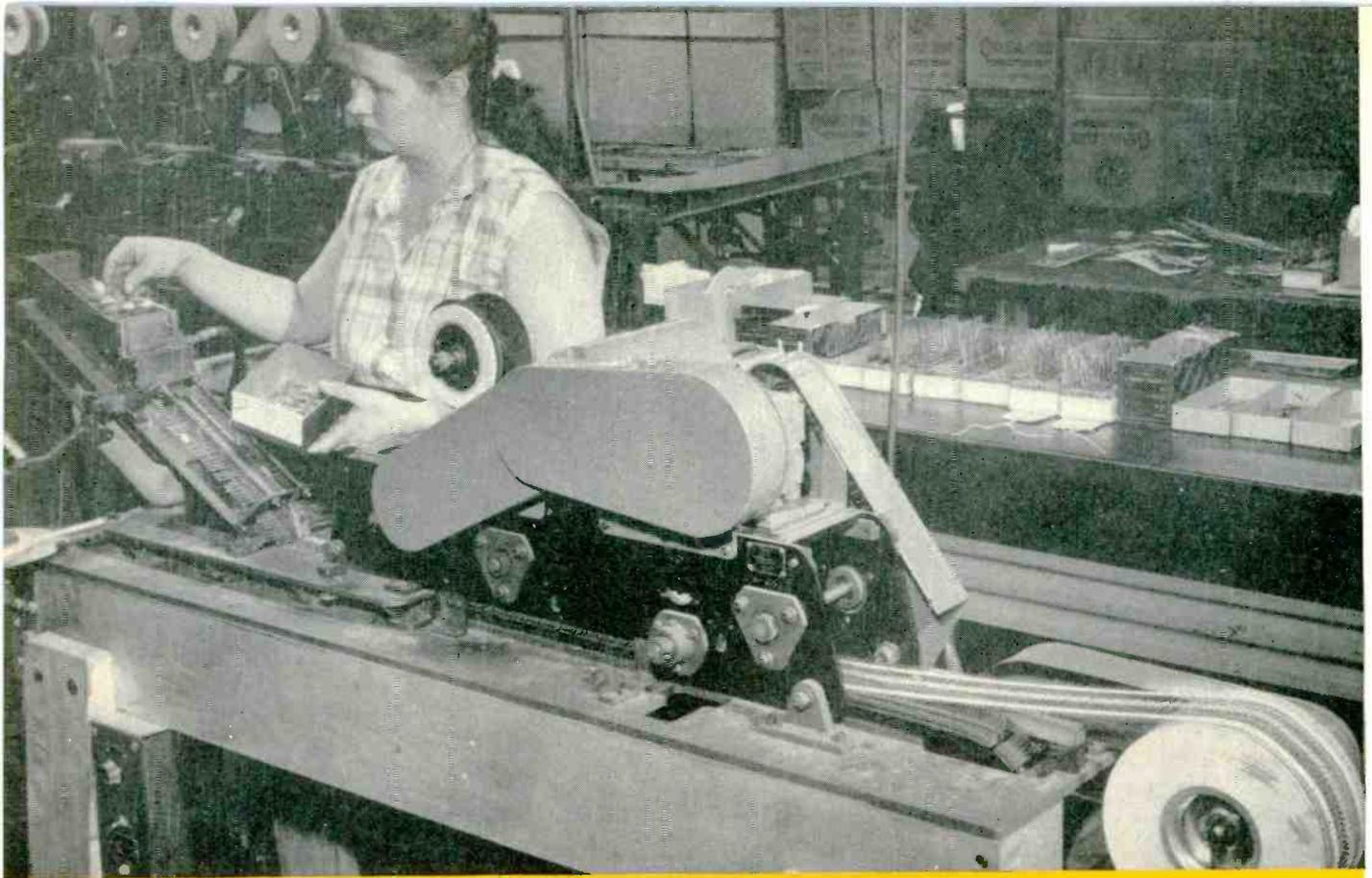
Summarizing the new look, modules have leads suitable for direct insertion in wiring boards. Can-type electrolytics change little in appearance, except that snap-in mounting lugs replace the twist-type. Controls change most in appearance; new designs display considerable ingenuity in getting terminals and control shafts out at the required directions. Even gang tuning capacitors for radios have gone plug-in, though with manual loading as yet. Transformers and coils for r-f and i-f boards look much the same. Sockets are single-hole snap-in types except for an occasional unit that stands off the board like a spider.

Paper capacitors with axial leads can be handled like resistors, but more and more plastic-housing units have plug-in leads at one end. Coupling plates and ceramic capacitors remain unchanged except for greater precision of terminal location; some have wedge-shaped flat terminals in place of wire leads. Selenium rectifiers get snap-in terminals. Wire-wound resistors are getting the same plug-in terminations as some paper capacitors. Transistor transformers, smaller than marbles, and various other types of transformers likewise are coming out with single-ended terminations.

Component-Belting Machines. When assembly machines use belt feed, the components must first be taped together for storage on reels. United Shoe's automatic belting machine for resistors uses four spools of $\frac{1}{4}$ -inch pressure-sensitive tape, two on each side, to produce a lead-taped belt. When feeding from a bulk-type resistor



INSERTION—Bulky and odd-shaped components are now inserted in boards by hand as on this Westinghouse line, but automatic insertion heads will eventually do this job too



BELTING MACHINE—Resistors loaded by handfuls into hopper of United Shoe's machine in Indianapolis RCA plant are fed into chute with air assist, dropped into teeth of sprocket chain for precise spacing, rotated between metal plates to straighten leads, then run between pairs of adhesive-tape strips form desired chain-like belt that is reeled up for use on insertion head

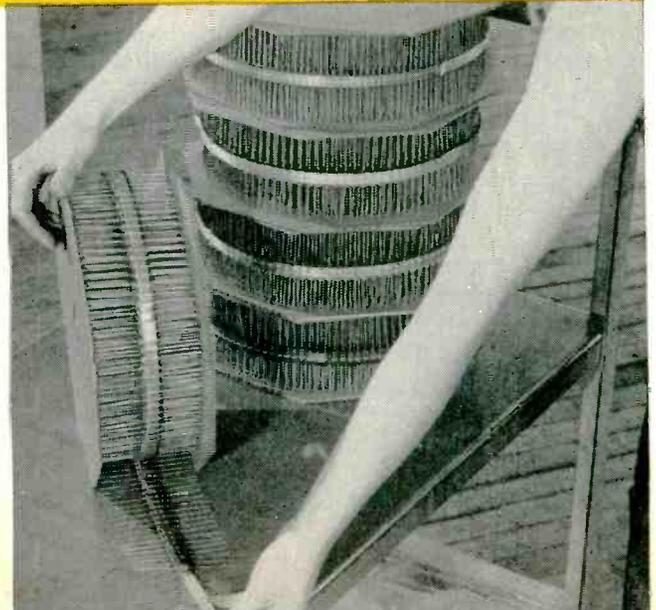
package, the operator feeds resistors into the hopper a handful at a time and aligns them roughly. Components flow from the hopper into the raceway, the motion of the resistors being assisted by an air stream and vibration.

At the bottom of the raceway the resistors drop one by one into pairs of teeth of a sprocket chain. This serves to space the resistors accurately. The chain first brings the resistor bodies under a motor-driven rubber roller. This

rotates the leads between metal plates for straightening. Rubber rollers then press the tape lengths together against the leads to form the desired chain-like belt.

Allen-Bradley has a number of machines for body taping of axial-lead components. The parts drop down a slide by gravity into a sprocket-type feed wheel that gives uniform spacing. A rubber roller presses the tape firmly against the parts while they are on the feed wheel.

BELTING MACHINE—Resistors or capacitors in corrugated paper sleeves are fed into vertical feeder slide of Allen-Bradley machine for body taping on Minnesota Mining's filament tape at rate of over 20,000 units per hour (10 to 20 filled reels, depending on component size). Twelve-inch tape leaders facilitate loading and splicing an assembly machines. Reels are expendable



3. MACHINE ASSEMBLY

Some two dozen huge machines for inserting components, terminals and jumpers in wiring boards are in operation or under construction today. Hundreds of smaller machine setups are used with manual loading as an experience-getting interim step

For the high-volume requirements of radio and tv plants, computers and some military items, in-line assembly machines as developed by Admiral, General Mills and United Shoe are favored. Here the wiring board moves from one station to the next while components are inserted, just as on a manual assembly line.

Although differing in details of board transport, board position, component feed and method of inserting components, all in-line machines have essentially the same production rate of 20 to 30 boards per minute or over 10,000 boards per 8-hour day. Likewise, all stop automatically when a malfunction occurs, so that no rejects get through. A single lamp comes on at the station in trouble, to guide the operator in clearing the jam. She can then operate the head individually to insert a new component.

Admiral Machine. Admiral has six automatic assembly machines running and one more under construction, with an additional 44-station machine being built for RCA. All eight are expected to be in operation by year-end.

Admiral will be using one of its seven machines for a radio board, two for a tv audio board, two for a tv sync board and two for a tv i-f board. Of the 231 components

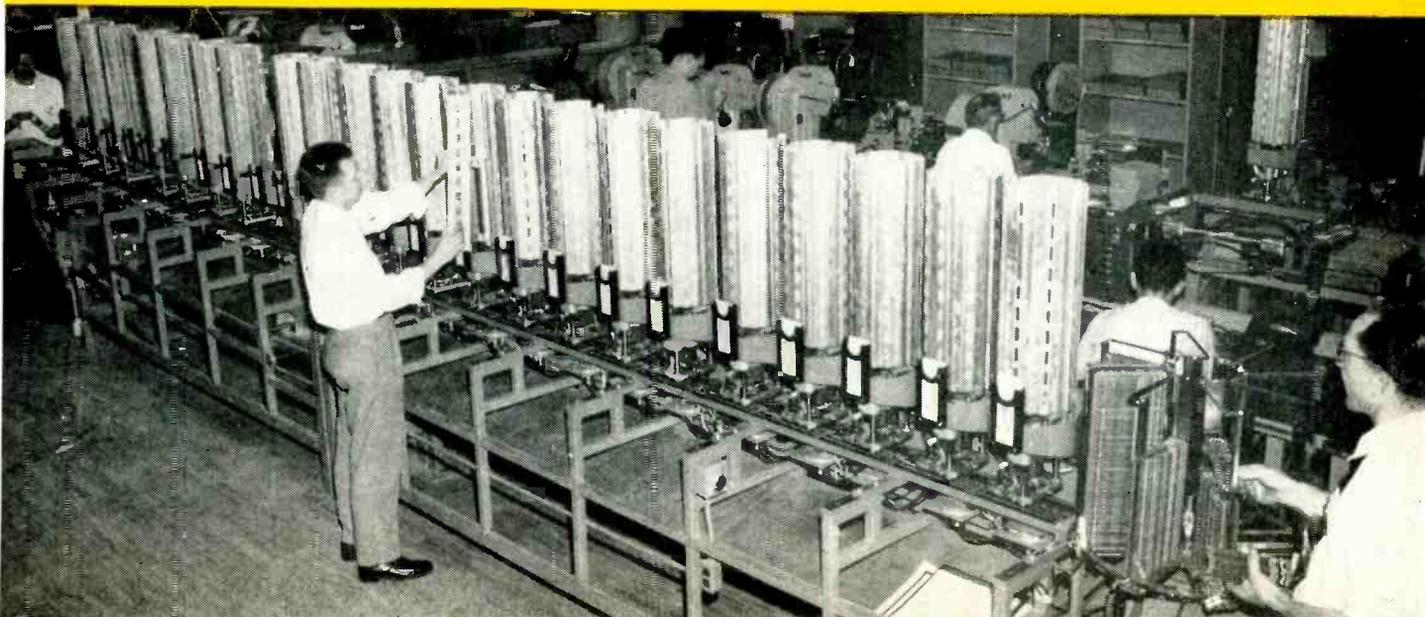
on three tv boards, a total of 190 will be assembled by machine, including 13 sockets. This figure will creep up gradually as new insertion heads are developed, working toward the goal of completely automatic insertion so that finished boards can slide right into an automatic dip soldering machine.

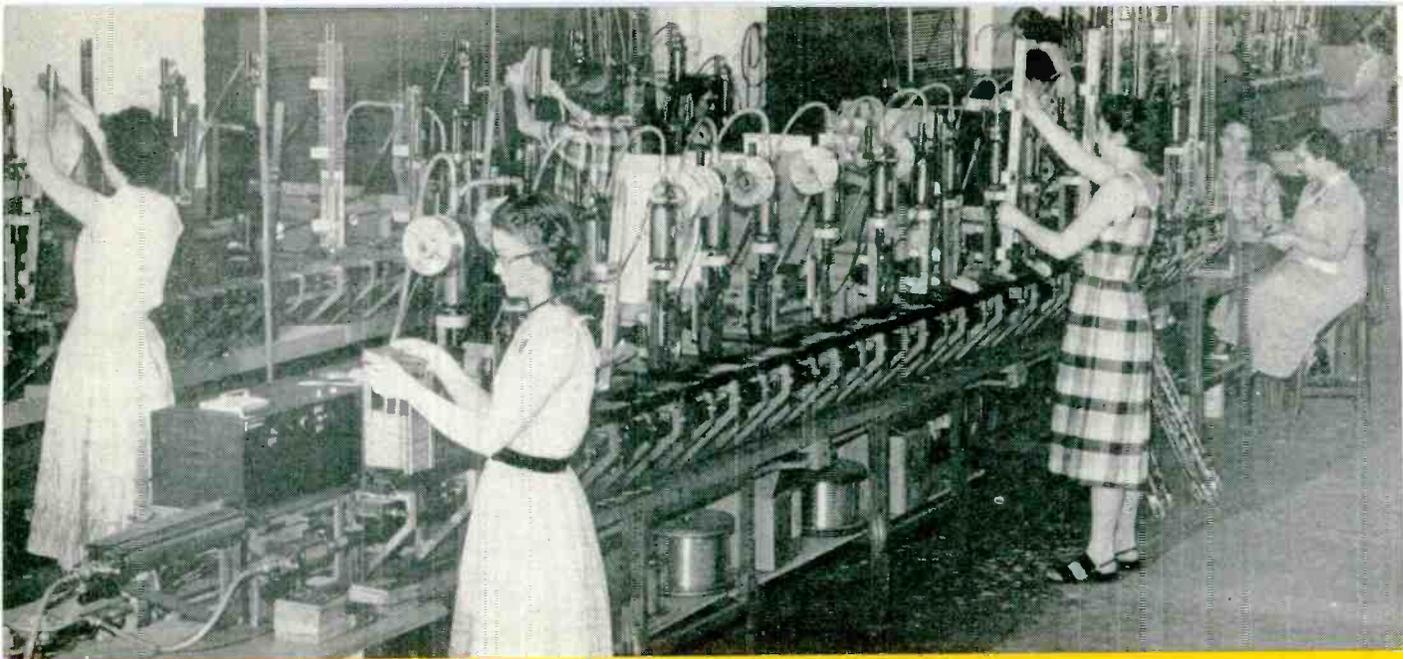
General Mills Machine. General Mills entered the electronic mechanization field with its 24-station Autofab machine built for IBM. This uses wrap-around sleeves on component leads and special forming jaws in each head to give the off-the-board mounting required by the intended application—assembly of thousands of boards in some hundred different designs for early warning radar computers to be installed at U.S. Air Force stations. The sleeves are driven into the plated-through holes in the board to give a tight mechanical connection that is later augmented by dip soldering.

The commercial version of the Autofab machine has conventional insertion heads and clinching anvils in place of the more costly sleeves for leads. The firm reports orders for three such machines.

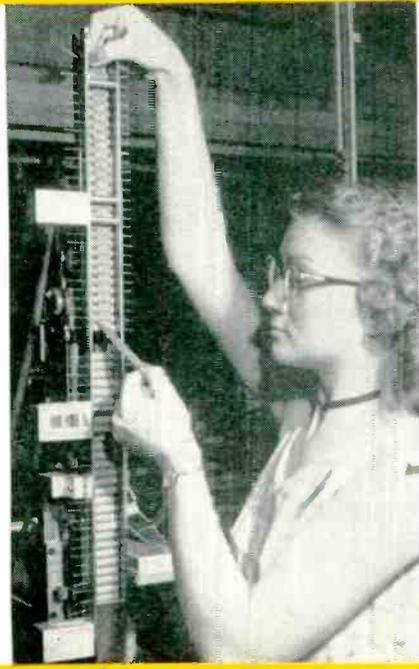
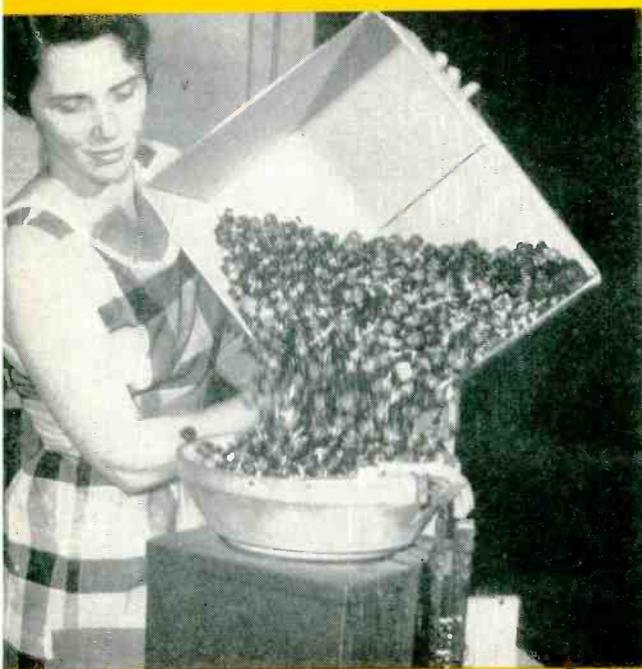
Autofab machines use magazine loading; each head has an automatically indexing turret holding eight magazines,

IN-NE MACHINE—General Mills Autofab as built for assembly of radar computer boards in IBM's Kingston, N. Y. plant. Eight-compartment loading turret at right takes boards with interconnecting terminals already inserted. Each head has self-indexing turret holding eight magazines. Boards are pushed along rails from station to station by two-chain conveyor





IN-LINE MACHINES—These three machines in Admiral's plant insert over 70 percent of the required components in the three boards currently used in the firm's television receiver. One air cylinder pushes boards down rails, without use of pallets, while another cylinder locks boards over conical positioning pegs at each station. Some stations have up to three heads



INSERTION HEADS—Dumping 7-pin sockets into hopper of Syntron feeder, for orienting by missing pin and loading into magazine that slips into position on Admiral's socket-inserting head. For same machine, body-taped capacitors in strips about 18 inches long are dropped into loading chute of capacitor head and tape is pulled off. Leads are cut and formed by head

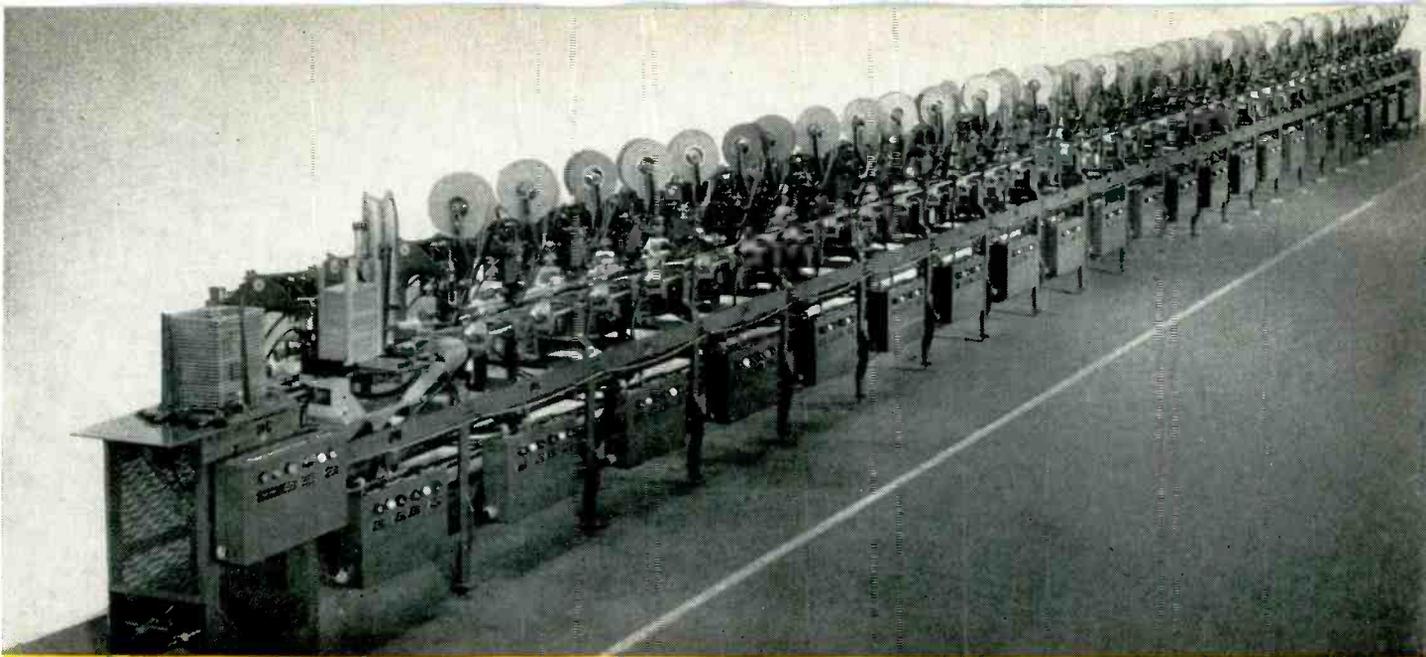
which advances one step when a magazine runs out. Power for turret rotation is obtained from a small horizontally mounted air cylinder inside the head. A somewhat similar eight-position turret feeds boards into the machine.

General Mills chose to cut leads beforehand to reduce the number of cutters and to simplify head design. The machine normally runs at 20 insertions per minute, whereas lead cutters operate at many times this rate. Omission of cutters from the insertion heads reduces the number of possible trouble points and eliminates the problem of disposing of cut ends of leads. Preliminary cutting also permits straightening of leads, with resulting further assurance of trouble-free insertion.

United Shoe Machine. United Shoe has acknowledged receipt of firm orders for at least six complete assembly systems. These systems average about 30 stations per machine.

Five machines have already been delivered. Two are in RCA's Indianapolis plant, starting as 44-station machines handling only axial-lead components; one of these will be elongated to 56 stations when new insertion heads are delivered.

At the present time, United Shoe uses double-tape belting across the ends of the leads. This requires four strips of tape, facing each other in pairs with the leads between the pairs. The tape required costs about 17¢ per thousand



IN-LINE MACHINE—Forty-station automatic assembly machine delivered by United Shoe Machinery Corp. to a leading radio-tv assembler, as set up for initial tests. Pallet return conveyor running under machine has since been added, providing completely automatic handling of pellets and replacing pallet feeder shown at left. Heads shown are belt-loaded from reels

parts, and the taping operation brings the total cost of component preparation up to about 25¢ per thousand parts. If experiments now under way are successful, tape costs will be almost halved by using adhesive on only one side of each lead and ordinary paper ribbon on the other side.

Body taping is still cheaper because only one length of tape is needed. With body tape, it is essential that the tape hold tightly during extremes of temperature and humidity and yet strip free without leaving a sticky residue or taking the paint off the component.

The chief deterrent to bulk loading of axial-lead components on individual insertion heads is the cost of the required vibratory feeder and its mounting. Another problem is that of reaching the hopper of the feeder if it is mounted in its logical position atop the insertion head. For these reasons, RCA has elected to use double-tape lead belting with its two United Shoe machines, but plans to go to less-expensive body taping just as soon as this appears feasible.

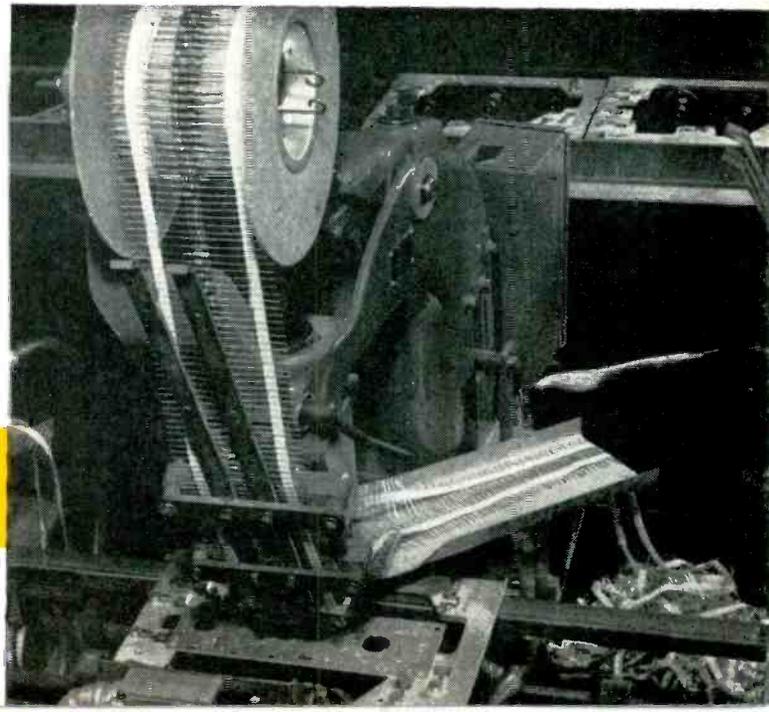
With either body or lead taping, an empty reel is easily replaced without down time, because the insertion heads have ample component storage capacity below the reels. New reels have leader strips of tape that serve for splicing.

After installing some half-a-dozen parts in over 150,000 radio wiring boards with a pilot-model United Shoe machine, Emerson has ordered a 37-head machine capable of installing practically all parts on their radio board and on one tv board. It is planned to alternate scheduling of the two boards, probably on a daily basis since changes in setup can be made before or after the regular working day. Three men can change the entire machine setup in less than an hour, allowing 4 minutes per head.

Other Assembly Machines. One set manufacturer uses several four-station machines of its own design to assemble a five-tube etched-wiring radio. Body-taped resistors and capacitors on reels are the only components inserted at present. The insertion heads cut, form, insert and clinch in much the same way as other in-line machines.

Development of a batch-loading socket-inserting head for automatic assembly machines has been announced by Elco Corp. With minor adjustments its Syntron vibratory elevator will handle and orient a number of different types of sockets. Orientation is by means of molded studs on the socket.

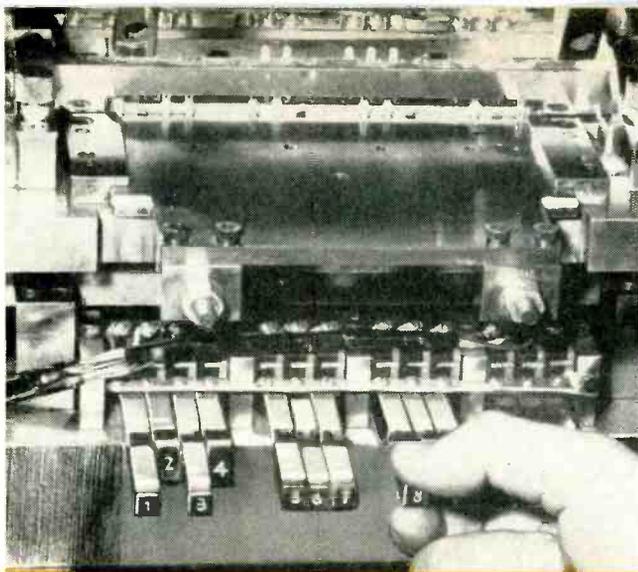
Market for Assembly Machines. It is estimated that 50 assembly machines having an average of 40 stations each will handle the present requirements of the electronic industry. This estimate may prove too conservative, because a recent survey by Stavid Engineering indicates that



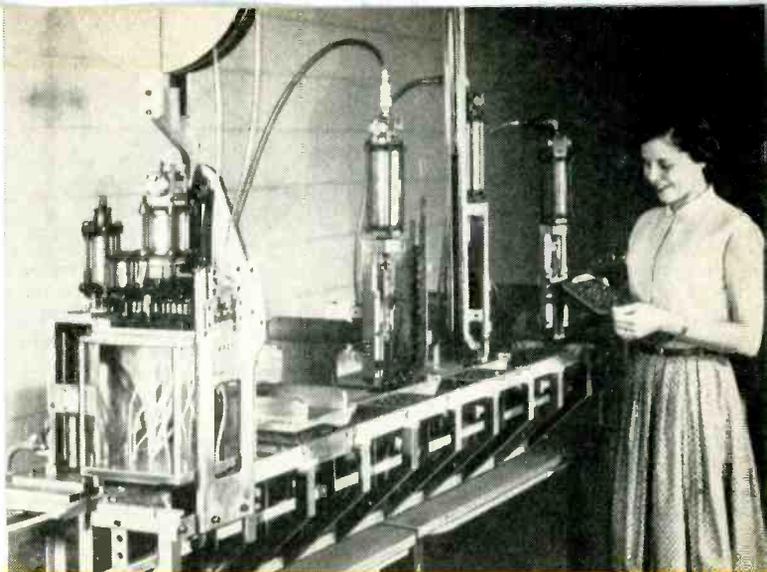
BELTING—Resistor-inserting head on RCA's United Shoe assembly machine, showing pallet for rectangular video i-f board and solenoid chute for taped cut-off leads

Comparison of Three In-Line Automatic Assembly Machines

	Admiral	General Mills	United Shoe
Status of production	Six machines in operation and one under construction for own plant; one 44-station machine scheduled for Oct. delivery to RCA	One machine in operation at IBM's Kingston, N. Y. plant; three more under construction to fill orders	Five machines delivered, including two to RCA and one to Emerson; additional machines under construction to fill orders, one of which goes to Stromberg-Carlson
Speed	12 boards per minute	20 to 30 boards per minute	20 to 30 boards per minute
Board feed	Automatic feed by pushing from bottom of single stack of etched boards, without pallets	Automatic feed by dropping from bottom of one of eight stacks of boards on input turret, without pallet. Boards may have terminals	Automatic feed by pushing from bottom of single stack at input of machine, for automatic loading into aluminum pallet
Board transport	Wiring board slides on rails, without pallet. Air cylinder moves rod running length of machine, having pusher bars that come up to move each board to next station, then retract and return	Board slides on rails, without pallet, and is pushed from station to station by spring-loaded fingers projecting from two-chain motor-driven conveyor having differential drive controlled by master cam	Board-carrying pallet is moved by two narrow motor-driven conveyor belts that run continuously. Closed-loop pallet return system running under machine requires only eight more pallets than stations
Board positioning	Second master air cylinder moves machine-length rod having cams that pull down side-rail segments at each station so as to bring two reference holes on each board down onto conical positioning pegs	Board-stopping dog comes up in between chains of conveyor at each station. Board is accurately positioned and clamped by spring action as conveyor stops. References for positioning are one long side and point at one end of board	Each pallet has projection on one side and two positioning pins. Diaphragm-type air cylinder moves machine-length rod that cams pallets sideways to (1) engage pallet positioning pins in V-notch and flat of side rail and (2) raise each pallet about 1/16" above belts
Timing	Electrical timer controls solenoid valves in air cylinder lines	Cams on variable-speed motor drive system control starting and stopping conveyor and heads	Timing adjusted by changing setting of conveyor time delay switch
Heads	Up to 3; average is 1 3/4 per station	One per station	One per station
Cutting axial leads	Done by insertion head. Cut leads go down chutes into scrap box at rear	Leads are cut beforehand by automatic magazine loading machine	Done by insertion head. Cut leads and taping go into scrap box
Forming axial leads	Done by insertion head just before insertion	Same	Same
Loading axial-lead components	Batches of 25 or more in corrugated cardboard sleeves as packed by vendor are dropped into raceway on head. Body-belted capacitors in 20" strips are similarly dropped. May go to body-belted on reels later	Magazines are used. Each head has eight-magazine turret that indexes automatically as a magazine empties	Lead-belted reels are used, holding 2,500 1/2-watt resistors. Belt is prepared beforehand by machine, using four strips of adhesive tape in pairs with leads between to give appearance of chain
Method of clinching	Roll-over clinch in any direction by pushing leads down into contoured anvils. End of lead bites into wiring	Angled or complete roll-over clinch in any direction by pushing leads down into anvil, or wiping clinch by moving fingers under board. Conical wrap-around sleeves on leads eliminate need for clinch on IBM machine	Angled or complete roll-over clinch in any direction by pushing leads down into anvil. Plan to use wiping anvils on disk capacitors and on large components having long leads that might buckle if pushed down
Loading disk capacitors	Plan to use expendable or reusable tubular magazines, with leads projecting through longitudinal slots, loaded by vendor	Plan to use magazines and grip short leads to insert or, when permissible, spread out long leads for handling like axial-lead components	Plan to use bulk feed from hopper on head, with 7/32" leads spaced 0.250" or 0.375", oriented in head
Loading tube sockets	Magazine feed now. Separate Syntron setup orients 7-pin sockets by missing pin and loads magazines	Magazine feed. Sockets are oriented beforehand by automatic magazine-loading machine	Plan to use Syntron feed from hopper to head, with orientation in head by missing pin
Loading i-f transformers	Plan to use body taping on reels. Unshielded units will have cardboard sleeves to permit taping	Plan to use magazine feed	Plan to use expendable paper magazines, with units oriented by vendor or oriented on head
Changing board width	Side rails easily adjusted from 2 1/2" to 6". New single-rail machine removes width limitations	Shift front rail and front conveyor chain to take boards from 2" to 10" wide	Pallets take several sizes of boards. Standard pallet takes boards up to 5 1/4" wide and 10" long
Changing board length	No change needed up to length limit of 10"	No change needed up to length limit of 10"	Pallets are designed to take several lengths of boards
Adding stations	Added in five-station sections having their own extension rods for board transport and positioning. First section has drive mechanism	Added in five-station sections. First section has drive mechanism providing power and control for up to 50 stations	Added in two-station sections. Extra lengths of belt are spliced in with ordinary belt clips. One machine will have 56 stations



TERMINAL INSERTER—Pushbuttons change pattern by which up to 41 interconnecting terminals are inserted simultaneously in wiring board by Berg machine shown on front cover



TERMINAL INSERTER—Malco unit for Admiral assembly machines chops required number of terminals from sprocket-hole strips and lets them slide down flexible plastic tubes into holes in board

the break-even point for in-line assembly machines can be as low as 50 boards. This surprisingly low figure is arrived at by balancing the cost of changing a machine setup against the cost of training workers for hand assembly and inspection of a new board design.

External Connections for Wiring Boards. Almost every etched wiring board requires external connections that cannot be made by dip-soldering. This is sometimes solved by means of special plug-in connectors, but more often the connections are made conventionally by soldering to terminals inserted in the board before assembly of parts.

The commonest procedure uses a press that automatically feeds and inserts one terminal at a time, with manual positioning of the wiring board. Some firms speed up the operation by setting the board into a metal template having appropriately located grooves and holes underneath for fitting over a positioning pin on the anvil of the press. Admiral used this technique while awaiting delivery of its fully automatic terminal inserter.

Semi-Automatic Terminal Inserters. A manually loaded machine serves for inserting terminals for Keller wire-wrapping tools in etched wiring boards at RCA's Indianapolis plant. A horizontal endless-chain conveyor operated by a foot-controlled air cylinder carries metal holding fixtures in which the operators insert the terminals. When a fixture is loaded, a board is placed over the terminals. At the next station an air-operated press stakes all terminals simultaneously.

Eyelet Inserter. With minor modifications, standard wire-terminal or lug-terminal eyelet machines can be placed on United Shoe heads. One eyeletting machine is needed for each eyelet on a board.

Malco Terminal Machine. To further mechanize the assembly of etched wiring boards for radio and tv sets, Admiral recently installed an automatic terminal-inserting machine made by Malco Tool and Mfg. Co. This machine will insert up to 40 self-retaining terminals. The complete time cycle of operation is 3 seconds, so that an operator

can turn out up to 20 boards per minute. Five more of the machines will be added shortly.

Terminals in strip form are fed from two large reels supported above the machine. For each cycle, a preset number of terminals is advanced across the anvils of cut-off dies.

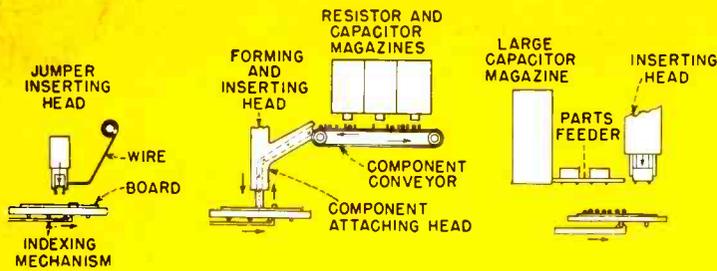
Descent of the die under air cylinder action severs the terminals from the strip, allowing each terminal to drop into its own length of flexible plastic tubing. The lower ends of these lengths of tubing are set into holes drilled in a template directly over the desired terminal positions. When a board is positioned accurately under this metal template by the feed mechanism, the terminals drop into the correct holes in the board. The board transport mechanism then advances the board to the next position on the line, where a metal platen is brought down by an air cylinder to press the terminals into the board. The design of the pin terminals is such that they are self-retaining once they snap in. The machine can be built into an automatic assembly line, where it occupies the space of two ordinary insertion heads.

Berg Terminal Machine. The Autolog machine built for IBM by Berg Mfg. and Eng. Co. gives practically instant pushbutton change of setup in inserting from 1 to 41 lugs in etched wiring boards. The operating rate is 1,380 boards per hour.

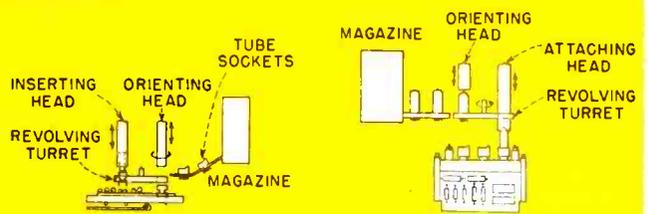
The machine uses one reel of lug strips for each of the 41 possible positions in which a lug may be needed. Each operation of the machine advances the desired strips the length of one lug, pushes the wiring board down over the lugs, shears the lugs from their strips and crimps them. Pushbuttons arranged around the machine act on plungers that stop the feed of lugs at an undesired position by disengaging the feed pivot on that particular lug strip.

Empty wiring boards are stacked in a tray at the left side of the machine, for automatic plunger feed from the bottom of the stack to the press position, thereby pushing finished boards out and down a chute.

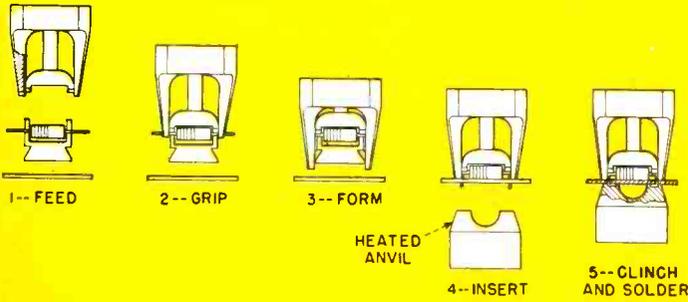
Single-Station Machines. Inherent flexibility is the prime requirement for efficient automatic assembly of extremely



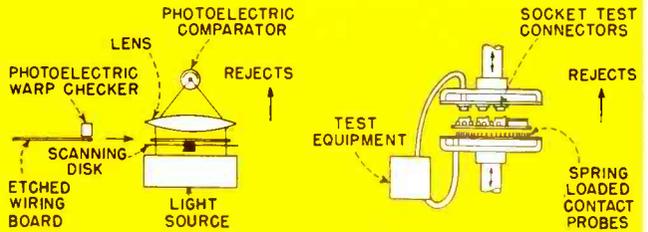
INDEXING FOR SINGLE-STATION MACHINE



TUBE INSERTER



COMBINING SOLDERING WITH INSERTION



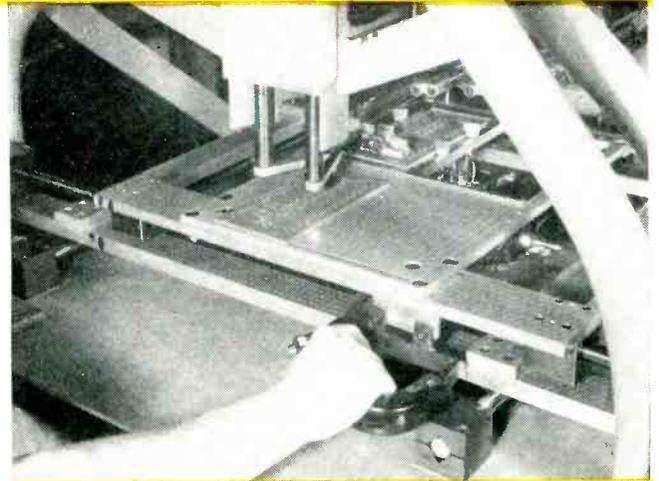
HOLE INSPECTION

TEST STATION

IDEAS FOR MECHANIZATION—A look into the future, as sketched by engineers of Stanford Research Institute and Melpar. Retractable steel pegs that come up in sequence to serve as stops for wiring board are one solution for single-station positioning. Hot-iron soldering of heavily tinned leads at insertion time is technique now being tried as alternative to dip soldering



TERMINAL INSERTER—Air cylinder presses terminals into board after they have been manually loaded into steel fixtures riding on oval stop-and-go conveyor in RCA television plant



SINGLE-STATION MACHINE—Stylus-on-template component inserter at GE's Utica plant. Each time stylus is lowered into new hole, new magazine indexes into position and feeds

short runs of wiring boards. The ultimate in flexibility is achieved when only the input materials and a memory device need be changed to produce a new design. The memory can be in the form of a template for semiautomatic operation or a punched tape, punched card or magnetic tape for completely automatic assembly at a single station. The memory device brings the components to the station in correct sequence and moves the wiring board to the correct position for each.

Ferris-Wheel Machine. One example of a template-memory machine is that used by GE's Light Military Electronic Equipment Department in its Utica, N. Y. plant to fill small-volume military electronic orders. Axial-lead components are cut, formed and loaded into formed steel magazines beforehand by a preparation machine that takes up to 25 components at a time. The magazines

are then loaded onto a huge drum resembling a ferris wheel, a template is placed in position and a wiring board is loaded onto the table. As the operator guides the stylus into each hole in turn of the groove in the template, the wiring board shifts correspondingly, the wheel indexes to a new magazine and a component is fed to the head for insertion and clinching.

Melpar Machine. Another example of a single-station machine for short production runs is that being constructed by Melpar under a Bureau of Ships contract. The present model inserts six axial-lead components in an etched wiring wafer and solders the joints. Under punched-card programming, the machine will select the required component from one of six storage hoppers, transport it to the insertion station, bend the leads, insert the leads in the wafer holes, then clinch the leads with a heated anvil that also solders

them to the etched wiring on the bottom of the wafer. On each succeeding cycle another component is selected from the same or a different hopper and similarly inserted and soldered after appropriate repositioning of the wafer by an air-actuated servo system.

The operating rate of the machine is 2 seconds per insertion or about 12 seconds per wafer. Changeover for a new design, involving changing all component parts, all wafers and the punched card memory, takes about 5 minutes.

The required amount of solder for achieving a good joint is provided by electroplating an 8-mil layer of solder over the copper foil in the pattern of the desired wiring. This solder then serves as the resist for etching out the unwanted copper.

As presently conceived, the Melpar machine requires that tinned eyelets be used in all holes.

Other machines are planned for combining the wafers into subassemblies and testing them, to complete the programmed assembly system.

GE-Signal Corps Machine. Working under Signal Corps contract as a logical continuation of this agency's Auto-Assembly system, GE now has in operation practically all of the individual machines that make up an automatic component assembly system. This single-station system uses punched card programming, and will be completely automatic through dip soldering and test when fed with the required components and etched wiring boards.

The system is unique in its use of individual carriers for the components, with the carriers in turn going into magazines.

The wiring boards travel through the machines on special metal pallets designed to take boards ranging from one inch square up to 8×12 inches.

The component preparation machine, a part of the system, serves to load the carriers. For axial-lead components this involves cutting and forming also.

Each magazine holds 20 carriers, and boards are put through in batches of 20. As the board feed system brings each pallet in turn up to the insertion head, the pallet and head are servoed to the proper position for receiving the component from its carrier. When all twenty carriers are empty, the punched card memory takes over to remove the empty magazine, bring in the next full magazine, servo the head and the pallet guide system to the correct positions for that component, then repeat the recycling of the 20 boards.

When the last component has been placed on a board, its pallet is routed to the automatic dip-soldering station. Here the board is sprayed with flux, dipped in solder, cooled, then passed on to the automatic test station. Tested boards are automatically accepted or rejected, then discharged from the system.

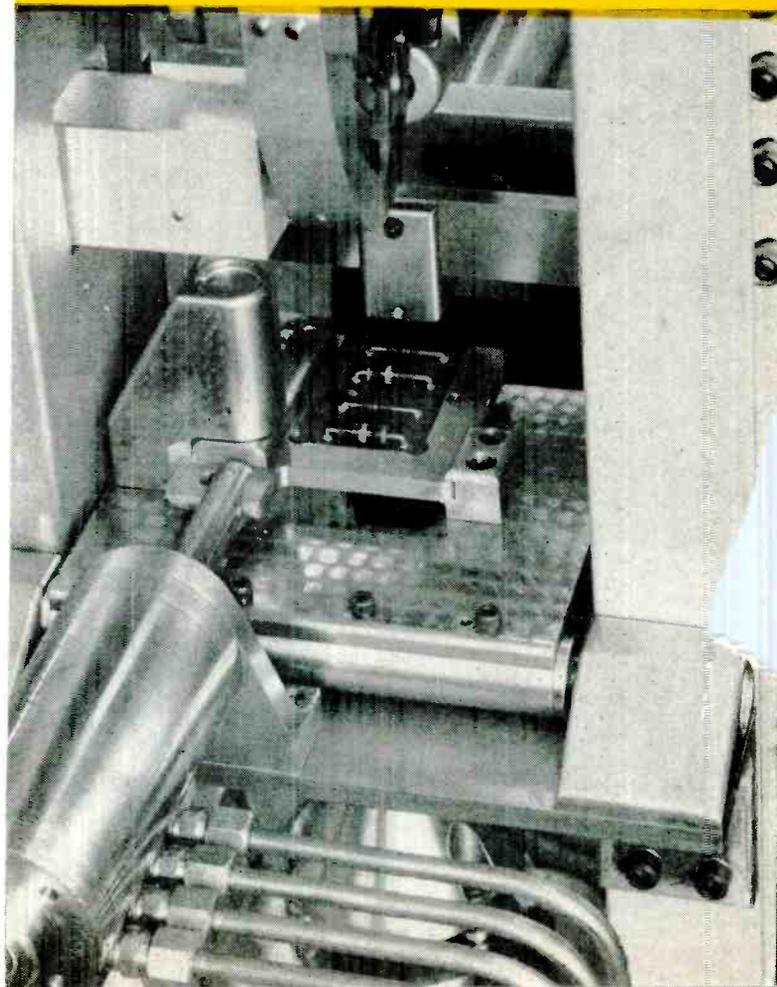
While in the solder bath, the board is vibrated to bring the solder into more intimate contact with the joints. Vibration is continued while the board is tilted up from the solder bath, to remove excess solder while still molten.

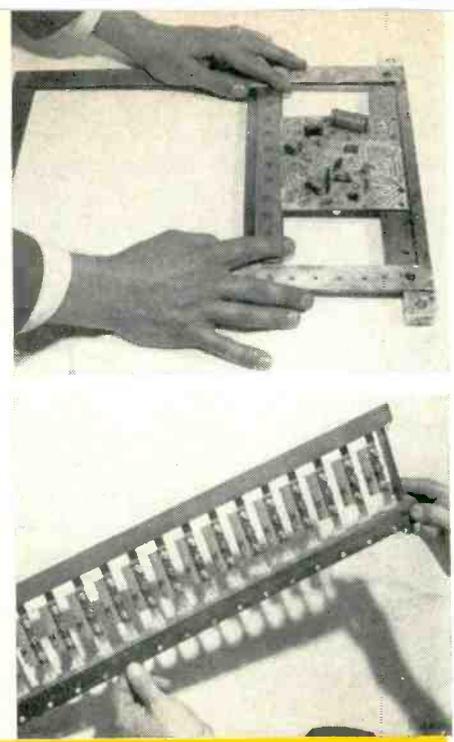
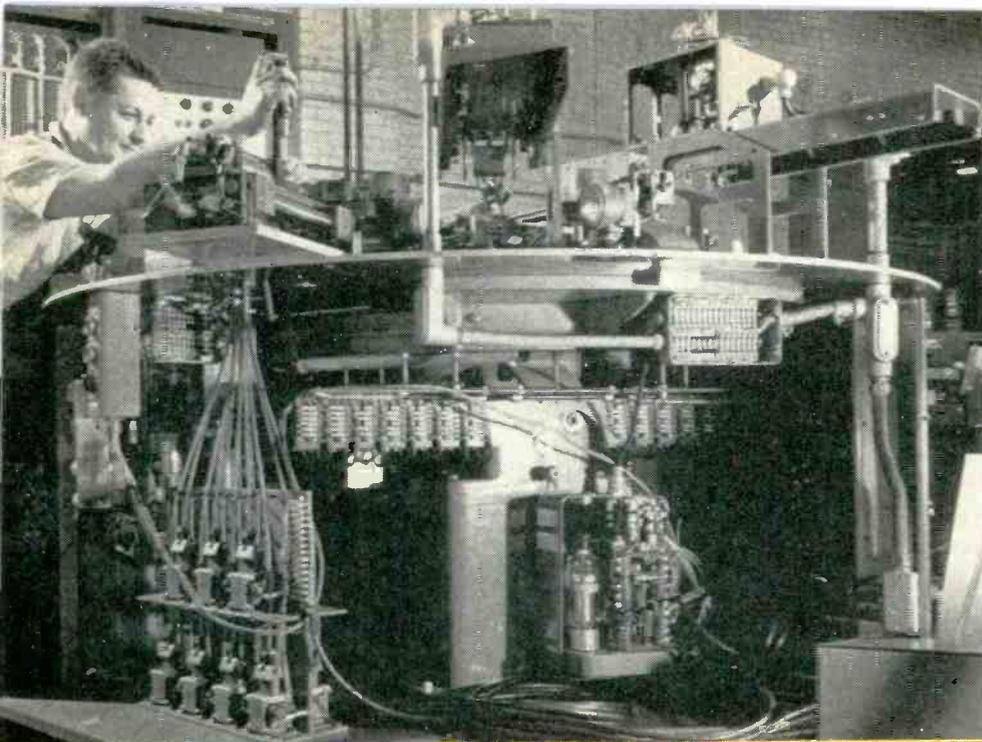
Module Machines. Project Tinkertoy has gone three ways. Basic research continues at the National Bureau of Standards, with tape capacitors and printed resistors receiving particular attention.

At ACF Electronics in Alexandria, Va., a plant has been



SINGLE-STATION MACHINE—Programmed system, under construction for Bureau of Ships by Melpar, will have punched-card control of magazines and air-servo positioner. Present model feeds board automatically and inserts choice of six different components at six positions on board in sequence. Clinching anvil is heated for self-soldering. Pushbuttons permit manual operation.





SINGLE-STATION MACHINE—Component preparation and test turret of programmed assembly system now being constructed for Signal Corps by GE. Wiring-board pallet and component carriers in magazine are shown alongside. Punched cards control automatic loading of specified components into carriers and cycle boards through insertion station until each magazine in turn is emptied

set up for producing modules commercially under the tradename Compac. Machinery here is of new design, streamlined for economical commercial production with a reported production capacity of 500,000 modules per month. Both Emerson and DuMont have announced plans for use of the modules in forthcoming tv sets.

The ACF modules retain the original ceramic wafer stack but now mount in a single square hole in an etched wiring board. The 12 riser wires, surrounding a square socket on the top plate, are pushed up into the square hole from below, and a four-blade tool is used to bend the riser wires down onto the corresponding etched wiring on the top of the board. After masking the socket holes, the board can then be dip-soldered conventionally.

Aerovox has leased the original Arlington, Va. module-building plant from NBS. It plans to conduct a research program aimed at evaluating both the commercial and

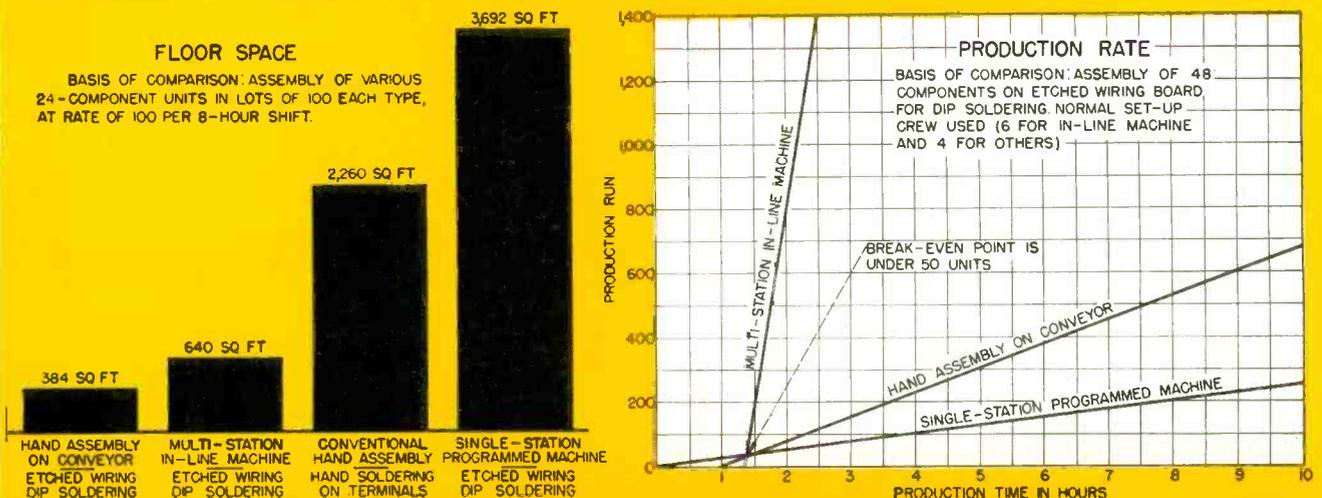
military market for modules serving as single stages.

As reasons for going into modules, Aerovox cites the reliability record of equipment already in use embodying modular construction. Along with ACF, the firm believes it is possible to produce a module that will sell for approximately the same price as equivalent components purchased individually.

Single Insertion Heads. Single heads mounted for bench use in conjunction with manual positioning of etched wiring boards are being made available by General Mills and United Shoe. These can be operated by foot power, by an electric solenoid or by the same air cylinders as are used on the in-line assembly machines.

With the head appropriately loaded, the operator places one board after another on the machine for insertion of a component, until the entire batch has been run through.

COMPARISON CHARTS—Statistics compiled by Stavid Engineering for Navy's Bureau of Ordnance compare floor space requirements and output rates for various production methods. Hand assembly of etched wiring boards on conveyor takes least floor space because one person does work of four to six machine stations. Even with 1.4 hours setup change, in-line machines are faster for runs over 50





MODULES—Now under Aerovox management is this Arlington, Va. module-making plant originally built by NBS for Project Tinkertoy. Commercial market for modules will be explored



MODULES—Insertion head for installing modules on etched wiring boards, developed at ACF in Alexandria, Va. plant as part of program to make product economically attractive

She then reloads with the next component and runs the boards through again, repeating this process as often as necessary. Various fixtures can be used to aid in precise positioning of the boards.

SRI Insertion Head. A basic insertion head developed by Stanford Research Institute will give up to 36 component insertions per minute, with automatic indexing of the board along one axis for up to ten positions. Leads must be cut to length beforehand. The pilot model of the head requires manual loading, but magazine loading can be readily added.

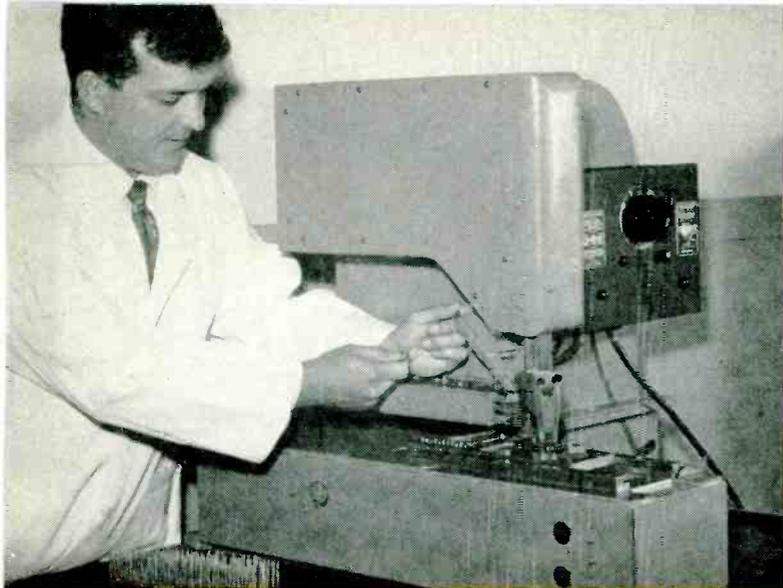
Minn-A-Matic Insertion Head. A single-head insertion machine for body-taped axial-lead components, ready for delivery early this fall by Minnesota Engineering Co., combines drilling with inserting and clinching. Boards are run through vertically by hand for low-volume batch production.

Boards are inserted to an adjustable stop and the machine is actuated by a foot pedal. The machine then clamps the board, runs two drills through it from the left while the leads of a component are cut and formed at the right, retracts the drills, then inserts the leads into the freshly drilled holes and clinches them flat against the wiring pattern with wiping arms. Correct hole alignment with the leads is thus assured. Angle of clinch, length of clinched tab and length of leads are all adjustable for flexibility.

Cut-and-Clinch Machines. Manual insertion is combined with automatic cutting and clinching on air-actuated machines used in large numbers as an interim to full mechanization in RCA's Bloomington, Ind. plant. Each operator inserts from five to seven components on the board manually after bending the uncut leads. These leads go



SINGLE HEAD—New General Mills unit designed for bench use, with wiring boards being fed in and positioned manually. Leads are clinched automatically after insertion



SINGLE HEAD—New General Mills unit designed for bench use, with wiring boards being fed in and positioned manually. Magazine or belt feed can replace present manual loading



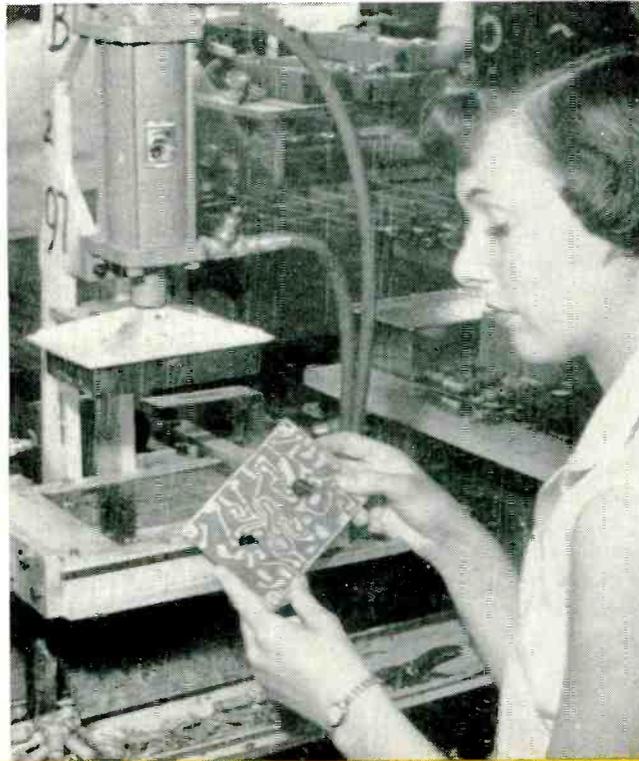
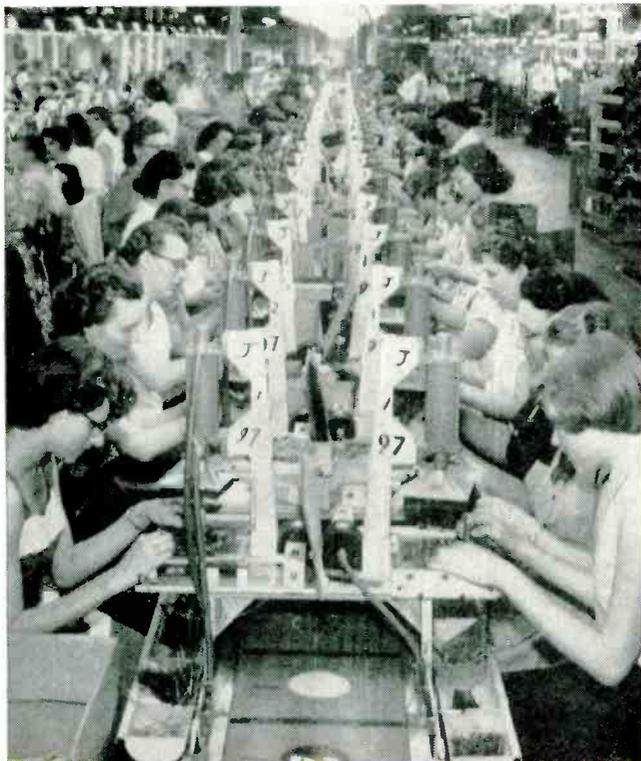
SINGLE HEAD—Basic heads from United Shoe's automatic assembly machine can be used as bench machines by adding a foot-treadle switch to actuate solenoid-operated control valve

through the board and through mating holes in a large metal plate underneath that serves as the cutting and clinching die.

When her quota of parts has been loaded, the operator presses a foot valve. This operates a vertically mounted air cylinder which lowers a contoured rubber pad to push the newly inserted components firmly down on the board. An interlocking horizontal air cylinder then moves the shearing blade across from right to left under the board, to cut and clinch all the leads simultaneously. The operator then

passes the board on to the next machine in the line for insertion of another group of parts.

Components are inserted in groups to give the advantages of a short time cycle and simplify the design of the clinching die. This die bends all leads in the same direction at any given position. By using a number of machines, each with its board-holding fixture oriented differently, and choosing components appropriately for each machine, leads can be clinched in the variety of directions required by the etched wiring.



CUT-AND-CLINCH MACHINES—After components are bent and inserted manually, air cylinders on these RCA machine setups push them down and then cut and clinch all leads in one operation. Each operator loads about half a dozen parts, then passes board on to next station. At right, board is being loaded over cut-clinch blade. Foot-operated valve initiates air cylinder sequence

4. DIP SOLDERING

Two complex machines now under construction will hook up directly to assembly machines for completely automatic fluxing and soldering. Simpler machines, already in use in many plants as another interim step to mechanization, do the same job when loaded manually

Dip soldering is in itself mechanization even though done by hand, because dozens or even hundreds of joints are soldered simultaneously. For successful dip-soldering, four interlocking factors must be compatible—flux, solder content, temperature and time cycle. To find a compatible combination these should be varied one at a time while carefully observing results.

The solder is invariably 60/40, which is near enough to the eutectic point to permit lowest soldering temperatures. The exact temperature is not critical in itself, but should be held constant by thermostatic control. Temperatures currently in use range from about 440 F to about 510 F, and immersion times range from 2 to 10 seconds.

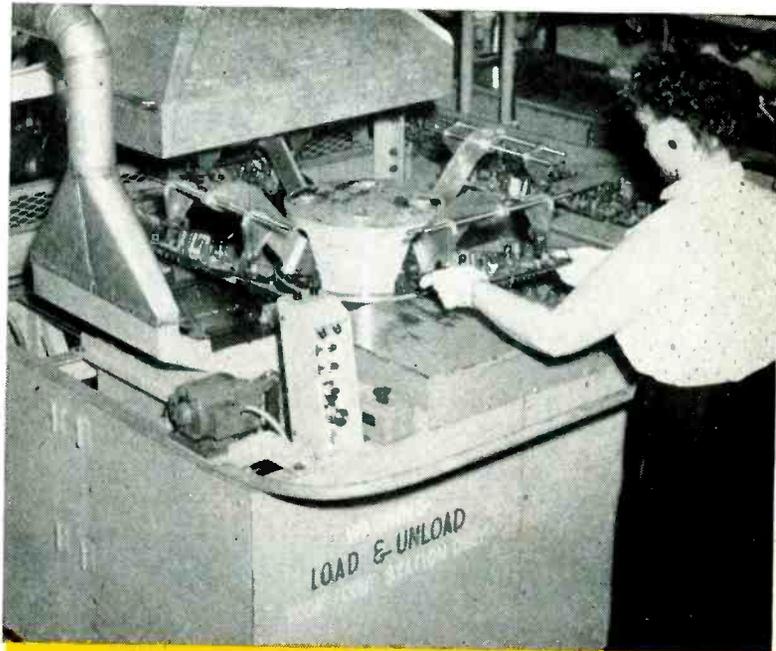
Several plants use timers started by a foot switch at the instant of immersion, to sound an alarm at the end of the selected interval. Consistently uniform time and temperature contribute to good dip-soldered joints.

Dip Soldering Machines. Westinghouse has seven automatic dip soldering machines in its Metuchen, N. J. plant. These employ four distinctly different designs, all requiring manual loading and unloading at the present time. All handle unclimbed components that are currently inserted manually on moving conveyor lines. The machines will be described in reverse chronological order, starting with the newest design.

Floating-Board Soldering Machine. One Westinghouse machine has four stations 90 degrees apart around the central indexing head. This machine takes a large tv wiring board supported in a metal pallet. After being loaded at the first station, a carrier arm comes up, swings 90 degrees and drops the board down over the spray-fluxing station. Next, the board is lowered into the solder pot, where it floats on the surface of the solder. Cam-like hooks on the carrier make the board enter and leave the solder at different angles so that all joints get equal immersion.

An air cylinder under timer control moves a Teflon wiper blade across the surface of the solder to push the dross over the edge of the pot. The blade then raises to clear the solder on its return stroke.

Up-and-Down Soldering Machine. A machine used on an earlier conventionally-wired Westinghouse tv chassis likewise has a four-station cycle, but the chassis is held flat at all times in a holder on a rigid arm of the machine. The entire center of the machine, with its four pro-

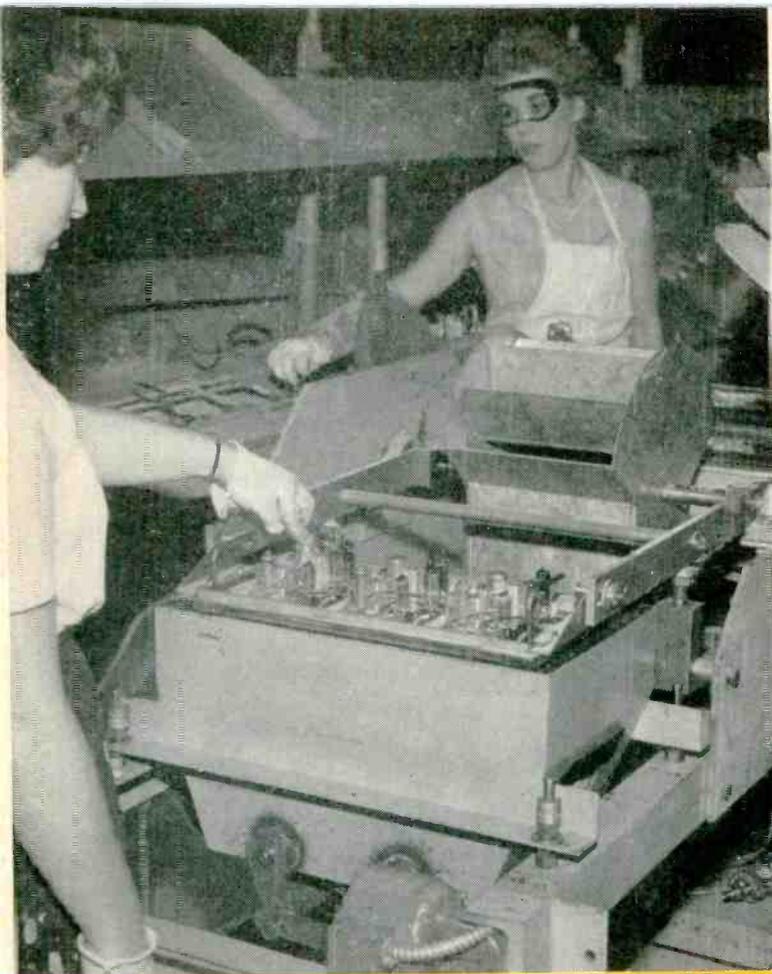


DIP SOLDERING—Four-station automatic machine in Westinghouse plant has individually pivoted carrier arms that first lower board over spray-fluxing station, then float it on surface of solder

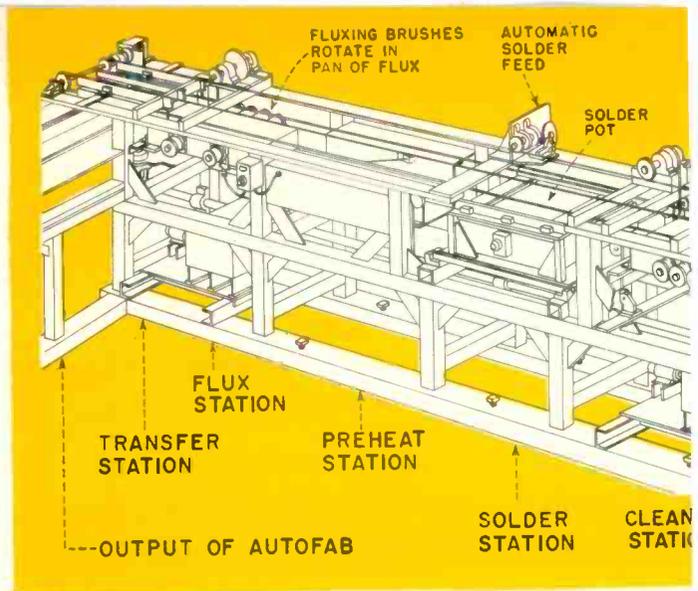
jecting arms, is moved up and down by one air cylinder and rotated by another cylinder. Fluxing is achieved by immersion in a pool of liquid flux. The chassis is dropped straight into the solder pot and similarly lifted straight out.

Flip-Flop Soldering Machine. For radio boards, Westinghouse uses a two-position machine in which a single carrier flips back and forth through the air between the fluxing and soldering stations. At the end of the soldering cycle, the arm rises out of the solder slowly enough for manual unloading. As in all other Westinghouse operations, the parts are inserted without clinching the leads underneath. For the greater part of its travel through the air a newly fluxed chassis passes through a blast of hot air to drive air bubbles out of the flux.

Sector-Scan Soldering Machine. The fourth type of Westinghouse machine, also used on radio sets, has a single carrier arm that swings 90 degrees back and forth horizon-



DIP SOLDERING—Machine soldering can be done in many different ways, as illustrated by these two Westinghouse designs. Flip-flop version above handles three radio boards at a time, for spray-fluxing at one end and soldering at other end after 180-degree upward swing through hot air blast. In up-and-down version below, entire central head moves up or down and rotates

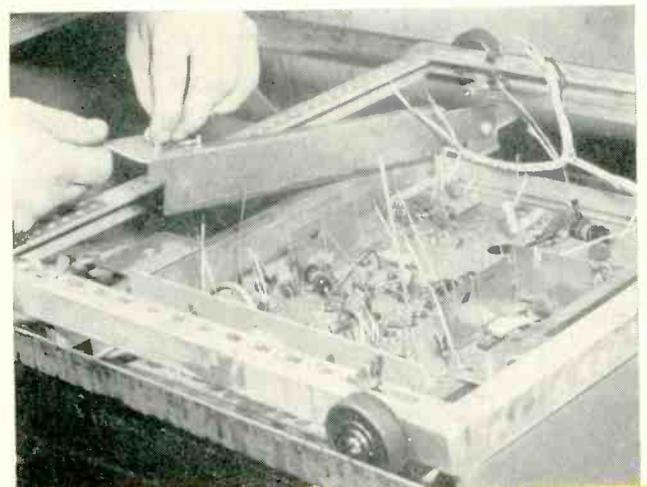


tally between the soldering and fluxing station. In this early design, only the soldering operation is automatic, even though the carrier swings over the fluxing position. The operator places the pallet-load of boards over the fluxing station directly, not on the carrier, for spray-fluxing at one end and soldering at other end after 180-degree upward swing through hot air blast. The boards are then set over a hot-air drum alongside the machine to dry the flux, before being loaded on the carrier for transport to the soldering station.

Conveyorized Soldering Machine. A dip soldering machine called the Autosol, designed by Tag Design for IBM to use with its Autofab assembly machine, is now under construction by General Mills. This will mount at right angles to the output end of the Autofab and will be driven by it through a coupling shaft running the entire length of the soldering machine. Two stainless steel conveyor chains running across the top of the machine will carry the pickup fingers for the wiring boards.

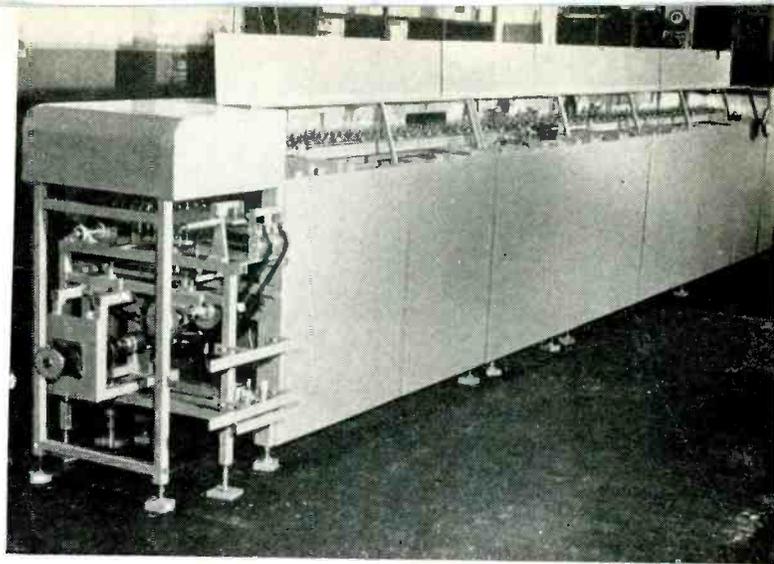
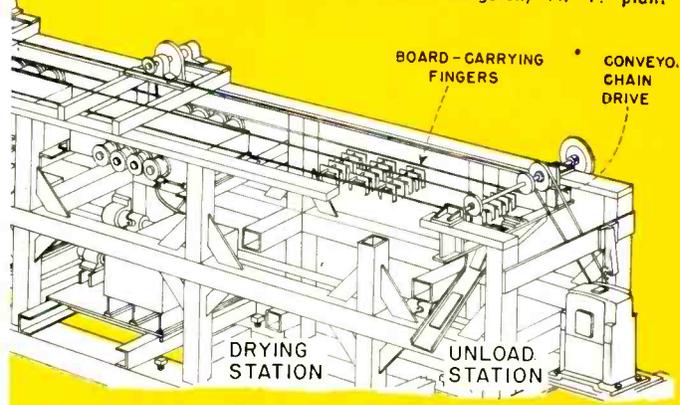
Every three seconds a set of fingers takes a finished board from the assembly machine. At the flux station, brushes rotating in a pan of liquid flux apply flux to the wiring boards.

The boards next pass through a pre-heat station that



DIP SOLDERING—Locking oscillograph wiring board in carrier of trolley-car machine used by DuMont. When car is pushed to soldering position, hydraulic lift brings pot up to board

DIP SOLDERING—Comparison of design sketch with final appearance of completely automatic Autosol machine designed by Tag and constructed by General Mills for direct coupling to output of Autofab machine at IBM's Kingston, N. Y. plant



dries the flux to a tacky state, then dip down again into the solder pot. The solder level in the pot is appreciably higher than the edges of the pot. Utilization of this meniscus phenomenon permits wiping the dross right over the edge of the pot with a Teflon wiper blade mounted on the conveyor ahead of each finger assembly.

After soldering, the board moves over 120 nylon brushes rotating in a pan of flux solvent for cleaning, then through a hot-air drying chamber. At the end of the machine the fingers are opened by cams to release the board into the output chute.

Trolley-Car Soldering Machine. In DuMont's version of a soldering machine, a wheeled pallet rolling on rails moves the assembled cathode-ray oscillograph wiring board into position over the solder pot. The pot is then brought up to the board hydraulically. The height of the solder pot is precisely controlled so the terminals are in the solder but there is an air space between the solder and the wiring board.

Selective Dip Soldering. Application of solder only to joints minimizes chances of shorts between etched wires

and cuts solder costs. One firm achieves such selective soldering by placing a pre-punched sheet of adhesive masking paper over the entire etched wiring pattern after assembly, so that only the joints requiring solder are exposed. The mask is stripped off and discarded after the soldering operation.

Another technique involves placing at the surface of the solder a metal plate having drilled holes for each joint. The plate prevents solder from reaching the etched wiring away from the joints. A variation of this method uses vertically-moving pipes in the solder pot to bring solder up to the joints.

Double-Dip Soldering. RCA consistently uses two solder pots. The first immersion is done rather quickly, and serves to make perhaps three-fourths of the joints satisfactorily. Just before transferring the wiring board, the operator wipes a large cake of beeswax over the surface of the second pot a few times. Somewhat longer immersion is used in the second pot, which is held about 10 F lower in temperature, to complete the remainder of the joints and give good buildup and filleting of the solder at the joints.

5. AUTOMATIC TESTING

Ingenious machine setups today measure and record electrical characteristics of dip-soldered printed boards and finished equipment automatically. The operator merely connects and disconnects the equipment, then tears off paper-tape results of the automatic tests.

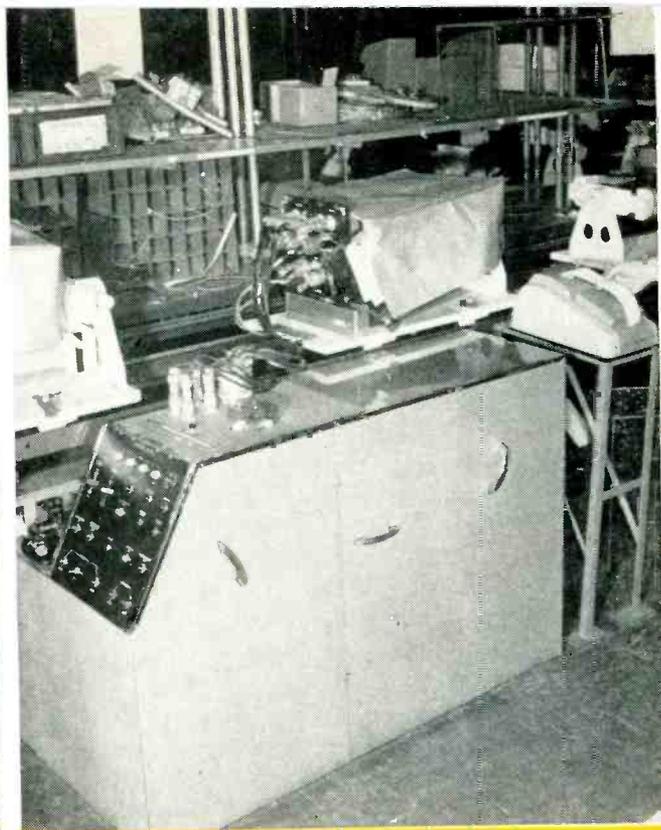
Etched wiring boards are particularly adaptable for semi-automatic test setups. The boards are set into fixtures for precise positioning over spring-loaded contacts that apply correct operating voltages and take off appropriate output voltages for a performance test.

As an example, in one Westinghouse setup the dip-soldered i-f board is slid vertically into the test fixture and eight horizontally mounted captive screwdrivers are run in two at a time for the i-f alignment.

Dip-soldered tv boards are tested in semi-automatic set-



AUTOMATIC TESTING—Setup used by GE at Utica. After operator clamps board into fixture at right, CTI machine runs off electrical tests and prints results on paper tape at left



AUTOMATIC TESTING—Completely automatic GE test machine for finished military electronic equipment is programmed by punched tape. Result is recorded on tape by Clary printer

ups at RCA's Indianapolis and Bloomington plants. Three positions are usually provided, to give the required pre-heating before test and alignment. A board is placed over spring-loaded contacts positioned to meet with the desired points in the etched wiring. A lever is then moved to actuate spring-steel fingers that press the board down.

Automatic Circuit Testers. A single automatic electrical test machine in GE's Utica, N. Y. plant is currently handling 107 different types of etched wiring board assemblies at the rate of about 3,000 assemblies per week, with one nontechnical operator. This CTI Super tester is a sequentially programmed unit performing up to 400 separate tests on a wiring board assembly. These tests include continuity, leakage resistances, resistances, impedances and static voltages.

Each type of assembly requires an interconnecting harness and an adapter box containing standard comparison units. When a test falls outside of the tolerance range, an alarm sounds and an associated device prints on paper tape the number of the test that failed. Average processing time per assembly is 3 minutes, as compared to 45 minutes for the former manual test line using 14 Foster analyzers.

Before using the automatic tester, about one board in 100 was found to have a defect that got past the 14 check and repair operators. With the machine, only four boards failed in the final unit installation, and these were found to contain components that were broken after test.

An automatic testing machine for checking electrical connections and circuit resistances has been developed by IBM at Endicott, N. Y. Punched-card programming controls the sequence of operations and the resistance limits for each test. Card feed rate is 50 pairs of cards per minute,

giving 50 tests per minute on an etched wiring assembly.

Automatic Performance Tester. Final performance testing of complete equipment has also been mechanized in GE's Utica plant. The machine used for this purpose is programmed by an endless loop of Flexwriter punched tape, so arranged that as many as four different electronic units can be tested at random on the one setup. The machine will scan the tape until it comes to the test program for the unit connected, then proceed to test it.

The prototype tester has plug-in facilities for up to seven different measurement devices, one readout instrument and a termination unit containing signal sources and loads. These are all arranged for automatic setup in accordance with the instructions coded into the punched tape by engineers beforehand.

Complete performance evaluation of a unit takes about 7 minutes, which includes recording of actual values on a Clary printer. These must be compared with tolerance limit data to determine whether the unit is passed or set aside for troubleshooting.

Conclusions. The key to success in all types of mechanized electronic production lies in flexibility—the ability to change over quickly from one wiring design to another with a minimum of down time on the equipment.

There is danger in the temptation to overproduce once an automatic line is running smoothly. New designs are essential for maintenance of a continuing, unsaturated market. More than ever before, sales and market research departments must team up with engineering and production in planning the optimum economic time schedule for their firm on its path to mechanization in production.

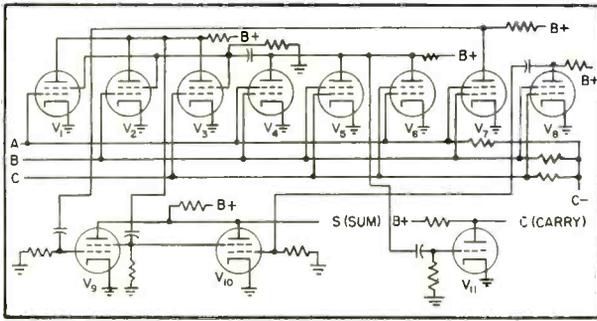


FIG. 1—Typical binary adder developed from pentode tubes

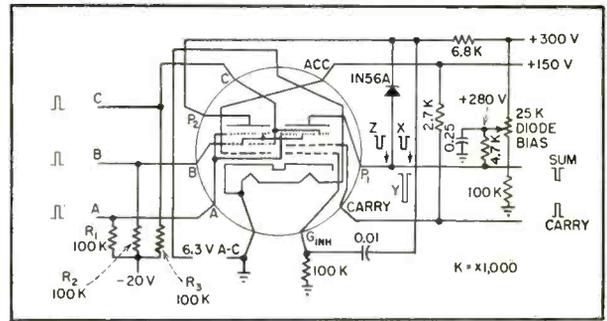


FIG. 2—Binary-adder tube replaces array of Fig. 1

Binary Adder Tube for High-Speed Computers

SUMMARY — Special-purpose electron tube has all required binary-addition functions self-contained in single envelope. Outputs have sufficient power to insure sharp rise times with fast operational speeds and will directly drive similar following tube without additional amplification

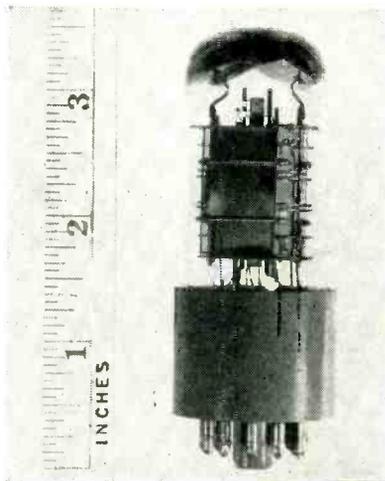
By **FREDERICK B. MAYNARD**

*Research Division
National Union Electric Corporation
Orange, New Jersey*

THREE-INPUT binary adders are conventionally developed by combining a number of simple elements or gates which have the required functions: and; or; inhibitor. This generally results in a complicated circuit of tubes, diodes or relays.

A typical adder developed from pentode electron tubes is shown in Fig. 1. This makes an excellent adder. However, the complete array must be repeated for each digital place to be added causing the number of components to become large, especially in the case of a several-place parallel binary adder.

All of the functions of the array



Experimental tube is sealed in T-9 bulb with 11-pin neosubmaginal base

of Fig. 1 may be accomplished in the single BG2 binary-adder tube illustrated in the photograph.

A schematic of the tube structure and associated circuit is given in Fig. 2.

The mount structure consists of a central flat cathode surrounded by two half sections of grids and plates.

Three grid inputs, A, B and C, are internally connected to control grids in both halves of the tube. These grids are externally biased to cutoff through grid resistors R_1 , R_2 , and R_3 .

Two outputs are provided. Plate P_1 produces a negative sum pulse

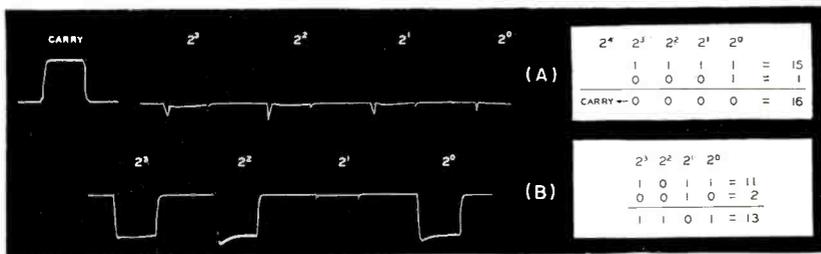


FIG. 3—Inhibited sum pulses and through carry in sample addition (A); sum pulses in sample addition (B)

in the event *A*, *B* or *C* is opened by a positive signal. The carry output produces a positive signal identical to the input signals, in the event any two or all three of the inputs are opened. During a double coincidence, however, no sum signal is produced. On a triple coincidence, both sum and carry signals are produced.

Operation

In the left half of the tube, as shown in Fig. 2, there is an accelerator grid which plays no part in the dynamic action. Following this is a set of three compound control grids so arranged that no electrons are gated to P_2 unless there is a double or triple coincidence of inputs on grids *A*, *B* and *C*. The output signal developed on P_2 is different in these two cases. On any double coincidence, one third of the grid area is opened, which produces a 20-volt negative signal on plate P_2 .

On a triple coincidence, the entire grid area is opened, producing an approximately 60-volt negative signal on P_2 .

Either of these two signals is sufficient to cut off completely inhibitor grid G_{inh} in the right half of the tube. These signals are shown on the feedback loop from P_2 to G_{inh} as waveforms *X* and *Y* and enter G_{inh} through the blocking capacitor. These signals are also offered a path from P_2 to P_1 across the 1N56A diode. However, the positive end of this diode is biased 20 volts negative with respect to the no-signal voltage on P_2 . The small signal *X* from P_2 cannot cause any potential change on the P_1 or sum output since it does not exceed the bias. The large 60-volt signal *Y* is able to override this bias resulting in a negative difference sig-

nal *Z* on the sum output.

Grid G_{inh} is biased to cathode potential and is therefore normally conducting. Following this grid is an accelerator element which is connected to a high positive voltage through a 2,700-ohm load resistor. This is the carry element. It draws current in the normal condition and hence is negative with respect to $B+$. Following the carry element are three signal grids, internally connected to the *ABC* inputs, which are normally cutoff.

Electrons which drift through the carry element are gated to P_1 if any of these grids are opened. Thus any single coincidence on *A*, *B* or *C* will produce a sum signal on P_1 . A double or triple coincidence will also tend to produce a signal on P_1 except that the negative signal produced on P_2 inhibits the electron flow by cutting off G_{inh} as has been previously described. Thus no sum signal is produced on P_1 at any other time than on a single coincidence.

Since a sum signal is required on a triple coincidence input and this is prevented from forming directly on P_1 because of the inhibiting, it is derived as the signal *Z* across the diode as described. When G_{inh} is driven negative on either a double or triple coincidence the carry element ceases to draw current and goes strongly positive. This produces an amplified positive carry pulse capable of directly driving another adder tube input.

Characteristics

Since this tube is a digital device operating only in the regions of cutoff and saturation, the important qualities are clean cutoff and high electron perveance. Since there is no requirement that this be a small-signal device, a reasonable input

pulse amplitude of 20 volts positive was selected as an operating goal and all signal grids were adjusted to give cutoff values of -12 to -15 volts. The inhibitor grid has a somewhat sharper cutoff at about -10 volts which contributes materially to the rise time of the carry pulse. This section has an available gain factor of about 30.

The carry element acts not only as an accelerator but as the output element of the most important signal from the tube. This has been designed to dissipate continuously about $2\frac{1}{2}$ w at a current of 15 ma.

Currents to plates P_1 and P_2 are approximately 3 ma. The static accelerator element ACC draws approximately 10 ma or 1.5 watts and is designed to dissipate this power continuously. A 6.3-volt, 0.8-ampere heater is used.

In a cascaded parallel-adder system the accumulation of delay in the carry is inherent and cannot be eliminated. This is so regardless of the components used in the adder. The delay arises from the fact that whereas the inhibitor signal and the sum signal are generated simultaneously by the input signals, the inhibitor signal must take the time to charge another grid before the sum signal can be shut off. This action generates the carry which in turn must charge another grid input in the next stage. Thus there are two delays in series at each stage. If this carry must generate another inhibitor signal and carry in the second stage, it is now delayed by a factor of 4.

Delay Spikes

The delay appears on the sum outputs as a leading-edge spike. Its width at any given output depends on the following factors: (1) the inherent rise time of the inhibitor system; (2) the inherent rise-time of the carry system; (3) the number of previous stages a carry has traversed.

The spike on the first 2^0 stage will always be small, since only the first factor is of consequence. On any succeeding stage it may be the same or some greater width up to (1) + (2) + (3) *n*, where the *n*th tube in *n* stages will be the worst case in certain additions, but in others will

be no worse than the first sum output.

An example of this widening spike during the progress of a carry through several stages is shown in Fig. 3A for a worst case in adding the binary $15 + 1$. Note the proportionate narrowing of the carry pulse in the 2^4 place.

Another example of addition is shown in Fig. 3B, in which a carry resulting from the addition of addend and augend pulses in the 2^1 place generates the sum signal in the 2^2 place.

The measured carry delay with the type BG2 tubes and recommended circuit constants is about $0.3 \mu\text{sec}$ per stage, maximum. This would result in a worst-case spike of approximately $3 \mu\text{sec}$ in a ten-stage adder.

In the case of serial addition, as shown in Fig. 4A, there is no accumulation of carry delay. The very slight delay due to the first and second factors mentioned above can be partly compensated by slightly overdelaying the carry signal in the feedback path. The sum outputs will have somewhat narrower spikes than even the best case of parallel addition. This should contribute greatly to the ultimate speed.

This tube was designed speci-

fically to operate in a several-stage a-c coupled parallel adder similar to the circuit in Fig. 4B. In this set-up it was found to work at pulse rates up to 100 kc in a four-stage adder. However, if a larger number of stages were used the speed would be reduced to the point where the worst-case spike could be differentiated from the sum pulse.

In a serial addition application, such as shown in Fig. 4A, a considerably faster operational speed can be obtained.

Applications

There are some other logical functions aside from straight binary addition to which this tube may be adapted. One of these is the two-input Boolean adder or anti-coincidence detector. For this application the bridging diode and carry resistor are not needed and the third input grid is biased permanently to C-. The sum plate, P_1 , will give the same outputs on $A = 0$ and $B = 0$ as on $A = 1$ and $B = 1$. Only the anticoincidence of A or B gives an output. Simultaneously if desired, the carry output could be used to separate the positive (11) coincidences and the negative (00) coincidences.

Another function may be added

with a fourth input on G_{inH} . By biasing this grid to cutoff by removing the feedback loop from P_2 and applying a positive signal D , sum outputs occur on coincidences of any ABC inputs with D , but not on any ABC coincidences without D , and not, also with D alone.

The tube could also be used as an ABC coincidence detector by feeding the P_2 signal to G_{inH} through a biased diode. This bias should be such that the small double-coincidence signal from P_2 will not cut off G_{inH} but the much more negative triple-coincidence signal will. The carry output would then give a signal only on an ABC coincidence. This signal will be in phase with the input signals.

Some interesting flip-flop and oscillator circuits can be designed around this tube. Since the carry output is in phase with the signal input, this may be fed back to one of the inputs with either d-c coupling to give flip-flop action or a-c coupling to give oscillation.

The following is an example of a different logical function which can be done in this way. Suppose some event could only be made to occur by the arrival of two elements A and B . Once started, however, the presence of either A or B would maintain the event and only the absence of both would cause it to cease.

This can be done with the BG2 tube by feeding back the carry into an input, say the C input. Direct-current coupling is assumed on both this feedback and the P_2 - G_{inH} feedback loop. Since the carry element is normally negative, grid C will remain closed. To form an inhibitor signal on P_2 it is necessary to open two inputs. Therefore, in this condition, nothing except a sum output will happen on either A or B inputs. However, if A and B are both activated, the carry is formed, which now opens input C . Thus if either A or B drops out, there are still two grids open and the flip condition will maintain. However, if both A and B drop out, the system will reset to the original condition and maintain that way until another A - B coincidence.

This development has been sponsored by an agency of the Department of Defense.

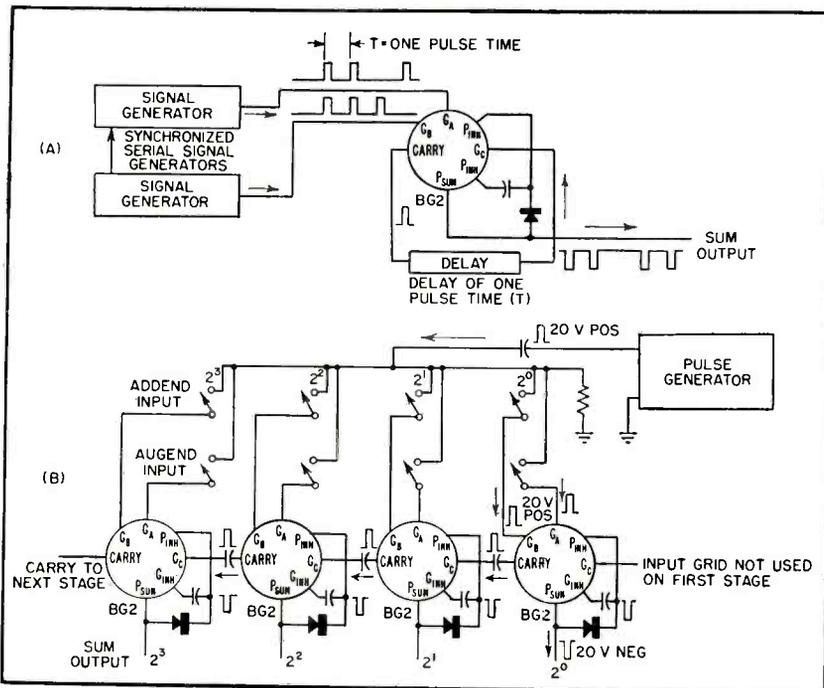
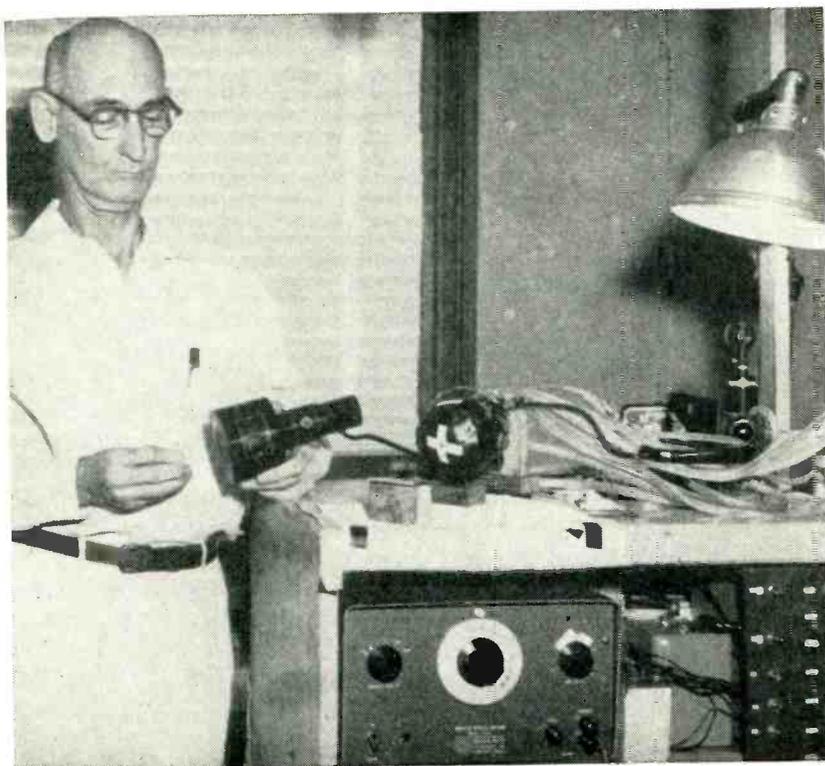


FIG. 4—Demonstration serial adder (A) and parallel adder (B), use BG2 binary-adder tubes. Serial adder can have operational speed in the region of 1 mc

Electromagnet Removes

SUMMARY — Multiple-coil electromagnet driven by 25-kw amplifier at 3 to 12 kc has been used by medical experimenters to pull brass, lead, aluminum or copper fragments from cat-eye vitreous in trays. Indications are that this can be developed into a device for use on human eyes



Electromagnet for nonferrous metals is designed as aid to eye surgery

EYES penetrated by particles containing sufficient magnetic material are usually saved by the ordinary electromagnet; eyes penetrated by fragments of nonferrous metals are commonly lost.

Development of an electromagnet for nonferrous metals, first operated on 60 cycles and used to pick up relatively large objects such as silver coins and copper rings^{1,2}, resulted in a study of possible application to eye surgery. Tests were made on bits of brass, lead, aluminum and copper suspended by threads, using an oscillator and a 30-watt amplifier.

Results were promising but indicated need for relatively high power over a considerable frequency range. Facilities for testing at two kilowatts were provided. Using that equipment a 2-mm copper-wire clipping was moved about 3-mm through cow-eye vitreous in a tray.

The Office of the Surgeon General of the Army became interested when it developed that about 25 percent of the numerous eye injuries in the Korean conflict due to metal fragments involved nonmagnetic metals.

The new electromagnet has been developed³ to a point at which par-

ticles of copper, aluminum and magnesium have been extracted from the eyes of experimental animals using a water-cooled electromagnet supplied from a 25-kw amplifier at 5 to 10 kilocycles.

Principles

When a simple coil carrying alternating current surrounds a closed conductor or a short circuited coil and a conducting object is adjacent to the inner member (see Fig. 1,) currents of substantially like phase are induced in the object and in the inner fixed member setting up attraction forces between them.

By proper configuration and geometry there is an attraction zone approximating a cone with its base in the surface of the structure. A conducting object situated so that the principal induced current paths lie within this region will be attracted by predominance of the attractive force over repulsion. Outside this zone there is repulsion.

This simple form is shown in Fig. 1 in which the attraction zone for large objects is shown in dotted lines. The model shown in the figure has a central magnetic core filling, an opening in the attractor and also an intermediate core between the attractor and field coil which intensifies the field of the main coil.

The zone of attraction is determined by configuration and certain adjustments and is not increased by increased power. Within this zone, however, effective pull is increased by increase of power

When both field-producing elements are windings energized by

Nonferrous Metals

By **WILLIAM VAIL LOVELL**

*Lovell Research Laboratory
Sanford, Florida*

direct connection to the source but reversed with respect to each other, and the coils are axially short, a middle region of attraction bounded by inner and outer regions of repulsion is formed. This is illustrated in Fig. 2. Two coils *A* and *B* are shown, one having twice the diameter of the other. Note the conducting ring of the same diameter as the inner coil. The curve in Fig. 3 shows the variation of force with distance from the structure on a conducting ring or disk.

For greater effectiveness it is necessary to control both the phase and magnitude of the current in the attractor.

Capacitors are used when working in the audio or higher frequency range. The magnitude of the attractor current is controlled by having a supplementary winding at the rear of the main field coil connected in series with the attractor, usually boosting. Figure 4 is a diagram of elements with the conducting object depicted as a single short-circuited turn near the attractor. With strong feed to the attractor the construction shown in Fig. 1 can also be made to show an inner repulsion range.

For effective work on particles, frequencies in the audio range or higher are needed. To move objects through a resisting medium considerable power is also required.

Power and Controls

The power plant is rated at 25 kw from 3 kc to 12 kc and the useful range can be extended to 50 kc by changing the driver output transformer. The power apparatus consists of a rectifier, a driver and a

power amplifier as shown in Fig. 5.

The power level of the large amplifier output is set by the output control of a variable-frequency oscillator which fixes the voltage impressed on the input to a 20-watt preamplifier.

Pulsing is controlled by a foot-switch at the operating stand through relays in the output circuit of the preamplifier (which has a permanent protective load) and a time-delay relay. The on-time is adjustable from $\frac{1}{10}$ second to several seconds and the pulse is stopped at any time by releasing pressure on the foot switch. The off-time insures proper cooling.

Coil Design

Dominant features in design for eye surgery are: the required range of action; shape of the coil to be accommodated to the human head; proximity-effect losses in the coil; limited use of iron in the magnetic circuit and necessity for leaving a large opening in the main coil for the attractor.

The surgeon can rotate the eye so that in general it is unnecessary to work at more than 12 mm, which is half the diameter of the eye. Most of the volume of the eye is within 7 mm of the surface so that an effective pull at this distance can be very useful. A taper is required, particularly on the nasal side and this increases the difficulty of producing a strong field at a distance from the surface of the structure.

In a given coil outline the aim is to arrive at an arrangement that will allow adequate cooling, have low impedance and give a high value for the product of flux and

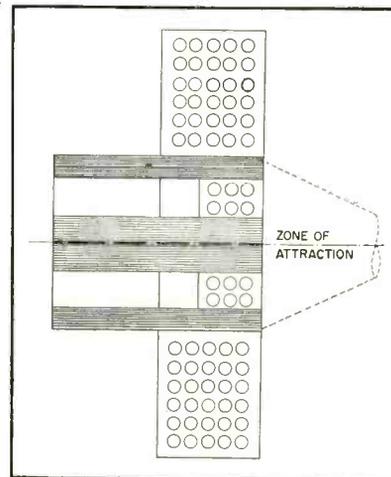


FIG. 1—Simple form of electromagnet showing attraction zone

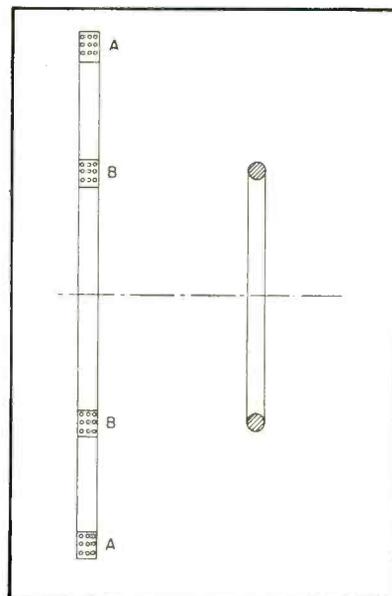


FIG. 2—Two coils *A* and *B* are shown at left with conducting ring at right

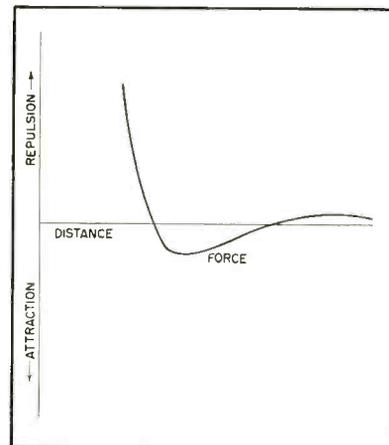


FIG. 3—Plot of force versus distance on a conducting ring or disk

reversed gradient at points in the working zone. Losses due to proximity effect are great and the spacing is worked out to give the best compromise between this factor and a high space factor.

Within limits, the higher the frequency the greater the pull. Heating of the object also increases with frequency. Failure of the Q of the coil, of a particular outline, to rise proportionately with increase in frequency signals the point of diminishing return for frequency increase. Above 10 kc the losses become severe; at 10 kc a Q of 12 to 14 is considered good.

Material used for the partial magnetic circuit is Armco Trancor 0.002-in. high-silicon steel which is worked at or near saturation. A thin layer of this iron as an intermediate core is helpful even at maximum power. The placement and thickness of the intermediate core are critical.

The electromagnet structure though tapered is relatively blunt compared to the pointed instrument used for iron and does not give the surgeon a clear view of his working field and so the central core is often omitted or reduced. This leaves a peep hole 3 to 5 mm in diameter through which the incision can be seen.

A probe type construction was investigated in which the attractor was at first a small sleeve or perforated disk of copper or brass 4 to 8 mm in diameter. This was later replaced by silver tubing for water cooling. A thin jacket of high-silicon steel surrounding the attractor was found beneficial. This

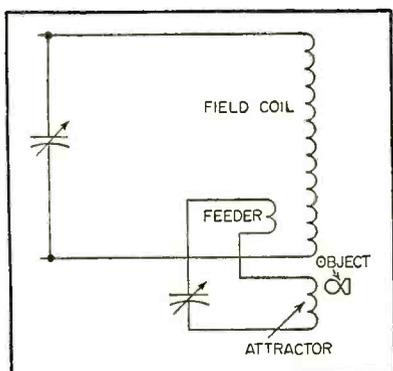


FIG. 4—Simplified circuit for controlling the phase and magnitude of current in the attractor

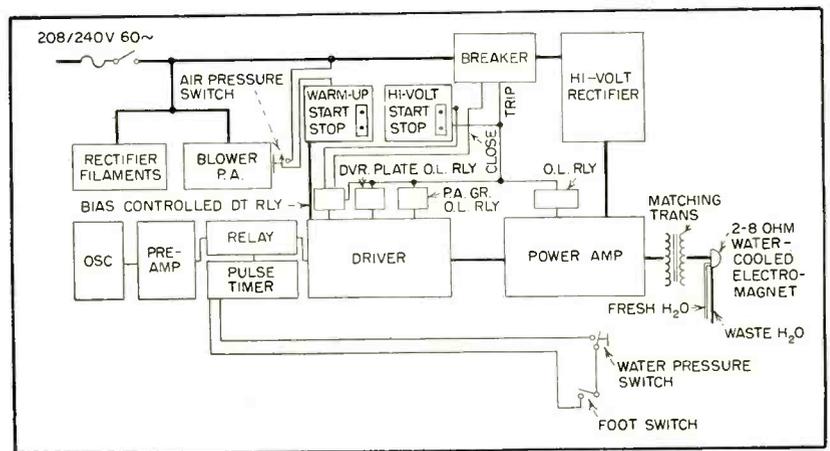


FIG. 5—Elements of sonic power unit. Power amplifier employs six 3X2500F3 tubes operated class AB₂ push-pull, parallel

probe extended about $\frac{5}{8}$ inch from the face of the coil. The probe form has a disadvantage in that the range is small with a small diameter probe.

Fields and Forces

A tapered coil, 4-in. o-d., 1 $\frac{1}{4}$ -in. i-d., wound with 0.06-in. by 0.04-in. copper tubing, using 8,000 ampere-turns, without the intermediate core and with attractor open circuited, creates a field of 2,000 gauss at 8.3 kc at the attractor aperture and 1,000 gauss at 1 cm out on the axis. The pull on a 2-mm particle of copper in this arrangement but with intermediate core and $\frac{3}{8}$ -in. attractor is measured at 20 times gravity at 7 mm from the attractor aperture and off center where the pull is great.

The vitreous jelly which fills the posterior chamber of the eye is a tenaciously resisting medium. A pull of about 5 g is required to move a 2-cu-mm piece of copper through fresh vitreous from a cat eye but after such a piece has been imbedded for two weeks in a living eye a pull of 100 g may fail to move it. The required force as expressed in g's is inversely proportional to linear dimensions.

Apparently there are variable factors, for some objects sink in the vitreous while others of the same size and composition remain in place. Difficulty of extraction of an object increases markedly in a matter of days or even hours due to the inflammatory process which embeds the object and sooner or

later destroys the eye. Copper is the worst offender in this respect, followed by brass and aluminum. Copper is much easier to attract than brass because of greater conductivity but the more rapid production of fibrinous coating on copper tends to put the two materials on a more equal footing.

The maximum force of 20 g developed at a depth of 7 mm in the eye on a 2-mm piece of copper using a tapered coil is about half the force developed on soft iron by one of the d-c hand magnets commonly used in eye surgery. The force is less on smaller objects and on those of higher resistance but it is sufficient to move a 1.6-mm piece of brass through fresh vitreous.

No trials have been made with human eyes but the near-term outlook seems to be favorable for objects 1 mm or greater in smallest dimension, especially those of copper and aluminum, if early operation can be provided.

Much credit is due to J. C. Wright, Signal Corps. The program has been carried out under Medical Research and Development Contract No. DA-49-007-MD-258 in cooperation with the Ocular Research Unit of Walter Reed Army Hospital.

REFERENCES

- (1) W. V. Lovell, An Electromagnet for Non-magnetic Substances, *Phys Rev*, p 251, Mar. 1946.
- (2) Lovell, U. S. Patent, 2,400,869, May 1946.
- (3) J. Harry King Jr., William Vail Lovell, Alfred A. J. Den, M. Noel Stow and William C. Owens, "The Extraction of Intra-ocular Nonferrous Metallic Foreign Particles—Preliminary Experiments with a New Electronic Magnet".

Automatic Recorder for Complex Impedances

SUMMARY — Oscilloscope recorder for barium-titanate-transducer research plots impedance from zero to 1,000 ohms as a function of frequency over a range from 100 cps to 1 mc. Circuit can be modified for use as a phase meter over wide frequency range

By **HAROLD M. SHARAF**

Laboratory for Electronics
Boston, Mass.

IN the study of electrical properties of barium titanate transducers an efficient method of measuring the characteristics parameters is needed. The automatic impedance plotter described in this article records the various electrical parameters as a function of frequency. The instrument is of the continuously recording type and has an accuracy of 2 percent.

Square-Law Circuit

In the basic square-law multiplier circuit shown in Fig. 1, one signal, $e_2 \cos \omega t$, is fed to both tubes in phase, while the other signal $e_1 \cos (\omega t + \phi_1)$ drives both tubes 180 deg out of phase. If the plate current of a triode tube is represented by a power series of the form $i \approx a_0 + a_1 e_g + a_2 e_g^2 + \dots$ where all factors above a_2 are to be considered insignificant, the integrated output of this stage is $e_o = a_2 e_1 e_2 \cos \phi_1 / \pi$, where ϕ_1 is the phase angle between the two input signals. If $e_2 \cos \omega t$ can be considered to be a reference voltage, then the output of the multiplier is seen to be $e_{o1} = K e_1 \cos \phi$. If the reference voltage is shifted in phase by $\pi/2$, this output will be $e_{o2} = K e_1 \sin \phi$.

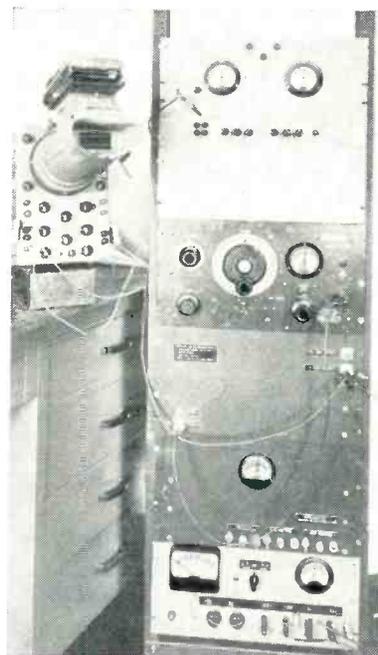
One recording instrument which possessed a nominal accuracy of 5 percent and a maximum frequency

response of 500 kc was constructed with the aid of this multiplier. The block diagram of the system is shown in Fig. 2.

The reference voltage for the real part of the complex impedance is taken directly from the source; that for the imaginary part is taken from an integrator network that provides an 89-deg phase shift at the lowest frequency used. To provide an adequate constant voltage source for the $\sin \phi$ reference chassis, a parallel form of agc was used to eliminate the need for an infinite-gain amplifier. With this parallel form of circuit, a nonlinear agc voltage was developed that kept the output of the reference voltage constant to better than 1 percent over the entire frequency range. The reference voltages are then used to drive the cathodes of two multiplier circuits shown as the $\sin \phi$ and $\cos \phi$ channels.

The signal voltage itself is amplified and coupled to the grids of the multipliers. This signal voltage is generated either by taking the voltage developed from the unknown to ground or across a 1-ohm resistor in series with the unknown.

In the first case, a large resistor is placed in series with the source. This has the effect of transforming the voltage source into a current



Rack-mounted complex impedance recorder. Impedance-frequency plot is displayed on oscilloscope at left

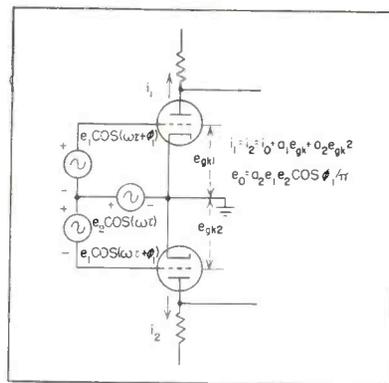


FIG. 1—Basic multiplier circuit used in recorder covering a frequency range up to 500 kc

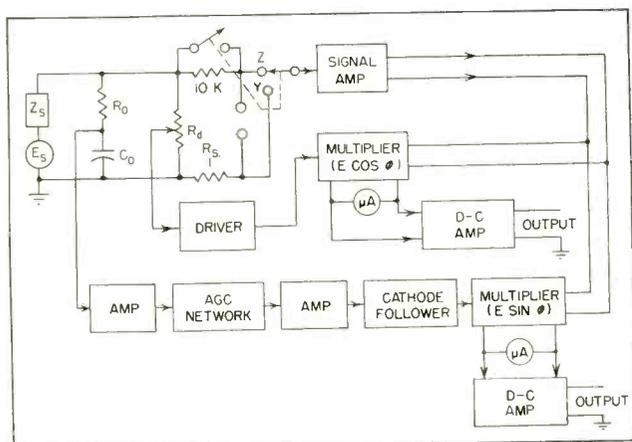


FIG. 2—Use of agc network in complex impedance recorder eliminates need for infinite-gain amplifiers

source. As the current is practically constant for $R \gg Z$, the instrument will record an output proportional to the impedance of Z . When Z approaches $0.01R$, the input leads are shifted to record the magnitude of current through Z or Z is recorded as an admittance.

In this manner, an impedance range of zero to infinity can be recorded on a finite meter scale. When the instrument is used as an admittance meter, the source impedance, Z_s , must be less than 1 percent of Z or proportional inaccuracies will be obtained. For this application, a power amplifier is well suited as it can be used in conjunction with a divider network to reduce the effective output impedance of the amplifier. Looking back into the divider, the maximum output impedance is equal to the value of the resistor that the output voltage is developed across.

Multiplier Voltage

The multiplier output voltage is taken directly from the plates of the triodes and used to drive an indicating meter. The meter itself provides the necessary integrator time constant. A small cathode resistor in the multiplier adjusts this stage to compensate for any small plate-voltage unbalance. The differential plate voltage is also coupled through a d-c differential amplifier where it is converted to a single-ended output and then connected to an oscilloscope for display purposes. A variable voltage is placed in series with the scope output to allow full-scale deflection of small re-

entrant loops situated about various impedance levels.

The instrument has one drawback, maintaining the accuracy of the square-law multipliers. The square-law characteristics are obtained by superimposing the i_b, e_c curves of two triodes. The composite curve is subject to error caused by both mechanical and electrical variances in this circuit.

With careful balancing of all circuit components, a maximum deviation of 2 percent from true square-law operation was encountered for a reference voltage swing of 2 volts. The signal level was approximately 0.2 volt. For the instrument as a whole, an accuracy of 5 percent was obtained over the entire frequency range. For a small deviation, say 25-kc, the accuracy approached 2 percent. A typical pattern of a series-resonant circuit is presented in Fig. 3A with $F_0 = 170$ kc, and a sweep-frequency from 100 to 500 kc.

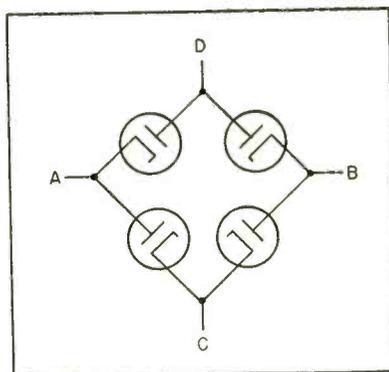


FIG. 4—Diode bridge circuit eliminates dependence on tube characteristics required in square law multiplier

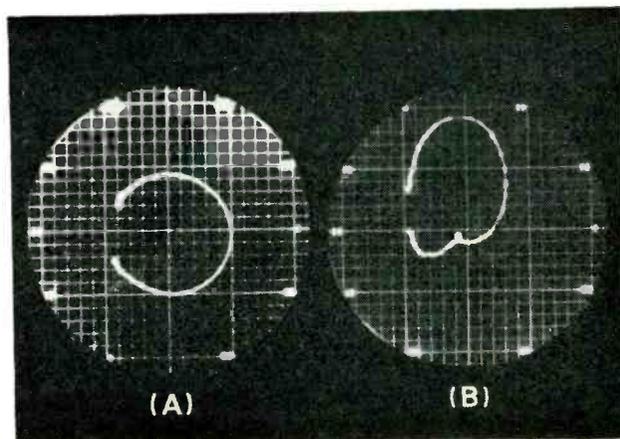


FIG. 3—Impedance pattern for series-resonant circuit (A) and for barium-titanate transducer coupled to a zero impedance load (B)

Figure 3B shows a typical pattern obtained from a barium-titanate hemisphere. The simplest equivalent circuit of a barium-titanate transducer is a parallel tuned circuit coupled to some form of load. If the driving current to this circuit is held constant, the input voltage will describe a closed loop as a function of frequency. For the case where the load impedance is zero, the circuit will degenerate to the case depicted in Fig. 3A. As the equivalent circuit becomes more complex, small re-entrant loops will appear in the closed loop and the loop may become elongated along one of the major axes. In plotting the dynamic impedance continuously, it is a simple task to discern the points of B_{max} , G_{max} , re-entrant loops, etc. The frequency and magnitude of B_{max} and G_{max} can be obtained almost instantaneously from this type of display.

Diode Bridge

To reduce the dependence of accuracy on tube parameters, a novel form of circuit was evolved for use in this instrument. Consider the basic bridge circuit depicted in Fig. 4. If a current is forced from C to D then the impedance level from A to B is approximately equal to that of the forward resistance of a single diode. If this current, henceforth called a switching current, is removed, then the impedance level will be equal to the back impedance of a diode. If point B is grounded and a voltage $E \cos \omega t$ is applied to point A through a resistor large in comparison to the forward re-

Amplifier for Fast Rise-Fall Pulses

SUMMARY — Pulse amplifier of high efficiency gives good power economy and amplitude control. The output pulse rises 100 volts in about 0.1 microsecond and falls 100 volts in approximately 0.2 microsecond with negligible pulse droop during pulse time

POWER ECONOMY is one of the problems often associated with the generation or amplification of a pulse having a fast rise and fall. Low stand-by current is especially desirable in pulse circuits of low duty cycle where the average power may be small compared to the peak power. However, during the pulse, the load may require high currents. Also, during the fast rise the current from the generator to the stray capacitances of the load may be quite high. During the fall, current into this generator may be many times the quiescent value. Amplitude control, where the height of the output pulse may need to be accurately known, is still another problem.

Design Considerations

The cathode follower is capable of supplying high currents for positive-going output voltages, but the current for negative-going output voltages is limited by the cathode load resistor. A plate-loaded amplifier is capable of supplying the heavy currents for fast negative-going signals, but the current for positive-going outputs is limited by the plate resistor. The load resistance in both cases should be made large to minimize power loss, although this is achieved at the expense of response in the unfavorable direction of output current.

The unfavorable direction is a

By **CHARLES R. DEMING**

Research and Development Laboratories
Hughes Aircraft Company
Culver City, California

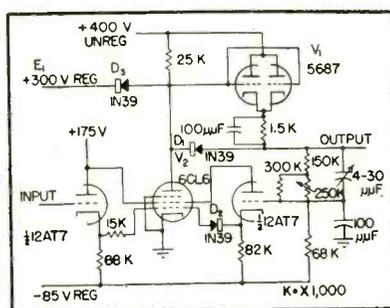


FIG. 1—Positive-pulse output circuit with amplitude control

negative-going waveform for a cathode follower and positive-going waveform for a plate-loaded amplifier. A two-tube circuit may be used in which a cathode follower has another tube as a load. The load tube may be driven to lower the output impedance. Negative voltage feedback applied to the load tube will reduce the output impedance still further.

Circuit

In Fig. 1, tube V_1 is both sections of a 5687 connected in parallel and V_2 is a 6CL6. The two halves of a 12AT7 are each connected as cathode followers for the input and amplitude control networks. Small capacitors located at the output are for frequency compensation in the

amplitude control circuit.

With no signal the input is at ground potential. The output voltage level is held at the base-line value of the pulse by negative feedback through D_2 , which applies the appropriate bias to V_2 . The negative input pulse cuts off V_2 . The plate voltage of V_2 and the grid of cathode follower V_1 rise to E_1 . The cathode potential and accordingly the output voltage of V_1 rise to E_1 and stay there so long as the input pulse maintains V_2 at cutoff.

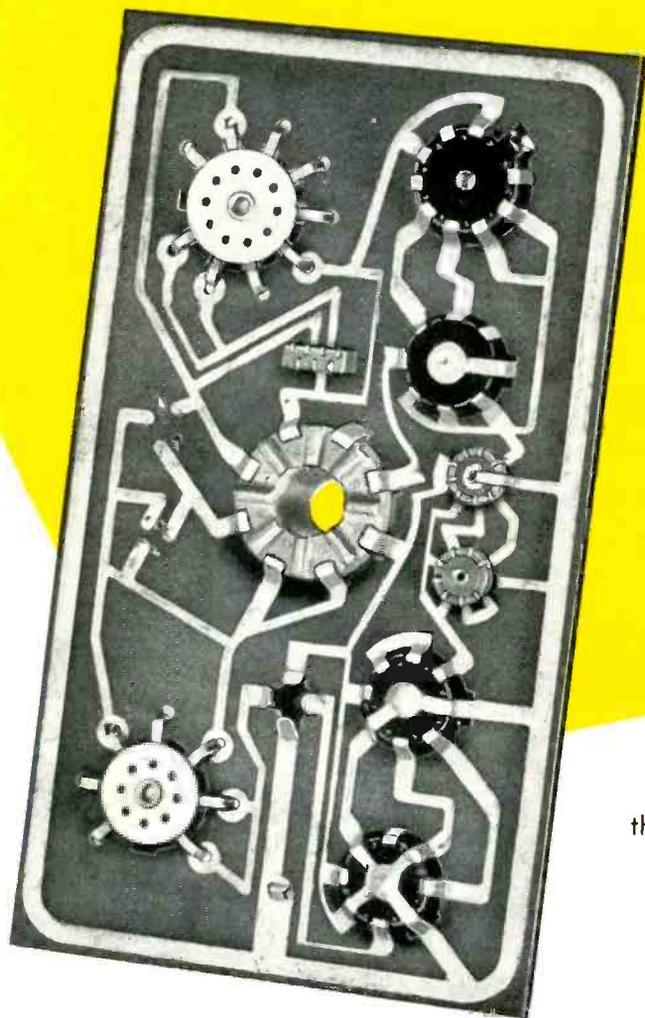
When the input voltage returns to zero the grid of V_2 also becomes zero since diode D_2 is still nonconductive as a portion of the positive output pulse is applied to the cathode of the diode. At zero bias V_2 conducts heavily through diode D_1 from the load quickly lowering the voltage at the output. As the output reaches the base-line of the pulse, the cathode of D_2 reaches zero volts. Further downward voltage applies bias to V_1 through D_2 to limit the negative-voltage excursion to the quiescent level, ending the pulse. The output of this circuit rises 100 volts in about 0.1 microsecond and falls 100 volts in about 0.2 microsecond.

The circuit was built into a cathode-ray tube test set at the Electron Tube Laboratories of Hughes Aircraft Company in Culver City, California. Credit is due to W. J. Cronin, N. Chalfin, and L. Toy for their valuable contributions.

TODAY... CINCH "STANDARD"

SERVICE BRINGS YOU PRINTING WIRING WITH

COMPONENTS ASSEMBLED



A development of the designing, materials and workmanship that has produced the Standard electronic component for a quarter of a century.

CONSULT CINCH

★ Cinch components fully perform the service for which they were designed, so that today judged by demand and usage, "CINCH is the Standard"

The CINCH sub-miniature socket insures positive electrical contact, holds tubes securely in place, permits easy maintenance and replacement, yields maximum insulation resistance and minimum high frequency loss.



Cinch components are available at leading electronic jobbers—
everywhere.

Cinch
ELECTRONIC
COMPONENTS



Centrally located plants
at Chicago, Shelbyville,
Pasadena and St. Louis

CINCH MANUFACTURING CORPORATION

1026 South Homan Ave., Chicago 24, Illinois

Subsidiary of United-Carr Fastener Corporation, Cambridge, Mass.

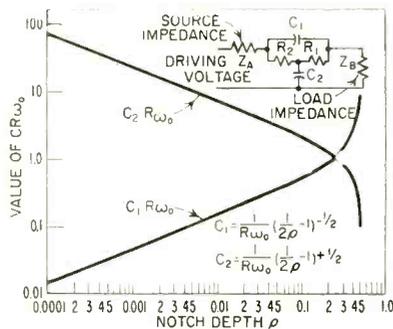


FIG. 1—Capacitor value curves

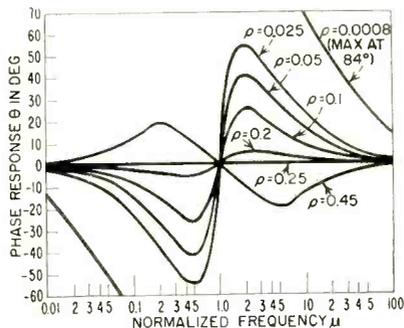


FIG. 2—Phase response curves

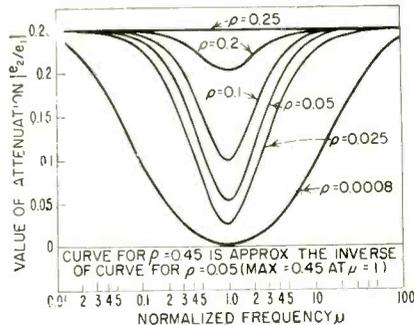


FIG. 3—Attenuation response curves

Notch Network Design

SUMMARY — Charts and simple synthesis procedure speed determination of component values for loaded bridged-tee network operating between equal impedances, for any desired notch depth and frequency. Attenuation and phase response are also given

By **C. J. SAVANT, Jr.** and **C. A. SAVANT**

University of Southern California
Engineering Center
Los Angeles, Calif.

SERVOMECHANISM design and equalization often call for amplitude attenuation at a particular frequency. This requirement, as with noise filters and many other applications, can often be satisfied by use of a bridged-tee notch network.

Practically, these requirements are usually reduced to approximately a ten-to-one ratio of load impedance to network and driver impedance. But even this simplification cannot be accomplished in many cases without undue circuit complexity.

Design of the R-C bridged-tee network in Fig. 1 involves specifying the notch frequency ω_0 , the notch depth ρ expressed as the gain of the network at the notch frequency, the source impedance Z_A and the load impedance Z_B .

The parameter for notch width n need not be considered in the

synthesis procedure presented here because notch width is minimized.

In this design procedure the source and load impedances are taken to be equal. This advantageous choice permits the cascading of a number of networks all of the same impedance level.

Design Procedure

As the first step, enter Fig. 1 with the notch depth ρ and read the values of $C_1R\omega_0$ and $C_2R\omega_0$. Now set $R_1 = R_2 = Z_A = Z_B = R$ and calculate C_1 and C_2 . If necessary, the source impedance can be made equal to the load impedance by padding.

Example: $Z_A = Z_B = 100,000$ ohms, $\rho = 0.05$ and $f_0 = 20$ cps. From Fig. 1, $C_1R\omega_0 = 0.33$ and $C_2R\omega_0 = 3.0$. Now $Z_A = Z_B = R_1 = R_2 = 100,000$ ohms, $\omega_0 = 6.28 \times 20 = 125.6$ radians per sec, $C_1 = 0.33/100,000 \times 125.6 = 0.026$

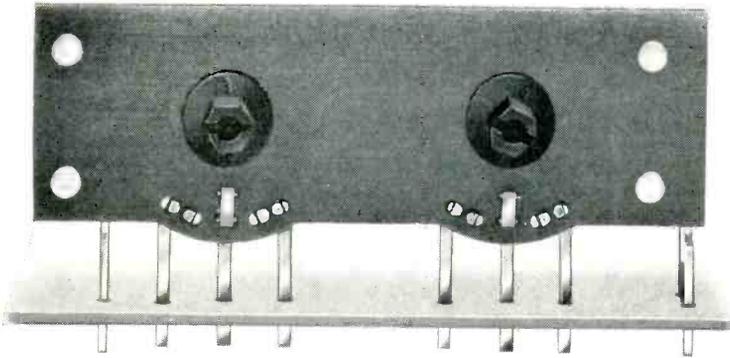
μf and $C_2 = 3/100,000 \times 125.6 = 0.24 \mu\text{f}$.

The attenuation and phase response for the bridged-tee network of Fig. 1 are plotted in Fig. 2 and 3 as a function of the normalized frequency $\mu = \omega/\omega_0$. The amplitude curves have the same symmetrical appearance and form as in the unloaded case¹ with two exceptions: (1) The d-c and infinite frequency gain is $\frac{1}{4}$. This means that the network acts as a four-to-one voltage divider at any frequency; (2) the minimum notch width becomes excessively wide for values of ρ over 0.025. The characteristics invert for values of ρ greater than 0.25 and the notch network changes from a band-reject to a band-pass filter.

REFERENCE

- (1) C. J. Savant, Jr., How to Design Notch Networks, p 188, ELECTRONICS, May 1953.

P. R. MALLORY & CO. INC.
MALLORY



Strip-type Mallory carbon control adapted for quick mounting and connection on printed circuits. Strips can be mounted in tandem to take minimum space on crowded chassis.



Strip-Type Mallory Multiple Controls*

Save Space . . . Speed Assembly on Printed Circuits

Low cost way to get close tolerance fixed resistors

The economical cost of the Mallory strip-type controls makes them useful in place of close tolerance fixed resistors. Just adjust them to the exact resistance required in the circuit, and you will have a fixed carbon resistor. The stability of the specially developed carbon element assures you of highly constant resistance value.

NEW ECONOMIES in the production of printed electronic circuits are made possible by these Mallory strip-type controls. Available in single, dual and triple sections, they have straight tinned terminals which project through punched slots in the printed sheet for dip soldering.

Mounting is simple and fast. Shouldered tabs fixed to the ends of the strip hold the control assembly in place. To save space, multiple sections can be mounted about $\frac{1}{2}$ " behind each other. Holes punched in the strip permit the shafts of the rear section to project through the front unit for adjustment.

For conventional chassis as well as printed circuits, this functionalized design reduces a carbon control to its simplest form. The resistance wafers are mounted directly on a phenolic panel. Due to this unique construction, Mallory is able to offer multiple units at a cost substantially lower than that of a similar number of single controls.

High stability of resistance, low noise and long service life are provided by the high-density Mallory control element. A complete range of resistance values from 250 ohms to 10 megohms is available. For full data, write or call Mallory today.

*Patent pending

Serving Industry with These Products:

Electromechanical—Resistors • Switches • Television Tuners • Vibrators

Electrochemical—Capacitors • Rectifiers • Mercury Batteries

Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

Expect more . . . Get more from

P. R. MALLORY & CO. Inc.
MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

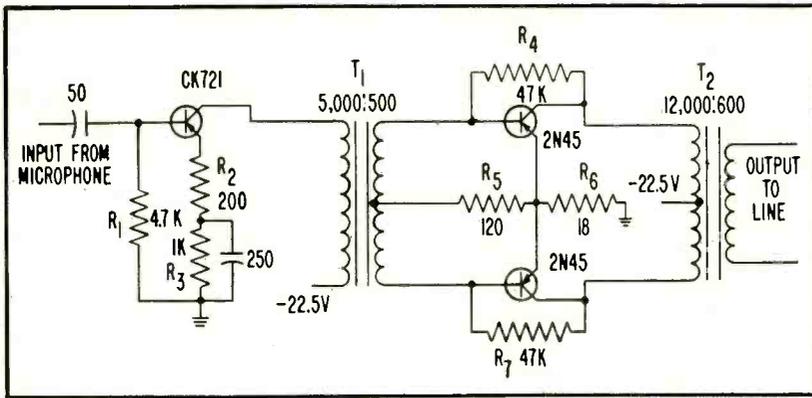


FIG. 1—Basic high-fidelity audio amplifier used as part of remote broadcast pickup unit having low power consumption

High Fidelity Transistor Power Amplifier

By ROBERT L. RIDDLE

Electrical Engineering Dept.
Pennsylvania State University
University Park, Pa.

LOW-POWER PORTABLE equipment finds greatest use for transistors. With them, it is possible to build a device that will deliver 50 mw and have a frequency response flat within ± 1 db over a frequency range of 30 to 20,000 cps. At the same time the amplifier will have less than 1-percent distortion over this same frequency range. The amplifier may also be designed to be temperature stable over a range from -20 to $+50$ C.

The circuit of such an amplifier shown in Fig. 1 consists of two 2N45 transistors connected in class A push-pull for the power output stages and a CK721 transistor connected in grounded emitter as the driver.

The driver is a grounded-emitter class A amplifier in which the bias is temperature-stabilized over the range from -20 to $+50$ C. This d-c temperature stability is obtained by the biasing network consisting of resistors R_1 , R_2 and R_3 . The 200-ohm unbypassed resistor in the emitter lead supplies negative feedback, which compensates for changes in the transistor with temperature and thus holds the distortion of the

driver below 1 percent over the frequency range 30 to 20,000 cps.

The power output stage consists of two 2N45 transistors connected in grounded emitter class A push-pull. The reason for using this configuration is to obtain 50 mw output and to reduce the total distortion in the output. This connection, owing to the phase relationships present in the output transformer, cancels out all the even harmonics.

The network of resistors R_4 , R_5 , R_6 and R_7 temperature stabilize the

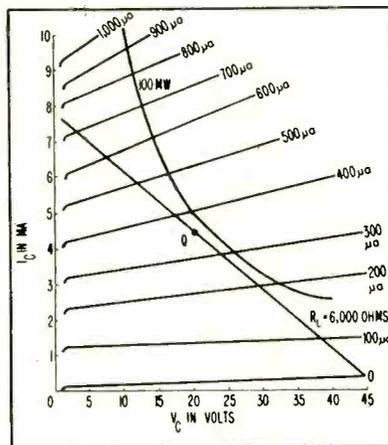


FIG. 2—Maximum allowable dissipation is shown by the 100-mw curve

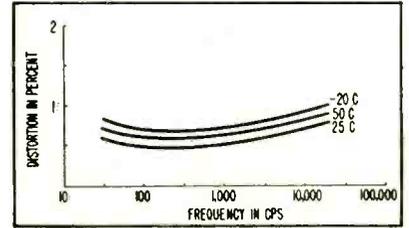


FIG. 3—Over the desired temperature and frequency ranges the transistor circuit has 50 mw output with less than 1-percent distortion

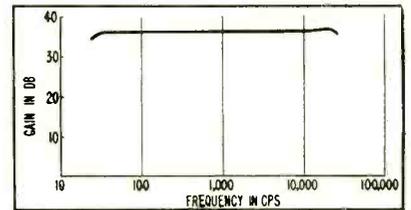


FIG. 4—Frequency response from 30 to 20,000 cycles is flat within ± 1 db

amplifier over the desired range. At the same time resistors R_4 , R_6 and R_7 supply negative feedback. Resistors R_4 and R_7 supply shunt type negative feedback that will lower the input impedance.

Series negative feedback, which will tend to increase the input impedance is supplied by R_6 . The input impedance to the output stages is thus stabilized. The negative feedback also holds the distortion within limits over the temperature and frequency ranges.

Transformer T_1 with an impedance ratio of 5,000 to 500 has less than 0.2-percent distortion over the frequency range 30 to 20,000 cycles. The frequency response of the transformer is ± 1 db over the range 30 to 20,000 cps. Transformer T_2 has an impedance ratio of 12,000 to 600 ohms and has the same requirements as transformer T_1 as to distortion and frequency response.

The operating point of the two 2N45 output transistors is shown in Fig. 2. The maximum allowable dissipation is shown as the 100-mw dissipation curve.

The transistor power output cir-

KEPCO KR SERIES

7 NEW

VOLTAGE REGULATED POWER SUPPLIES
for powering electronic equipment

SAVE TIME AND MONEY
Build these compact Power Supplies
into your equipment!

Kepeco Voltage Regulated Power Supplies are conservatively rated and are designed for continuous duty at 50°C ambient. The regulation specified for each unit is available throughout its output voltage range for line voltage variations from 105-125 volts and load variations from 0 to full load.

FEATURES:

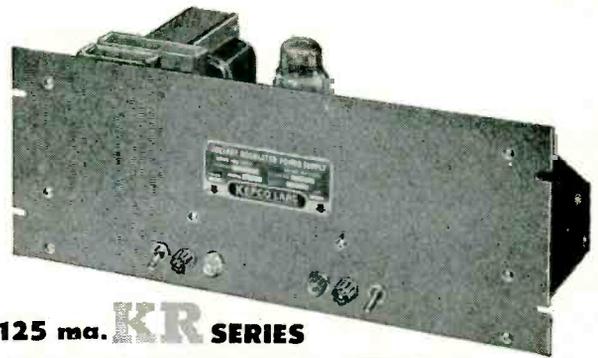
- Superior Regulation.
- Ultra-Stable 85A2 0G3 Reference Tube.
- Low Ripple.
- Low Output Impedance.
- Fast Recovery Time, Suitable for Square Wave Pulsed Loading.
- Voltage Range continuously variable without Switching.
- Either Positive or Negative may be Grounded.
- Oil Filled Condensers.
- Wire Harness and Resistor Board Construction.
- Power Requirements 105-125 volts, 50-60 cycles. Units operate up to 400 cycles.
- Terminations and locking type voltage control on rear of unit.
- AC, DC Switches, Fuses, and Pilot Lights on Front Panel.
- Color Grey Hammertone.
- Guarantee One Year.

To include 3" Current and Voltage Meters, Add M to Model number (e.g. KR 1-M) and Add \$30.00 to the Price.
To include Dust Cover and Handles for Table Mounting, Add C to Model-number (e.g., KR1-C) and Add \$10.00 to the Price.
To include Meters, Dust Cover and Handles, Add MC to Model number (e.g. KR 1MC) and Add \$40.00 to the Price.
PRICES F.O.B. Flushing.



KEPCO LABORATORIES

131-38 SANFORD AVENUE • FLUSHING 55, N. Y.
INDEPENDENCE 1-7000



125 ma. KR SERIES

MODEL	OUTPUT	VOLTS	CURRENT	REGULATION		RIPPLE (RMS)	19" Rack Mount		
				line 105-125v	load 0-max.		W	H	D
KR1 \$90	1	100-200	0-125 ma	0.3 volts	0.3 volts	3 mv.	19"	7"	7½"
	2	6.3 AC	3 amp.	*	*				
KR2 \$90	1	200-325	0-125 ma	0.2 volts	0.2 volts	3 mv.	19"	7"	7½"
	2	6.3 AC	3 amp.	*	*				

*AC Voltages unregulated.



300 ma. KR SERIES

MODEL	OUTPUT	VOLTS	CURRENT	REGULATION		RIPPLE (RMS)	19" Rack Mount		
				line 105-125v	load 0-max.		W	H	D
KR3 \$180.	1	100-200	0-300 ma	0.3 volts	0.3 volts	3 mv.	19"	7"	11"
	2	6.3 AC	5 amp.	*	*				
KR4 \$180.	1	200-325	0-300 ma	0.2 volts	0.2 volts	3 mv.	19"	7"	11"
	2	6.3 AC	5 amp.	*	*				

*AC Voltages unregulated.



600 ma. KR SERIES

MODEL	OUTPUT	VOLTS	CURRENT	REGULATION		RIPPLE (RMS)	19" Rack Mount		
				line 105-125v	load 0-max.		W	H	D
KR5 \$240.	1	100-200	0-600 ma	0.3 volts	0.3 volts	5 mv.	19"	10½"	13"
	2	6.3 AC	10 amp.	*	*				
	3	6.3 AC	10 amp.	*	*				
KR6 \$240.	1	195-305	0-500 ma	0.2 volts	0.2 volts	5 mv.	19"	10½"	13"
	2	6.3 AC	10 amp.	*	*				
	3	6.3 AC	10 amp.	*	*				
KR7 \$250.	1	295-405	0-600 ma	0.2 volts	0.2 volts	5 mv.	19"	10½"	13"
	2	6.3 AC	10 amp.	*	*				
	3	6.3 AC	10 amp.	*	*				

*AC Voltages unregulated.

cuit will deliver 50 mw of power over the desired temperature and frequency ranges with less than 1-percent distortion, as shown in Fig. 3.

The frequency response is de-

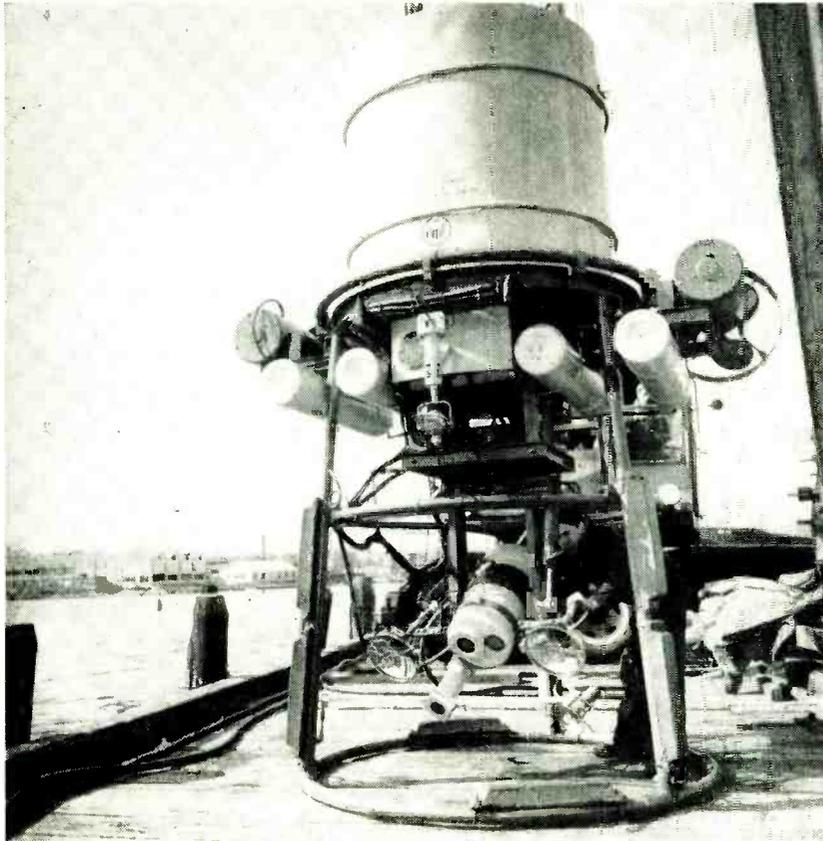
lineated in Fig. 4. Total gain of the driver and output stages adds up to 36 db.

The total power drain on the amplifier is 10 ma at 22.5 volts, or a total power of 225 mw. The total

amplifier is operating with better than 20-percent efficiency.

The work described in this article was performed during the time that the author was employed at Collins Radio Co., Cedar Rapids, Iowa.

Underwater Television Camera Hovers Or Cruises



DEPARTMENT OF NAVY's Bureau of Ships has successfully tested a new underwater television equipment (AN/SXQ XN-1) that permits complete surface control of the movement of the camera unit.

This development uses a new method of underwater depth control originated by the Bureau of Ships that is sufficiently responsive to permit hovering and cruising six inches above the bottom of the ocean without disturbing mud and silt that would reduce underwater visibility.

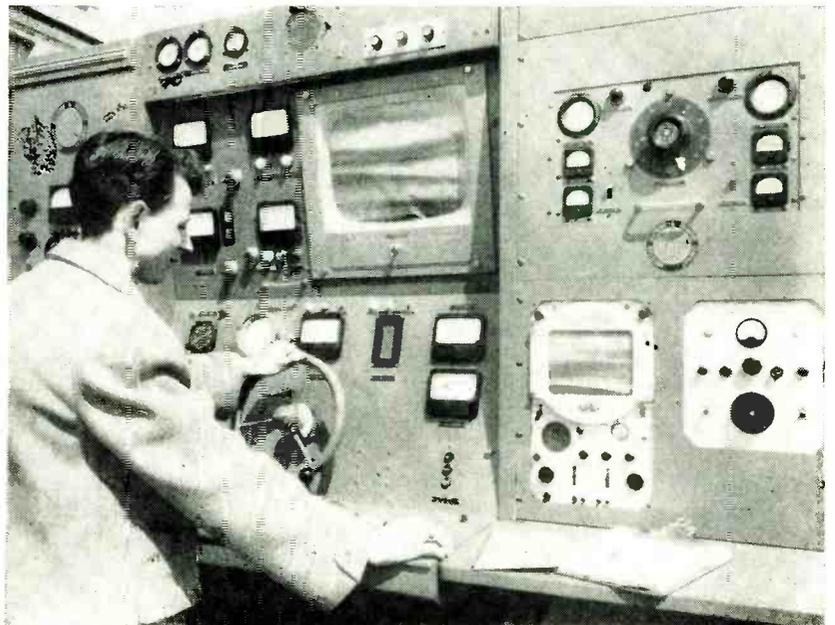
Surface weather conditions that make shipboard diving operations hazardous do not restrict the use of this device for surveillance of salvage and submarine rescue problems in advance of the diving operation.

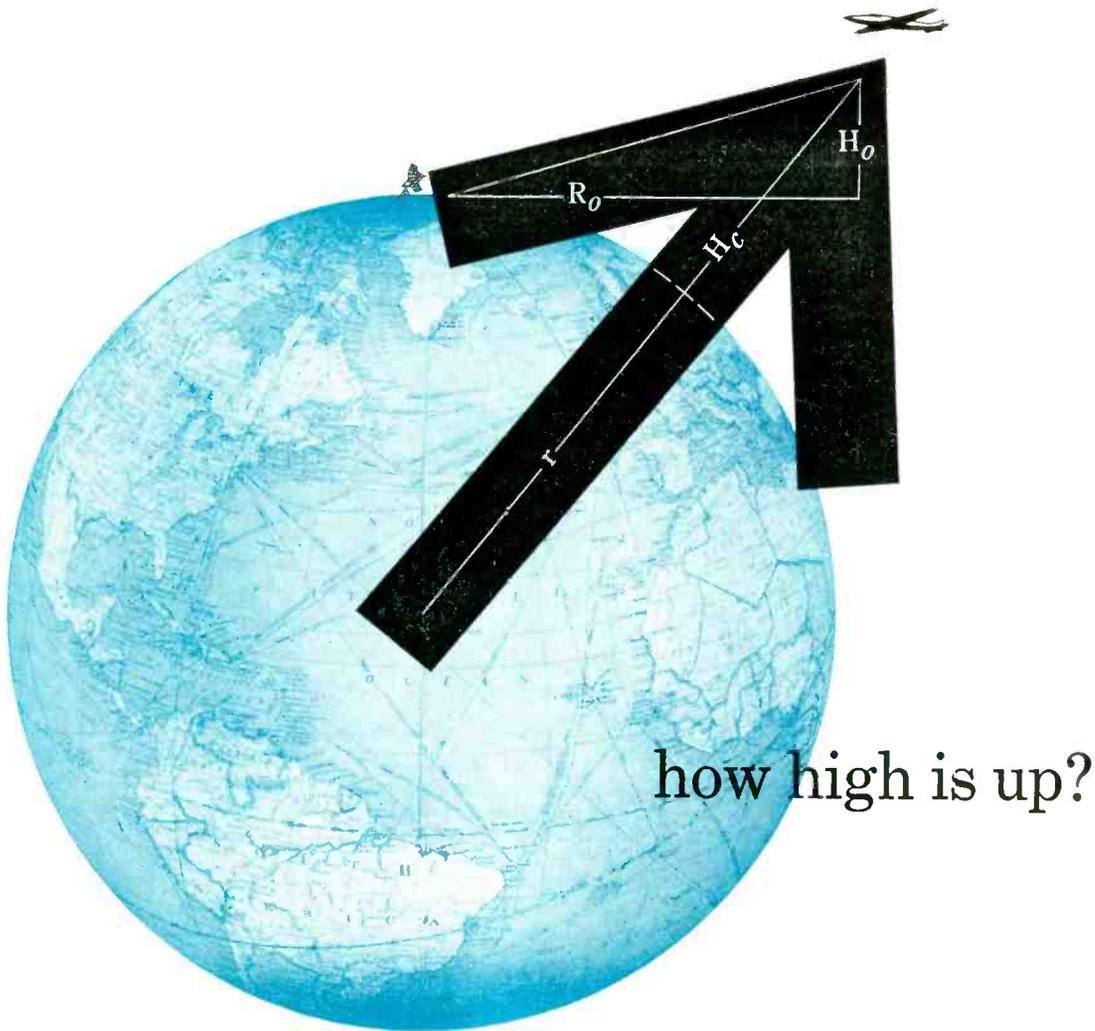
Provision has been made for the addition of a mechanism to the unit that will be experimentally applied to aiding the salvage diver in performing his task.—G.T.M.

(continued on page 178)

Undersea camera (shown above) is small compared with the equipment designed to take it underwater and control its position. The television pickup device is contained in the cylindrical housing at the bottom, with illuminating lamps on each side. A piston used in pointing the camera can be seen near the technician's hand, almost in front of his face, while above, gears used to swivel the camera are visible. Three fan-like propellers are mounted near the upper rim of the framework. The unit can be maneuvered about or caused to hover when they are made to rotate.

Control console for the undersea television camera is shown at the right. Two monitor oscilloscope screens indicate to the operator what the camera sees. Other meters and indicators show the length of cable out, its tension, depth and number of hours service on the illuminating lamps.





how high is up?

A child's conundrum becomes a matter of life and death...when radar tells a lie. When our radar tracks attacking aircraft...or an incoming missile...the lives of all of us on target balance on the pinpoint of a mathematical riddle.

How high is up? It depends on the point-of-viewing.

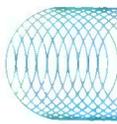
Because of earth's curvature, radar sees an interloper... 100 miles away... 6600 feet lower than it really is. Readings must be corrected instantaneously before being fed to our interceptors... otherwise, attacker and defender play true or false at twice the speed of sound.

Electronic Engineering Company of California has designed an analog computer that makes this vital correction... converting radar observation into true altitude above sea level. The computer continuously solves the equation

$$H_c = H_o + (R_o^2 / 2r)$$

The mathematics are complex. The mechanism, with a two-gang HELIPOT* series A precision potentiometer at its heart, is beautifully simple. Both are fully described in a new application data sheet... write for Data File 901.

Helipot makes precision potentiometers... linear and non-linear... in the widest choice of sizes, mounting styles and resistances. Many models are stocked for immediate shipment... our engineers will gladly adapt standard models to your requirements... or design entirely new HELIPOT precision potentiometers for you.

 **Helipot** *first in precision potentiometers*

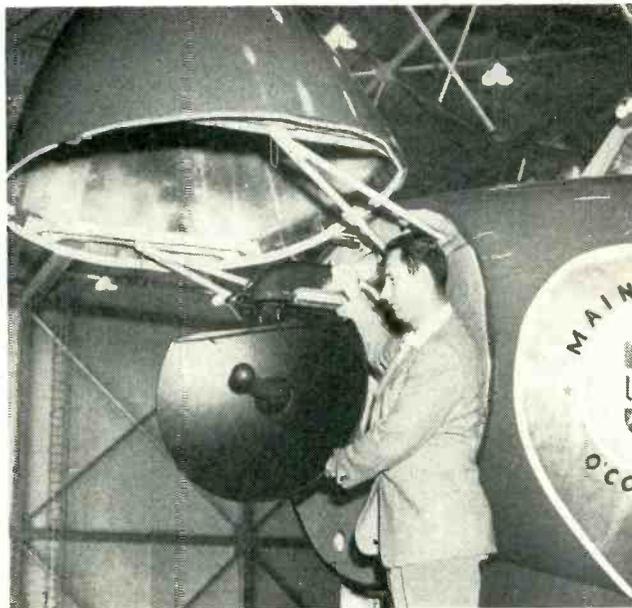
*Helipot Corporation/South Pasadena, California
Engineering representatives in principal cities
a division of BECKMAN INSTRUMENTS, INC.*



Weather Mapping Radar Uses C-Band



Tilt control (left) operated from pilot's position can be used to change the horizontal area scanned by the antenna shown in the opposite photograph. Oscilloscope is at the center of the instrument panel. Weather radar being installed in United Air Lines



fleet uses the C-band, centered at 5.5 cm. Antenna (right) normally housed in plastic nose of aircraft is capable of 360-degree rotation but generally scans only the 240 degrees at front and sides of the aircraft nose.

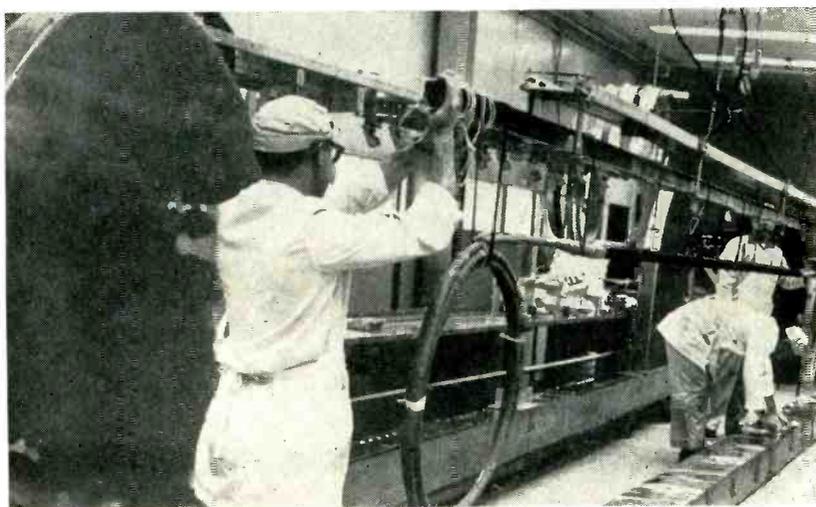
TURBULENCE in the atmosphere caused by thunderstorm activity is often a hazard and always a discomfort in airline operations. Fortunately the nature of thunderstorm turbulence provides an excellent radar target. Experiments by United Air Lines, Inc. using 5.5-cm radar equipment built by RCA showed that this frequency was generally superior to either 3 or 10 cm for penetrating intervening rainfall.

Other features built into the resulting AVQ-10 weather radar, which weighs only 125 pounds, include an isoecho circuit (ELECTRONICS, p 200, Oct. 1954). The purpose of this circuit is to accentuate to the pilot the areas of densest rainfall that is associated with maximum turbulence. Since the dynamic range of the conventional ppi radar display is limited, greater effective visual range has been obtained by reversing the display

where return signals are strongest.

The isoecho circuit comprises a pair of video amplifiers whose outputs are 180 degrees out of phase. When return signal intensity reaches a preset level, the out-of-phase amplifier begins to cancel the output from the other video amplifier. As a result, the display changes from a luminous area to a luminous ring. The dark center in the ring represents the area of greatest turbulence.

Transoceanic Telephone Cable Has Built-In Repeaters

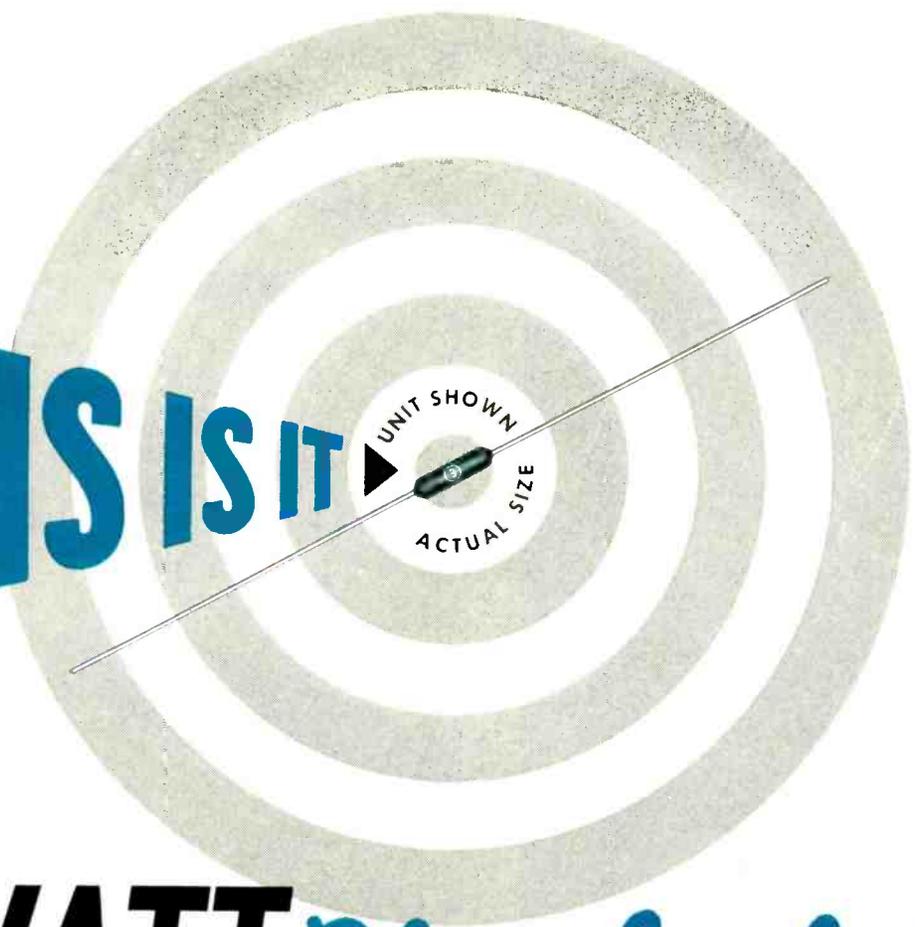


BY THE MIDDLE of July, *HMTS Monarch* had already completed laying some 200 miles of submarine cable from Clarenville, Newfoundland towards the eventual eastern termination at Oban, Scotland. When the 1,900-nautical mile distance has been bridged twice by separate cables containing 52 one-way repeaters, North America and

Repeaters built at laboratory-like Western Electric plant are carefully packaged for shipping to cable company for incorporation in cable and armoring. Later they will go under the ocean where they are expected to function satisfactorily for 20 years.



THIS IS IT



NEW 3-WATT Blue Jacket[®] miniaturized axial-lead wire wound resistor

This power-type wire wound axial-lead Blue Jacket is hardly larger than a match head *but it performs like a giant!* It's a rugged vitreous-enamel coated job—and like the entire Blue Jacket family, it is built to withstand severest humidity performance requirements.

Blue Jackets are ideal for dip-soldered sub-assemblies . . . for point-to-point wiring . . . for terminal board mounting and processed wiring boards. They're low in

cost, eliminate extra hardware, save time and labor in mounting!

Axial-lead Blue Jackets in 3, 5 and 10 watt ratings are available without delay in any quantity you require. ★ ★ ★

SPRAGUE TYPE NO.	WATTAGE RATING	DIMENSIONS L (inches) D		MAXIMUM RESISTANCE
151E	3	1 1/2	1 3/4	10,000 Ω
27E	5	1 1/4	3/4	30,000 Ω
28E	10	1 1/4	3/4	50,000 Ω

Standard Resistance Tolerance: ±5%

SPRAGUE



SPRAGUE ELECTRIC COMPANY • 35 MARSHALL ST. • NORTH ADAMS, MASS.

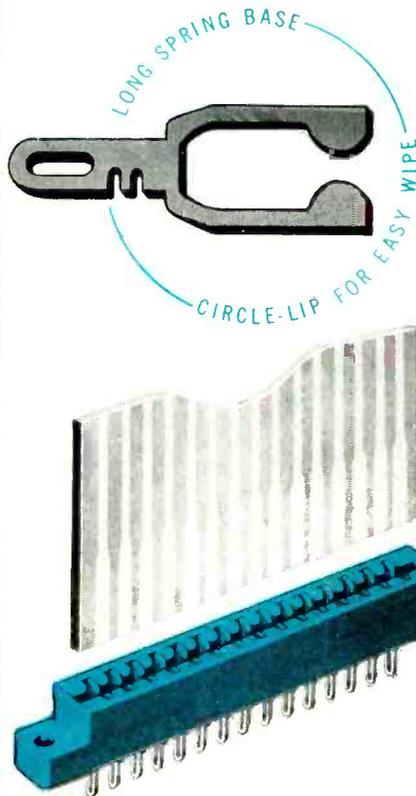
AMPHENOL

**PRIN-CIR
CONNECTORS**

revolutionary
NEW
contact design

IN
AMPHENOL
PRINTED CIRCUIT
CONNECTORS

4 contact tail styles . . .



10, 15, 18, 22 contacts . . .

Prin-Cir connectors are the result of careful design work by AMPHENOL Development Engineering. They feature compact bodies and a new contact design that is greatly superior to any available for printed circuit applications.

Prin-Cir contacts can't be set, can't be overstressed when used with standard .061" to .071" boards, have very low millivolt drop and extremely long life. This contact has an extra-long spring base and a circle-lip for good wiping action.

Prin-Cir connectors are available with 10, 15, 18 and 22 contacts in four contact tail styles: Standard Eyelet, Wire Wrap, Pin and Open End. They may be ordered with one or more polarizing keys in any contact location.

Bodies are molded of an improved version of AMPHENOL blue dielectric and contacts are gold-plated.

AMERICAN PHENOLIC CORPORATION
chicago 50, illinois

In Canada:
AMPHENOL CANADA LIMITED, Toronto

AMPHENOL

Write for special Product Bulletin!



the British Isles will be linked for the first time for wire telephone service.

Plans call for opening 36 circuits late in 1956, thus greatly increasing reliability of telephone service which since 1927 has been carried on by radiotelephone. The \$40,000,000 project is a joint undertaking of American Telephone and Telegraph Co., British Post Office and Canadian Overseas Telecommunication Corp.

Also involved is Eastern Telephone and Telegraph Co., a Canadian subsidiary of AT&T, which will operate the Dominion section of the microwave radio relay system connecting Portland, Maine and Sydney Mines, Nova Scotia. The Nova Scotia-Newfoundland cable using 16 repeaters of British design will operate in either direction.

The deep-sea repeaters, which will be spaced about 40 miles apart, employ 3 electron tubes and are each housed in a flexible copper tube some 8 feet long and 1½ inches in diameter. Supported on the inside by steel rings, the repeater sub-assembly is finally built into the cable and appears only to be a tapering bulge. It can thus pass through the cable ship's gear so that laying will be uninterrupted.

Higher Velocity of Propagation

CONSISTENTLY higher values than $299,776 \pm 4$ km per sec for the velocity of propagation of electromagnetic waves have been reported since the war. A new average value recently announced is $299,793 \pm 1$ km per sec.

Results obtained by the National Bureau of Standards give $299,792 \pm 6$ km per sec by the molecular constants method and $299,795 \pm 3.1$ km per sec by the radio interferometer. The final value for velocity of propagation for radio waves in free space was determined as a weighted average of 110 independent measurements made during 10 days. The uncertainty of ± 3.1 km per sec includes an estimated systematic error of ± 0.7 km per sec in addition to a 95-percent confidence

PERFORMANCE - GUARANTEED

Magnetic Shields

COST NO MORE-

WHY TAKE LESS?

You're time and money ahead with Performance-Guaranteed Magnetic Shields, for our shields are *guaranteed* to meet the requirements of your circuit to mutually agreed upon shielding specifications. Dry hydrogen annealed, as required . . . of MuMetal, A.E.M. 4750, or whatever commercially available material is most suitable . . . fabricated or drawn . . . painted or lacquered to match any shade, or unfinished. Write for the industry's most complete catalog, MS-104, today.

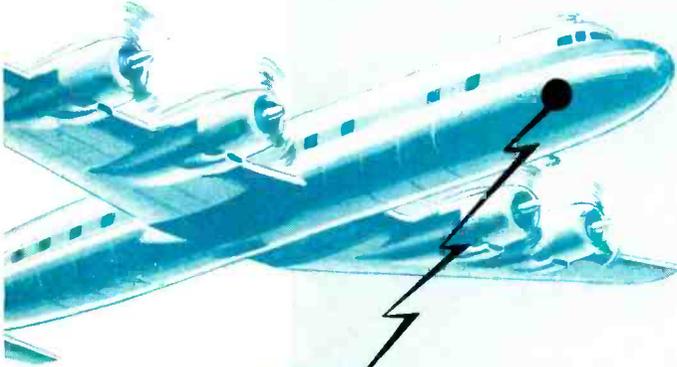


MAGNETICS inc.

DEPT. E-26, BUTLER, PA.

PERKIN

AIRBORNE RADAR
DC POWER SUPPLIES
 for Military and Commercial Aircraft



TYPICAL** 6000 VOLT MODEL
 DC OUTPUT: 6KV \pm 5% @ 100 microamperes

SPECIFICATIONS:

1. D. C. OUTPUT VOLTAGE TAP provided at 600 V.
2. A. C. INPUT: 100-120 Volts, 380-420 cps, Single Phase
3. RIPPLE VOLTAGE: Less than 120 Volts, peak to peak
4. TEMPERATURE RANGE: -55°C to $+85^{\circ}\text{C}$ @ 50,000 feet altitude

COMPONENTS: NO TUBES! Conservatively designed and derated selenium rectifier cartridges connected in voltage quadrupler circuit.

DIMENSIONS: 2" High x $5\frac{1}{4}$ " Long x 4" Wide

WEIGHT: 2 $\frac{1}{4}$ lbs.

ELIMINATES LEAKAGE PROBLEMS AT HIGH ALTITUDES INHERENT IN OIL-FILLED DESIGNS—HERMETICALLY SEALED AND POTTED WITH A SPECIALLY FORMULATED EPOXY RESIN.*

Perkin Engineering Corp. has been designing and manufacturing AIRBORNE HIGH VOLTAGE RADAR POWER SUPPLIES since 1951. There are over 3,000 Perkin units operating in Military and Commercial Radar Systems (such as APS - 42 etc.) with no reported cases of field failures whatsoever.

*Perkin units do not employ standard commercial catalog resins. Special epoxy resins are formulated for each unit (depending on the voltage and temperature ratings) by our chemists.

**8 KV, 10 KV and other ratings can be designed for your specific mechanical and space configuration.

PLEASE SEND US YOUR SPECIFICATIONS FOR OUR PROMPT ANALYSIS and QUOTATIONS or
 Fill out and return this coupon to . . .

PERKIN ENGINEERING CORP.

345 KANSAS ST., EL SEGUNDO, CALIF. • Oregon 8-7215

Please send further data on Power Supplies rated at
 _____ Volts and _____ Amps

NAME: _____

TITLE: _____ Products Mfg.

COMPANY NAME _____

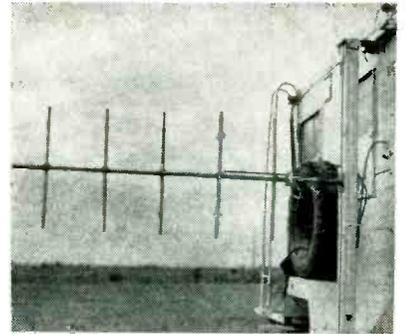
ADDRESS _____

CITY _____ STATE _____



interval for the mean value of the measurements.

Two receiving antennas spaced 1,500 meters apart were used. By varying the position of a transmitter over a path that halfway encircled the two receiving antennas, the phase difference between the receivers was made to change. Wavelength of the radio waves was then calculated by dividing the accurately known distance between the receiving antennas by half the total change in phase difference.



Five-element antenna used at one of the transmitting stations. Measurements were carried out on a dry lake bed near Willcox, Ariz. where a five-mile bare flat surface was available

A radio frequency of 172.8 mc obviated skywave interference and minimized ground effects. In practice, two transmitters were located on extensions of the line through the two receiving points. Change in phase difference was then noted at the receiving points when the transmission was switched from one transmitter to the other. Ambiguity was resolved by moving one transmitter across exactly one half the equiphase contours between the two transmitter positions. For convenience, the actual measurement was made at audio frequency by heterodyning to 1 kc. Frequencies of the transmitters and the resulting heterodyne were checked against WWV. Accurately known ground constants were used to adjust for ground effects while the index of refraction of the air was calculated as a function of temperature, pressure and humidity.

Radar Aids Meteorology

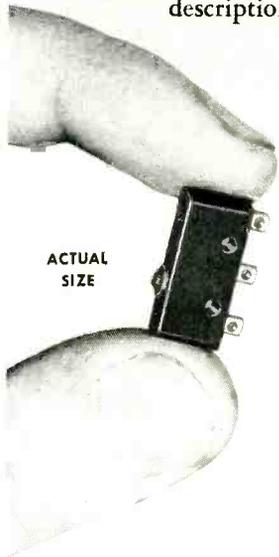
RADAR techniques used for tracking isolated showers and thunder-

Electro-Snap Switches Can Be Adapted to Almost Any Job — Quickly, Easily, Economically

Just choose the Electro-Snap Basic Switch that meets your electrical requirements, add the proper actuator — and presto! — you have a tailor-made precision switch that exactly fits your application. Electro-Snap makes a wide variety of stock actuators to fit almost any requirement. And our engineering department is at your service if a standard combination "won't fill the bill."

For prompt action on your switching problems, send us a brief description and rough sketch of the switch you need.

Switching Problem?



SUB-MINIATURE SWITCHES TYPE E-4

S.P.D.T., 1 circuit; 5 amps, 125/250 v. AC
Operating force 150 grams max.
Exceptionally vibration-resistant.
Special model E4-7 is stabilized for — 65° to + 350° F. operation.



Push Button Actuator



Toggle Actuator (Momentary or Constant Contact)



Double Toggle Actuator



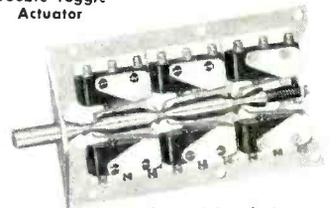
Roller Leaf Actuator



Leaf Actuator



Extension Leaf Actuator

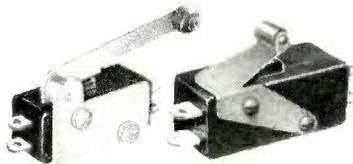


Ganged Interlock

TYPE S SWITCHES Series S1



S.P.D.T., 2 circuit; 10 amps, 125/250 v. AC/ 30 v. DC. Ind. Screw or solder terminals on ends or one side of switch. Also available with reset button at bottom of switch or in Type S-100 Make-Before-Break Series where switch completes a new circuit before interrupting old one.



Roller Lever Actuator



Roller Actuator



Push Button Actuators (Various button sizes available)



Special Push Button Actuator designed for fire control system



Toggle Actuator (momentary or constant contact)



Extension Leaf Actuator

DOUBLE-POLE SIMULTANEOUS ACTION TYPE D-8

D.P.D.T., 4 Circuit
15 amps, 125/250 v. AC.
10 amps, 30 v. DC Ind.
Eight terminals and four separate circuits which operate simultaneously permit switch to reverse 3-phase motors, replace expensive relays, etc.



Roller Leaf Actuator



Roller Lever Actuator



Leaf Actuator

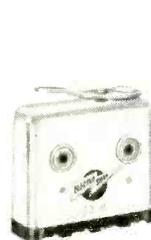


Extension Leaf Actuator



Push Button Actuators (Various button sizes available)

HERMETICALLY-SEALED DOUBLE-POLE SWITCH



Type J2-4



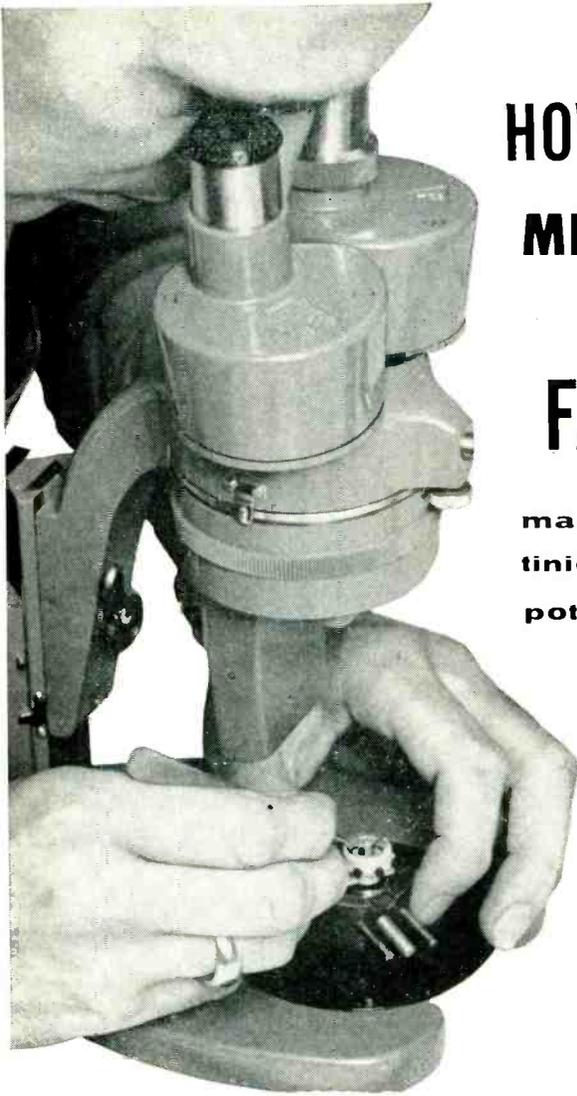
Toggle Actuator for J2-4

D.P.D.T., 4 circuit 10 amps, 125/250 v. AC/30 v. DC.



HOW 3-D MICRO-VISION HELPS FAIRCHILD

manufacture world's
tiniest production-run
potentiometer



In a case less than $\frac{1}{2}$ " in diameter, 35 sub-miniature parts are precision-assembled; hair-thin springs are welded into fine slots. This tiny unit, designed and developed by the Guided Missiles Division of Hughes Aircraft Company, is a sensing and controlling element for aircraft and missiles; critical tests must assure highest mechanical and electrical efficiency.

Fairchild Camera and Instrument Corporation attributes the efficient mass-production of this unit to the use of Bausch & Lomb Stereomicroscopes—in assembly, inspection, and quality control. "Operators have both hands free and use both eyes to obtain normal, three-dimensional vision magnified to the required power—with high efficiency and operator comfort."

Write for FREE Copy of this Exclusive 3-D Micro-Vision Data Book



- See actual stereo views!
- Know *how* and *where* to use Stereomicroscopes!
- Fit exact model to job needs with Selector-Chart!

WRITE TODAY for Data Book
D-15. Bausch & Lomb Optical Co.,
61445 St. Paul St., Rochester 2, N.Y.



America's only complete optical source... from glass to finished product.

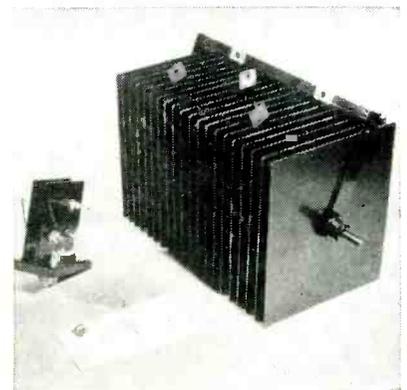
storms have been known and employed for some time. A greater field of usefulness for radar lies in the study of cloud physics, according to Alan C. Bemis, of Massachusetts Institute of Technology. The term cloud physics includes the study of all physical processes occurring within clouds.

The theory for formation of rain based upon ice crystals has been supplanted to a great extent as a result of radar and aircraft explorations. It was formerly generally believed that the introduction of a few ice crystals among many super-cooled cloud drops caused ice crystals to grow at the expense of the water drops. With increase in size, they were thought to fall out as snow, melting to rain at lower altitudes. These studies continue.

In a paper describing work carried out under a Signal Corps contract, Bemis showed the relation between radar signal intensity and the number and size of droplets causing the echo.

Radar echoes from precipitation are returned by the drops within a volume of space determined by the beam width and half the pulse length. The intensity of any single returning pulse is a function of the spatial distribution of the drops

Silicon Power Rectifier



The 20-finned selenium rectifier at the right is typical of those used in the telephone plant for converting alternating to direct current. Bell Labs' new silicon power rectifier at the left comprising four units and two cooling fins may eventually replace the larger one. Active elements are 4 wafers a tenth of an inch square, similar to those on the paper in the foreground. A wafer is placed in a tiny can and attached to a bolt for mounting



Byron Jackson Co.

watts of real power to drive antennas



MODEL
(BJ-30A)
*Hi-Power
Standard
Signal
Generator*

AND MICROVOLTS TO MEASURE NOISE

5 watts RF output into 50 ohms impedance.

160 db range of attenuation —15.0 volts to 0.10 uV.

CW—AM—PM operation.

Master oscillator—tuned power amplifier circuit.

Continuous tuning 40 MC to 400 MC—spiral dial scale 4 feet long.

Dial calibrated at intervals of 1% frequency.

Leakage fields less than 0.1 uV/meter.



USM-16
(BJ-75A)

*Multi-Purpose
Standard Signal Generator*

a clear, sharp crystal note

AT 440 MC!

FLEXIBILITY PLUS!... with AM, FM, PM or Sweep Modulation available at the flip of a switch

Continuous coverage 10 to 440 MC. Single band; no switching.

Tunes to within less than 1000 cps of desired frequency with respect to two-step temperature-controlled crystal calibrator.

Automatic frequency stabilization at any desired frequency.

Internal or external AM, FM, PM (alone or in conjunction with video pulse and Sync Out pulse). Sweep Frequency modulation with marker pip.

Output 0.1 uV to 0.224 volt (—127 to 0 dbm) into 50 ohm load. Selected output remains constant over full frequency range.

After warm-up, frequency drift is less than $\pm 0.002\%$ in eight hours at room temperature.



Byron Jackson Co.

ELECTRONIC DIVISION

Mailing Address: P.O. Box 2017, Terminal Annex
Los Angeles 54, California

TELEPHONE
RYAN 1-5166

and this changes from pulse to pulse causing a grassy appearance on an R-scope. It has been found impossible to compare accurately the height of the grassy echo with the pip from a signal generator.

Fortunately, the average value of the signal intensity is a function of ΣNd^n , that is, the number and size of the drops causing the echo. It is relatively simple to build an electronic device that remembers the size of each returning pulse and averages it with its immediate successors. Output from such a meter can record continuously the average value of about 1,000 pulses. Theory and experiment agree that 1,000 at usual repetition rates gives a good average.

Measurement of average signal intensity does not, however, uniquely determine the number and size of the raindrops being examined, but knowledge of characteristic drop size distributions and other measurements permit the cloud physicist to deduce much from radar signal intensity data.

For example, it can be assumed under some conditions that the number of particles N remains constant with time. Then the changes of ΣNd^n measure changes of particle size. Much time has been spent on the average or most common relationship between ΣNd^n and precipitation rate, so that a single radar may be used as a rain gage covering thousands of square miles. The results show useful accuracy for certain applications in hydrology, agriculture and flood control.

Rain Gages Send Radio Reports

McG-H PACIFIC COAST NEWS BUREAU

FLOOD CONDITIONS in the Sacramento River drainage basin are subject to extensive control by regulation of water released from Shasta and Keswick Dams. Such control is based upon runoff information.

The Bureau of Reclamation's Central Valley Project in Northern California has installed a network of six radio reporting precipitation stations that give immediate in-

836.0

864.9

483.6

167.93

999.9

291.83



faster! more channels!
more versatile!

THE NEW POTTER DIGITAL MAGNETIC-TAPE HANDLER

0 to 60 inches/sec. in 5 msec! 2, 6 or 8 channels

High-speed magnetic tape recorders with low start-stop times bring a new dimension to data handling by absorbing and dispensing digital information when and where it's needed! Any phenomenon can be recorded as it occurs, continuously or intermittently, fast or slow. It can later be fed into computers, punch cards, printers, etc.

Speeds of 60 inches per second with 5-millisecond start-stop times permit digital techniques with jobs previously requiring more expensive, less reliable methods. Typical applications include business problems, high-speed industrial control processes, missile study, and telemetering.

In addition, Potter Magnetic Tape Handlers offer wider tape widths for more channels with lower tape tension controlled by photoelectric servos. Yet, the price is a fraction of much less versatile recorders. Other data handling components and complete systems are available for special problems.

DETAILED SPECIFICATIONS

Model	902AJ	902BJ	902BK	902CJ	902CK
Number of Channels	2	6	6	8	8
Tape Width (Inches)	¼	½	½	¾	¾
Tape Speed (in./sec.)	15/30	15/30	15/60	15/30	15/60
Reel Size (dia. in inches)	10½	10½	8	10½	8
Reel Capacity (feet)	2,400	2,400	1,200	2,400	1,200
Start Time	5 Milliseconds				
Stop Time	5 Milliseconds				

For complete information, write to Department 10-F.



POTTER INSTRUMENT CO., INC.
115 Cutter Mill Road, Great Neck, N. Y.

leadership in semi-conductors

from

Transitron[®]

SILICON

GERMANIUM

Transitron

SILICON POWER RECTIFIERS

Send for Bulletin TE-1321



T

Transitron

SUBMINIATURE GLASS GERMANIUM DIODES

Send for Bulletin TE-1319



T

Transitron

MEDIUM POWER SILICON RECTIFIERS

Send for Bulletin TE-1321 D



T

Transitron

GOLD BONDED GERMANIUM DIODES

Send for Bulletin TE-1300



T

Transitron

HIGH POWER SILICON RECTIFIERS

Send for Bulletin TE-1321 C



T

Transitron

MATCHED QUADS

Send for Bulletin TE-1310



T

Transitron

SILICON BONDED DIODES

Send for Bulletin TE-1308



T

Transitron

AUDIO TRANSISTORS

Send for Bulletin TE-1320



T

Transitron

SILICON JUNCTION DIODES

Send for Bulletin TE-1322



T

Transitron

POWER TRANSISTORS

Send for Bulletin TE-1320 C



T

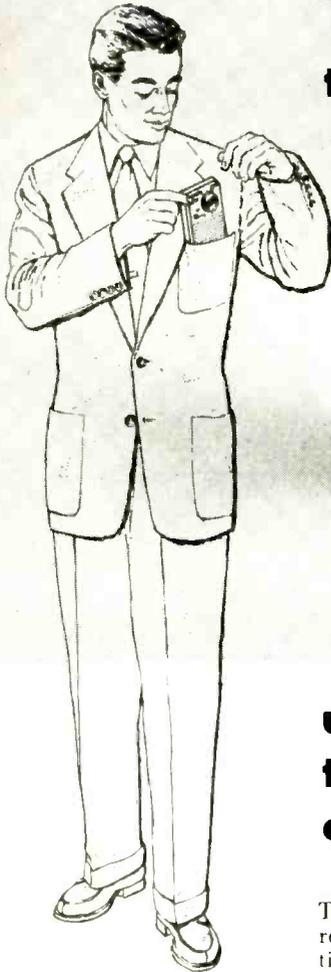
All Transitron semi-conductors are produced to the most rigid military and commercial specifications to assure long life and complete reliability. They provide the trouble-free, dependable performance that is so essential in modern complex electronic equipment.

Whether your requirements are for Germanium or Silicon, the solution can be found in Transitron's diversified line of semi-conductors. A wide variety of standard types, along with over 300 special types, are available. Your inquiries are invited.

Transitron[®] electronic corporation
 melrose 76, massachusetts



TI subminiature transformer . . .

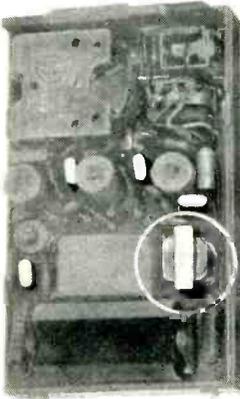


used in the first transistorized consumer product!

The world's smallest commercial radio receiver makes the most of miniaturization possibilities with a Texas Instruments subminiature transformer and four TI transistors. TI subminiature transformers, such as the one used in the Regency pocket radio, are adaptable to mass production dip-soldering assembly techniques.

Your most *experienced* source of supply for transistorized circuit components, Texas Instruments produces the most complete line of subminiature transformers, consisting of 32 standard models. Ranging from less than $\frac{3}{8}$ inch cubed (one milliwatt output) to one inch cubed (200 milliwatts output in push-pull), TI subminiature transformers are precision units specifically designed for transistorized and other miniaturized circuits. TI engineers will design special models — in virtually unlimited variety — to meet your exact requirements.

Don't delay your own product miniaturization program. Write today for Bulletin DL-C 424, describing TI subminiature transformers in detail.



Rear view of pocket radio with back removed, showing TI transformer and transistors in relation to other circuit components.

formation on flood-producing rainfall. Terminating at the Bass Mountain relay station, these radio circuits are controlled from the nearby Keswick Power Plant. Location of the stations and distances involved are indicated from the map in Fig. 1.

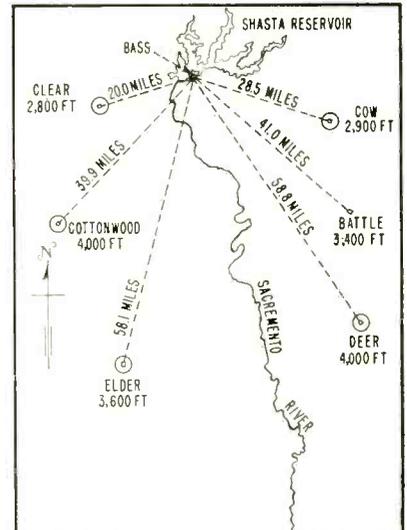


FIG. 1—Map shows orientation of reporting stations that are located on or adjacent to streams that contribute to flood conditions

A new type of heated precipitation gage shown in Fig. 2 and 3 weighs snow or rain, producing distinctive signals by means of a photoelectric coding apparatus.



FIG. 2—General view of Deer Creek reporting rain gage station

The operator at the control point (Fig. 4) selects the station to be checked, presses a key to call it and reads from an oscilloscope the reply

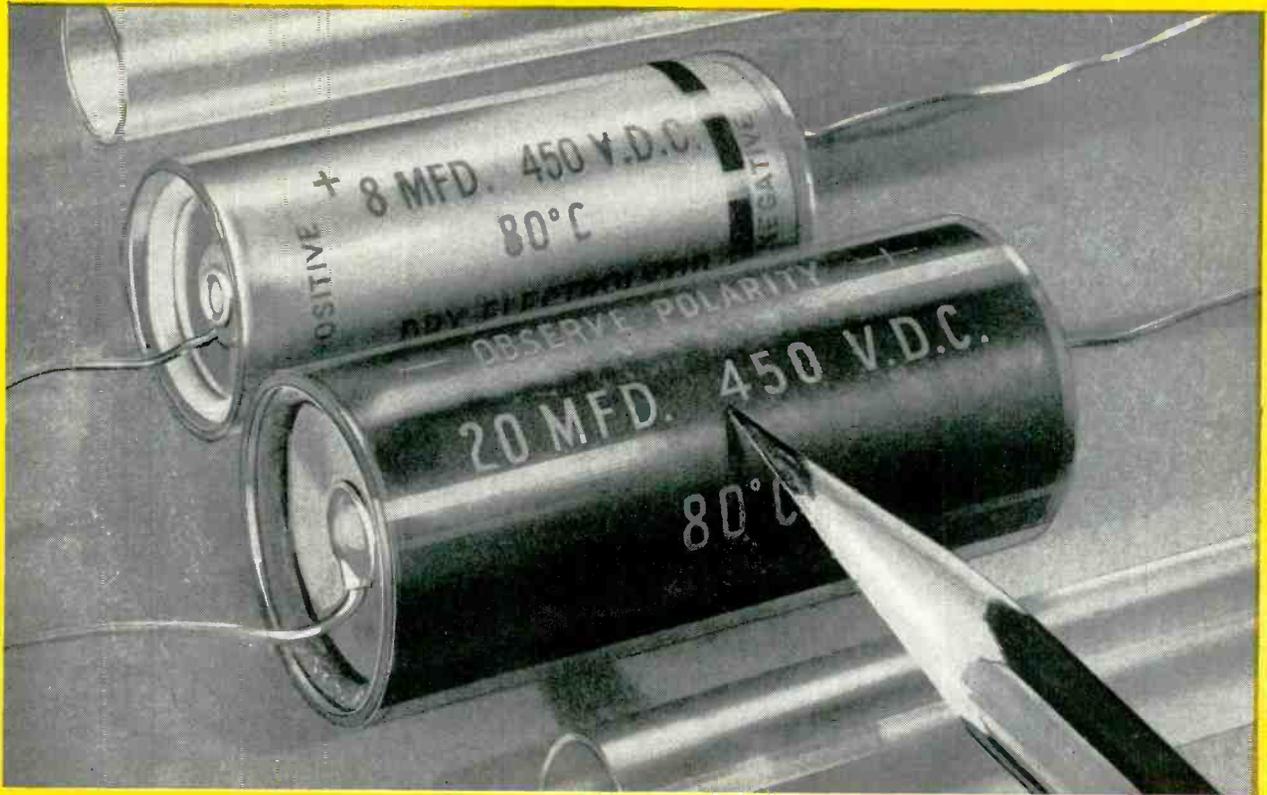


TEXAS INSTRUMENTS

INCORPORATED

6000 LEMMON AVENUE DALLAS 9, TEXAS

Protection plus Transparency



Use TRANSFLEX* When You Need Easy Inspection... Flexibility... Chemical and Abrasion Resistance

Transflex, Irvington's transparent plastic tubing, has become increasingly popular for low and moderate temperature use as more designers and manufacturers discover its combination of high protection and easy inspection. Transflex has a tensile strength of 3000 psi, dielectric strength of 1000 vpm, good dimensional stability and abrasion resistance . . . resists oils, alcohols, acids, alkalis, common hydrocarbon solvents. It is recommended for continuous operation at temperatures from -58°F to 176°F .

Electrical equipment manufacturers use Transflex as a dust-proof, abrasion resistant covering for resistors and capacitors, for terminal and lug insulation, as flexible conduit in lighting and ignition systems . . . anywhere component identification or periodic visual inspection is required. The aircraft industry likes its flexibility at high altitude temperatures. Processors use Transflex for low pressure hose, flexible shaft covering, or piping corrosive liquids. Stocked in sizes from .022" to 2.000" I.D. Write for technical literature.



PLASTICS PRODUCTS

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

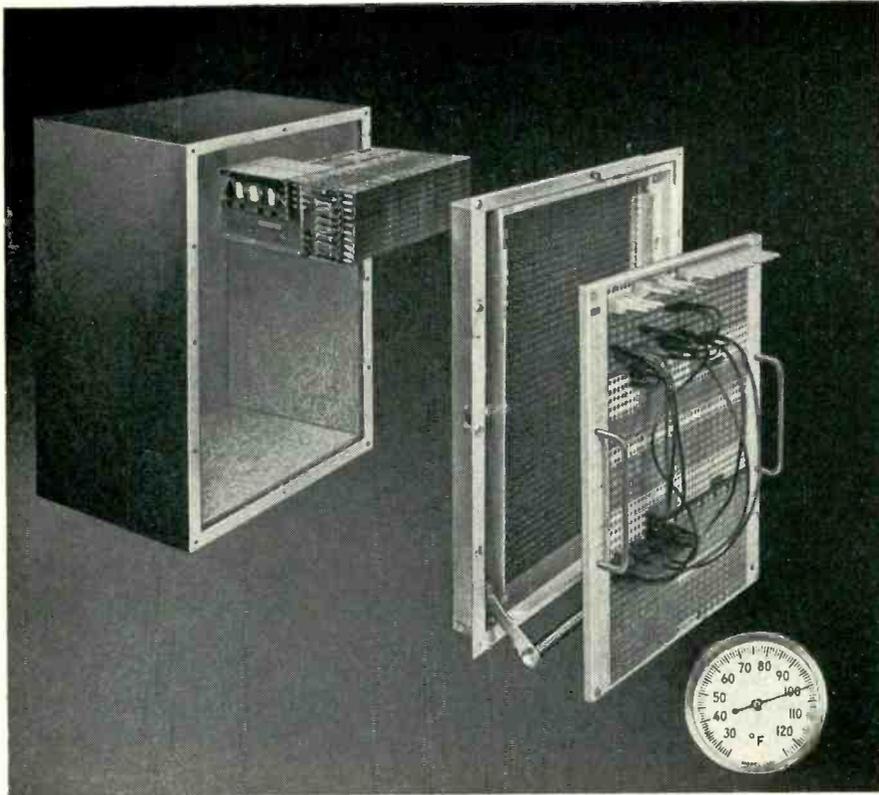
IRVINGTON DIVISION

MINNESOTA MINING & MANUFACTURING COMPANY

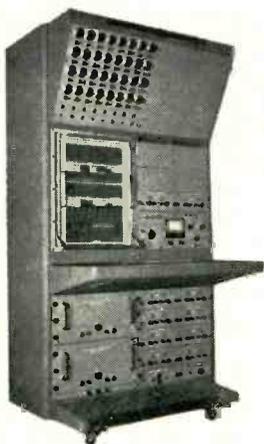
11 ARGYLE TERRACE

IRVINGTON 11, N. J.

News in Analog Computing...



ASSURES MAINTENANCE OF YOUR EQUIPMENT'S ORIGINAL ACCURACY...



It is of understandable importance to you, when investing in analog computing equipment that you have definite assurance the equipment will maintain its original accuracy in use.

Such assurance is yours, in Electronic Associates' Computer Group Type 16-31R. All critical elements, such as precision computing networks, passive elements and relays are contained in a blower-equipped, thermostatically controlled oven located directly behind the patch bay—with temperature controlled to 100° F plus or minus one degree—assuring maintenance of accuracy and stability.

This 16-31R is the Computer which can be expanded by a unique building block system to the most complex systems. Demonstration and rental of computing time is available at EAI Computation Center, Princeton, New Jersey. Details on request. Write Dept. EL-11, Electronic Associates Inc., Long Branch, New Jersey.

Visit our booth at the Instruments Society of America Conference.

ELECTRONIC ASSOCIATES
Incorporated

EAI SETS THE

P A C E
PRECISION ANALOG COMPUTING EQUIPMENT

LONG BRANCH, NEW JERSEY

indication of precipitation caught. This information is then trans-

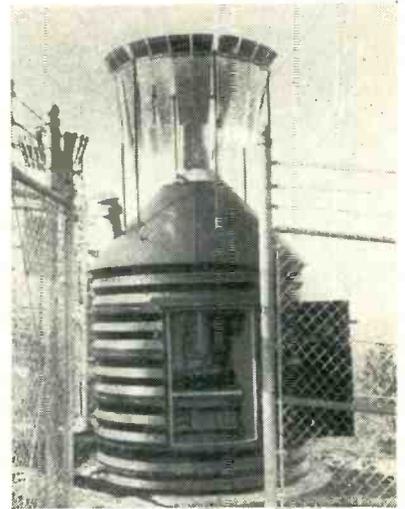


FIG. 3—Deer Creek radio reporting rain gage station showing special baffle around mouth of gage opening to cut down wind eddies and insure representative catch



FIG. 4—Operator interrogates rain gage station and receives coded report on a cathode-ray oscilloscope

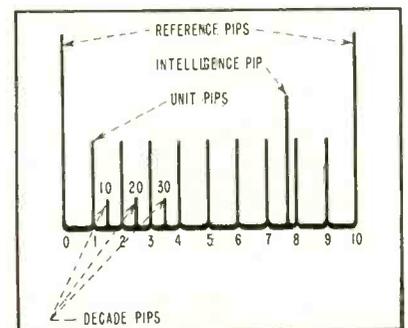


FIG. 5—Example of coded report shows 37.75 inch rainfall

mitted by teletypewriter circuit to water control headquarters.

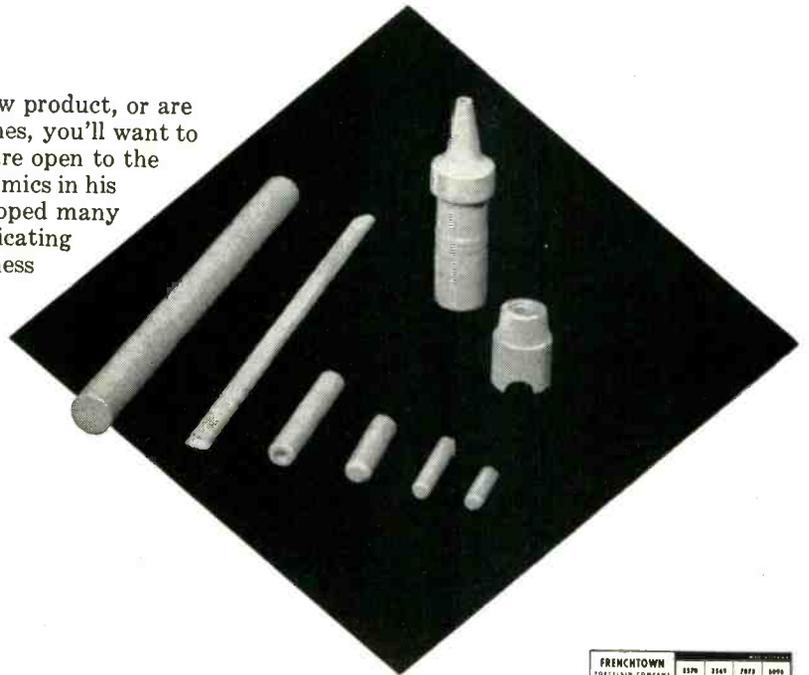
With the system, flood peaks can

**FRENCHTOWN
ENGINEERED CERAMICS
OFFER**



big advantages!

Whether you plan the development of a new product, or are seeking ways to further improve existing ones, you'll want to look into the many new possibilities which are open to the design engineer who includes *engineered* ceramics in his planning. Our ceramic engineers have developed many formulae which, together with modern fabricating methods,* have greatly enlarged the usefulness of these amazing materials. Always outstanding as electrical insulators, Frenchtown ceramics, particularly the high alumina bodies, are being specified more and more for critical mechanical applications.



Check these BIG advantages:

- ◆ MECHANICAL STRENGTH
Compressive strength up to 187,000 psi.
- ◆ ABRASION RESISTANCE
Demonstrated by use for sand blast nozzles.
- ◆ HEAT RESISTANCE
Softening temperatures up to 1971° C.
- ◆ THERMAL CONDUCTIVITY
Coefficient (c.g.s. units) up to 0.0180.
- ◆ THERMAL EXPANSION
as low as 2% cumulative at 700° C.

*Grinding and extrusion facilities • NICOTE® Metallized Ceramics

Send for this helpful bulletin giving complete data on mechanical and electrical properties of all Frenchtown Engineered Ceramics.

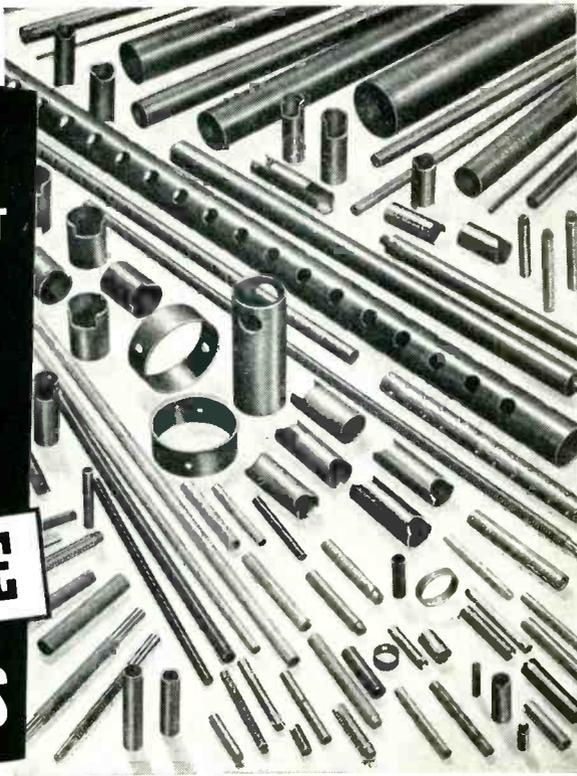
FRENCHTOWN PORCELAIN COMPANY	ELECTRICAL & MECHANICAL PROPERTIES OF FRENCHTOWN CERAMICS			
	1570	1540	7073	5096
Material	Alumina	Alumina	Alumina	Alumina
Color	White	White	White	White
Form	Tube	Tube	Tube	Tube
Length	100	100	100	100
Outer Diameter	1/2"	1/2"	1/2"	1/2"
Inner Diameter	1/8"	1/8"	1/8"	1/8"
Weight	0.15	0.15	0.15	0.15
Compressive Strength	187,000	187,000	187,000	187,000
Abrasion Resistance	100	100	100	100
Heat Resistance	1971	1971	1971	1971
Thermal Conductivity	0.0180	0.0180	0.0180	0.0180
Thermal Expansion	2%	2%	2%	2%

frenchtown PORCELAIN COMPANY

86 MUIRHEAD AVENUE | TRENTON 9, NEW JERSEY

5

IMPORTANT REASONS WHY YOU SHOULD SPECIFY RESINITE COIL FORMS



1. **RESINITE AC** combines all the mechanical and dielectric advantages of phenolics with the high dielectric strength, moisture resistant and non-corrosive properties of cellulose acetate.
2. **RESINITE 104** is a tough material suitable for stapling, severe forming and fabricating.
3. **RESINITE 8104** minimizes the effects of electrical property degradation characteristic of laminated phenolics when subjected to high humidity and temperature.
4. **RESINITE TruTork** provides an internally threaded or embossed form to fit any threaded core, regardless of diameter or threads per inch.
5. **RESINITE** gives torque control of plus or minus 1 inch ounce—axial pressure in excess of 25 pounds.

Ask us how you can save money by replacing expensive plastics with low-cost Resinite tubes for many applications involving high chemical or moisture conditions.

Get full information on Resinite Coil Forms. Request detailed technical literature.

RESINITE CORPORATION

Sales Representatives in:

New England: Framingham, Massachusetts, Trinity 3-7091

Metropolitan New York, New Jersey:
Jersey City, New Jersey, Journal Square 4-3574

Upstate New York: Syracuse, New York, Syracuse 4-2141

Northern Ohio, Western Pennsylvania: Cleveland, Ohio, Atlantic 1-1060

Indiana, Southern Ohio: Logansport, Indiana, Logansport 2555

California: Pasadena, California, Sycamore 8-3919

Canada: Montreal, Quebec, Canada, Walnut 0337

Division of

PRECISION PAPER TUBE COMPANY

2035E W. CHARLESTON ST. • CHICAGO 47, ILLINOIS

be forecast as much as 12 hours in advance on Sacramento River tributaries.

Square-Law Circuit

By K. S. LION
and R. H. DAVIS

Department of Biology
Massachusetts Institute of Technology
Cambridge, Mass.

ELEMENTS having a square-law characteristic are frequently used in analog computers, in particular for multiplication problems. Four types of such elements are primarily employed.

Thermal instruments are used, such as thermoconverters¹ or temperature limited diodes², having an output voltage proportional to the temperature of a wire, which in turn is proportional to the square of an input voltage or current. The time constant of such devices is high, sometimes up to several seconds.

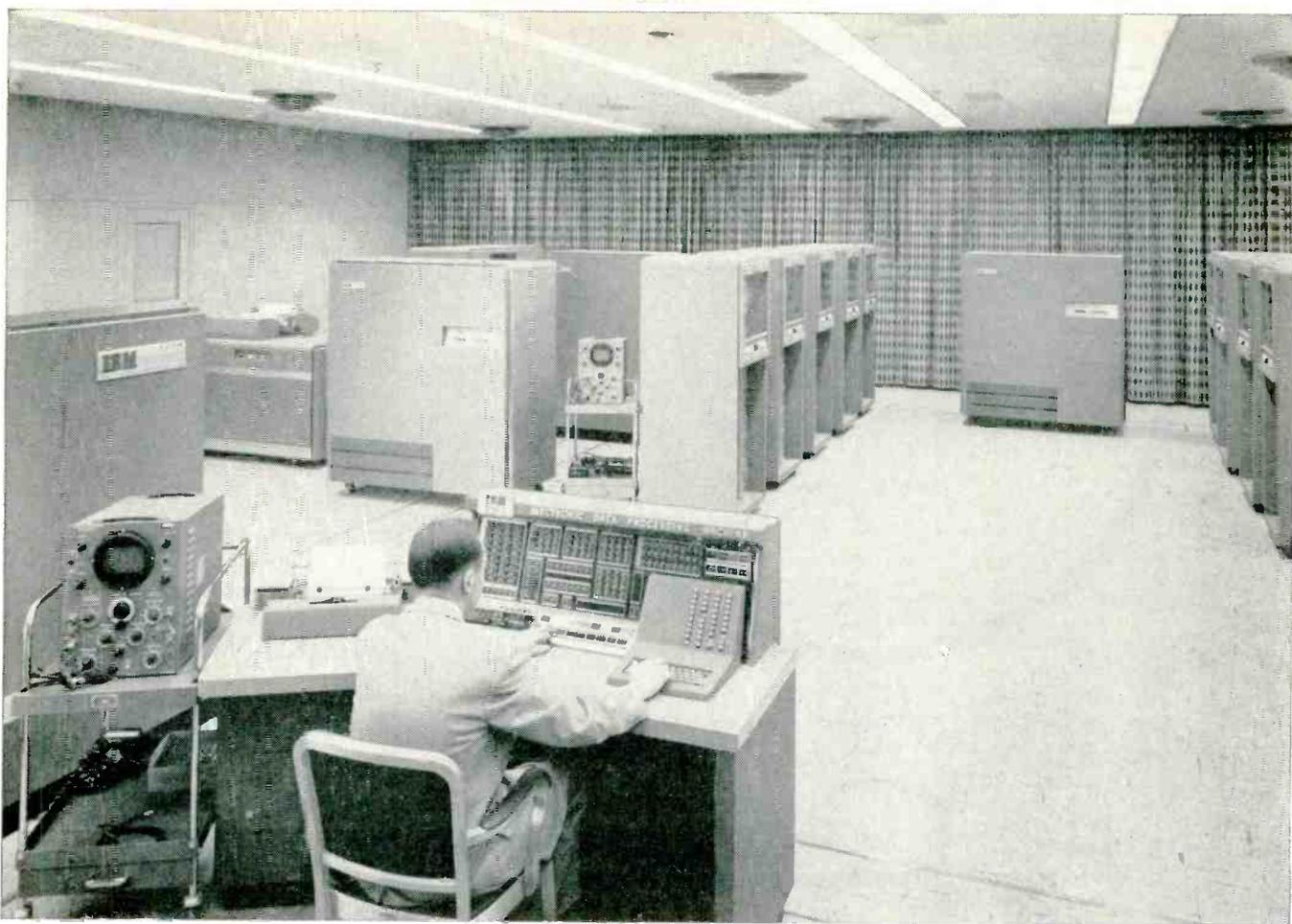
Parabolic functions can be synthesized from segments of diode characteristics.³ Such setups require a considerable number of elements; for instance Chance⁴ uses 15 diodes for a range from 0 to 25 volts input, while Marshall⁵ uses 22 diodes for a range of -100 to +100 volts input.

Beam deflection square-law tubes⁶ can be used, in which an electron beam of rectangular cross-section strikes a parabolically shaped target. The input voltage deflects the beam and the amount of target current varies in accordance with the shape of the target. This method requires special tubes⁷.

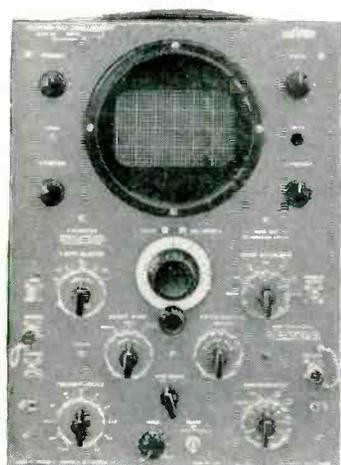
For applications where moderate accuracy is satisfactory, triodes or pentodes can be employed and operated in the limited range where the plate current varies approximately with the square of the grid voltage or screen voltage⁸. The characteristic of such tubes changes with age and operating conditions.

New Circuit

The new square-law device described in this paper and illustrated in Fig. 1A requires a source furnishing a triangular wave of negative polarity e_i . It is connected in series with the input signal e_i and applied to a diode D and a load re-



IBM selects DU MONT TYPE 329* as test oscillograph for their new type 702 computer



When IBM Corporation, world's largest manufacturer of computer equipment, produced their new Model 702, an essential phase of the project involved selection of a cathode-ray oscillograph to go into the field with each computer as standard test equipment. Requirements were strict.

IBM's approach to the problem was to conduct side-by-side evaluation with other competitive instruments. On the basis of actual performance, they selected the Du Mont Type 329 as their test oscillograph.

What are some of the primary reasons why IBM decided on the Du Mont Type 329? Excellent sensitivity—either d.c. or a.c. coupled. Precisely calibrated sweeps with movable notch magnification—ideal for making accurate measurements. Brightness—adequate for display of very fast pulses. Synchronization simplicity—

the Type 329 "locks in" on almost any type of signal. Stability—the trace remains steady as a rock despite power line fluctuations, etc. Reliability in service—calibration adjustment requires no extra test gear and is a simple one-step process. And virtually any tube may be replaced without special selection.

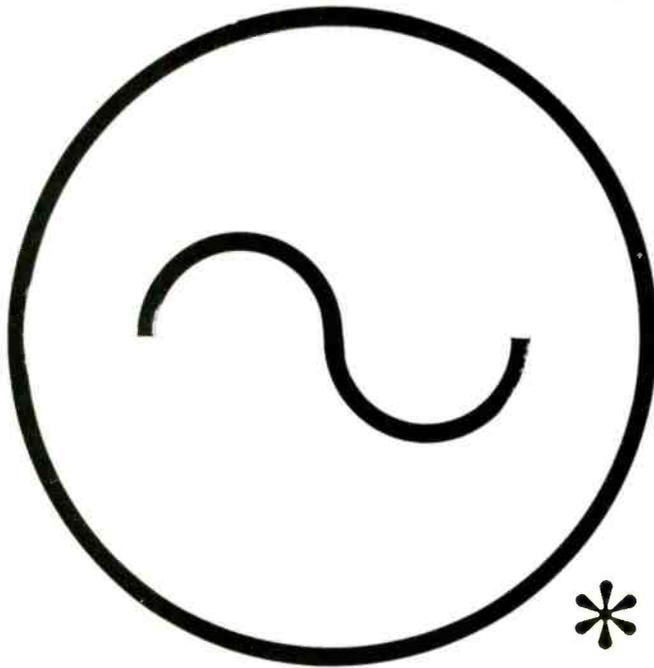
Another factor contributing to the selection of the Type 329 was the well known Du Mont Field Service Organization, which assures that regardless of where in the United States the equipment is used, swift, competent service facilities are in the immediate vicinity.

If you have instrumentation requirements, Du Mont facilities are always available for discussion and recommendations. Write us today for complete information on the Type 329, or on any problem you may have relating to cathode-ray instrumentation.

**Modified slightly for IBM's application.*

DU MONT

ALLEN B. DU MONT LABORATORIES, INC. • TECHNICAL SALES DEPARTMENT
760 Bloomfield Avenue, Clifton, New Jersey



for insulated wire, one source **Continental**

For the run-of-the-mill wiring problems—or the hundreds of specials—the one source for practically all types of permanently insulated wire—is Continental. Whether it's electronic hook-up wire, military hook-up wire or cable, switchboard AVB—TA—SHFS Cable or Wire . . . Asbestos, Glass, Nylon, Varnished Cambric, Polyethylene, etc. . . the **Always Correct Source** is Continental Wire Corporation. Refer your special wiring problems today to Continental's Wire and Cable specialists.

*A.C. Source

Contact: Continental Sales, Box 363, Dept. C
Wallingford, Conn., Phone COlony 9-7718

POWER and RHEOSTAT CABLE—TYPE AIA
available in Sizes 18 AWG—2,000,000 CM inclusive.



Stranded copper conductor, asbestos insulation, asbestos braid. Heat, flame, moisture resistant impregnation and finish.

For open installation in high operating temperatures, oil, grease, corrosive vapors or moisture. Maximum temperature 257° F.

Continental

WIRE CORPORATION

WALLINGFORD, CONNECTICUT • YORK, PENNSYLVANIA

sistance R_a . A saw-tooth source can be used instead of the triangular-wave source, the only requirement being that the sides of the triangles are straight.

As long as the signal voltage e_i is zero, the plate potential of the diode alternates between zero and the negative peak value of the triangular wave; therefore no current passes the diode and the voltage e_a across the resistor R_a is zero. If an input signal e_i is applied with a positive polarity (as indicated in Fig. 1) the plate potential of the diode becomes positive for a fraction of the triangular cycle; a current passes the diode so that triangular voltage pulses e_a (area a) appear across the resistor R_a .

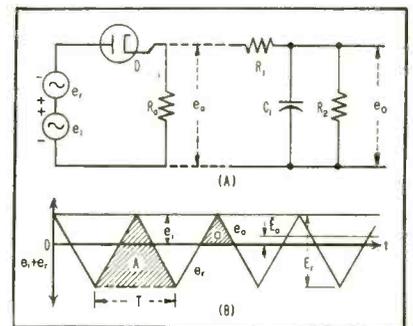


FIG. 1—Circuit (A) and mode of operation (B) of basic square-law circuit

From a simple geometric considerations the areas of the triangles a are proportional to the square of their altitudes. They are proportional to the square of the signal voltage e_i . Since the areas of the triangles a are also proportional to their average value \bar{E}_a an average-forming network consisting of R_1 , C_1 and R_2 furnishes the desired result.

Voltage e_o at the output of this network is proportional to the square of the input signal e_i . The average-forming network can be omitted if the subsequent stage responds directly to the average value, for example, a moving-coil system of sufficient inertia.

In quantitative terms, if a designates the area of the small triangles, A the area of the reference pulse and E_r the peak value of the triangular source voltage, then

$$\frac{a}{A} = \frac{e_i^2}{E_r^2}, \quad a = \frac{A}{E_r^2} e_i^2$$

The average voltage for each small



Jennings
RADIO[®]
VACUUM ELECTRONIC COMPONENTS



JENNINGS VACUUM TRANSFER RELAYS

with self contained DC coil easily mounted by
Aircraft Marine Products in their pulse forming networks

THREE Type RD1 Normally Open Vacuum Relays are soldered to the side of the pulse forming network so that each evacuated contact enclosure is immersed in silicone oil with the rest of the network. The use of these relays therefore results in fewer high voltage bushings, contacts that will not contaminate, and short lead lengths that minimize inductance and stray capacitance. This construction also permits the built-in DC actuating coils to be removed without disturbing the sealed network.

These relays easily meet standard vibration tests of 10 to 55 cps and shock tests of 15 G. Temperature requirements are -55° C. to $+85^{\circ}$ C. with 30 minute operation at 105° C.

The RD1 is a SPST relay, available with either normally open or normally closed contacts. A similar relay (Type RE2) has SPDT contacts and slightly larger models (Type RM2 and RM4) are made with 2PDT and 4PDT contact arrangements. These units have peak working voltage ratings up to 12,000 volts and continuous RF current ratings of 10 amperes rms at frequencies up to 30 mc. It is also possible to make and break under load with fast break times of less than 10 milliseconds. Switch capacitances are as low as 0.1 mmfd and contact resistances are as low as .005 ohms. As their contacts are sealed in a vacuum, contact resistance does not increase with usage. This factor makes them excellent general purpose relays for DC switching.

*Write us regarding your own relay problems.
Literature mailed on request.*

JENNINGS RADIO MANUFACTURING CORPORATION • 970 McLAUGHLIN AVE. P.O. BOX 1278 • SAN JOSE 8, CALIFORNIA

for COLOR TV

Distributed-Constant Type T 30036. Phase characteristics linear within 5% to 4 mc.

**for GUIDED MISSILES**

Encapsulated multiple-tap Type 384. Stabilized for rugged environments.

**for COMPUTERS**

Miniature encapsulated plug-in Type T 30009; Only 1 1/4" wide by 1 1/2" high.



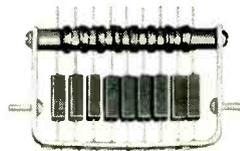
Shallcross DELAY LINES

for LABORATORY DEVELOPMENT

Variable step Type 382. Total delay, 1.1 μ s in 0.02 μ s steps. Reflections less than 10%.

**for RADAR**

Multiple-section, open Type 380. Total delay, 0.33 μ s with 0.04 μ s taps.

**for COMMERCIAL INSTRUMENTATION**

Enclosed Type T 30030. Total delay, 1.5 μ s with 0.05 μ s taps.



These six Shallcross lumped-constant and distributed-parameter delay lines cover a wide variety of pulse, video, and timing circuit requirements.

Typical specifications are shown above. Modifications of total delay, tap delay, rise time, attenuation, impedance, bandwidth, dimensions, and mounting are readily possible to match individual requirements exactly.

For detailed specifications and dimensions of basic types, send for Bulletin L-38. A copy of Specification Sheet SS-7 will also be enclosed so you may fully outline your delay line requirements for a prompt recommendation by Shallcross Engineers.

pulse with the area a is

$$\bar{E}_a = \frac{a}{T} = \frac{A}{T E_r^2} e_i^2$$

or, since $A = \frac{1}{2} E_r T$, the average voltage is

$$\bar{E}_a = \frac{1}{2 E_r} e_i^2 = \text{const} \times e_i^2$$

This voltage is independent of the frequency and the shape of the reference voltage.

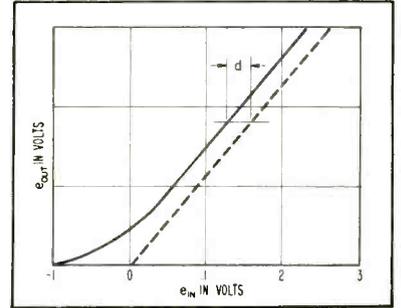


FIG. 2—Ideal switch (dashed line) contrasted with diode characteristic (solid line)

The voltage e_a is applied to the averaging network R_1, C_1, R_2 , which must satisfy the equations $2\pi f_r R_1 C_1 \gg 1$ and $2\pi f_i R_2 C_1 \ll 1$, where f_r is the frequency of the triangular wave-form generator and f_i the sinusoidal frequency of the input signal. If then $R_1 \gg R_2$, the output voltage will be

$$e_o = \frac{1}{2 E_r} \frac{R_2}{R_1 + R_2} e_i^2$$

The circuit has the advantages of predictable response characteristics, zero output for zero input and no fundamental limitation on output range.

The major limitation of the device is its restricted frequency response. The ease with which two or more units with identical characteristics can be constructed permits the combination of a pair of the devices into a simple multiplier.

Errors

Errors may arise from the departure of the characteristics of the diode from those of an ideal switch and from variations in magnitude and deviation from linearity of the triangular wave form.

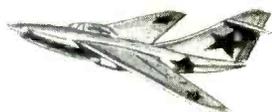
The characteristic of a diode is shown as a solid line in Fig. 2. It departs from that of an ideal switch (dotted line) in two ways.

For input signals larger than

Shallcross

MANUFACTURING COMPANY
522 Pusey Avenue, Collingdale, Pa.

Takes more than a quick eye



TODAY!



12-Information Channel-Playback System for use with The Glenn L. Martin Co.'s new T-13 Gunnery Trainer, designed and developed by Cook Research Laboratories, a division of Cook Electric Company.



AIMING HIGH today calls for more than just "drawing a bead." Split-second timing is absolutely essential to the operation of the intricate instrumentations and equipment necessary to give adequate training in gunnery to both our anti-aircraft troops and to our jet pilots.

Eleven STANDARD ELECTRIC Model S-1 Timers are shown on the large control panel in the center of the photograph above.

STANDARD

Serving industrial, governmental and educational institutions since 1884.



The STANDARD ELECTRIC TIME COMPANY

97 LOGAN STREET • SPRINGFIELD 2, MASSACHUSETTS

PRECISION TIMERS • CHRONO-TACHOMETERS • LABORATORY PANELS • PIPELINE NETWORK ANALYZERS

about 1 volt, the output is proportional to the sum of the input voltage and a small voltage, d . The effect of any constant component of voltage d may be eliminated by placing a corresponding bias voltage in series with the diode. The effect of any variable component of d may be reduced by means described by Kelner, Gray, and MacNichol⁹. Any residual component of d will produce a fractional error in the output equal to d/e_i .

Output voltage is not linearly related to the input voltage for values of input voltage less than about 1 volt. This deviation from linearity may be minimized by using a load resistance R large compared with the diode resistance.

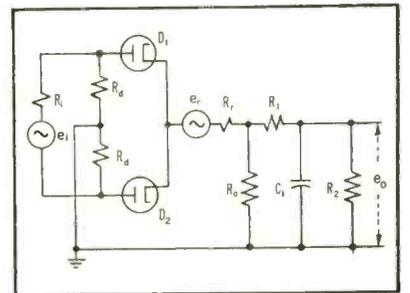


FIG. 3—Square-law circuit for both positive and negative inputs

The cathode-to-plate capacitance of the diode results in current approximately equal to $R_a C_a de_i/dt$ where C_a is the capacitance of the diode. If a symmetrical triangular wave form is used for e_i , the output will be a square wave of an average value equal to zero, so that no error results. If e_i is not symmetrical in form, the effect may still be canceled by subtracting from the output an equal and opposite voltage derived from a similar circuit in which the diode is replaced by an equivalent capacitance. In either case, the error may be minimized by reducing the value of R_a , choosing a diode with low capacitance and careful wiring of the circuit.

Since the output is inversely proportional to the magnitude of the reference wave form, variations in its magnitude produce fractional errors equal to the ratio of the deviation to the standard magnitude. Errors due to departures from linearity may be computed if the shape of the reference wave form is



MIL-T-27 Power and Audio
MS (Military Standard)
MIL-T-27 400 Cycle
Pulse Transformers
Molded Toroidal Inductors
High Fidelity Transformers
Transistor Transformers
Link Replacements

You'll find them all in the new

CHICAGO

CATALOG
of

the World's Toughest Transformers

These are just a few of the popular types of transformers for military, new equipment, general replacement, control and power circuit applications listed in CHICAGO's new Catalog . . . over 500 transformers, with complete physical and electrical specifications on each unit.

And more important—they are all in stock for quick delivery from your local CHICAGO distributor.

**Write Now FOR YOUR FREE COPY
OF THIS VALUABLE REFERENCE.**

Ask for Catalog CT-554

CHICAGO STANDARD TRANSFORMER CORP.

3501 ADDISON STREET • CHICAGO 18, ILLINOIS



EXPORT SALES:
Roburn Agencies, Inc.,
431 Greenwich Street,
New York 13, N. Y.

now FOR DC OR RESISTANCE INPUT

MODEL 200-A uses an input of 10,000 ohm resistance potentiometers as an input transducer providing 10 to 1 scale expansion and origin positioning. Available standard digital input accessories are essentially inputs of this type. Any resistance potentiometer will provide an analog input for this configuration.

MODEL 200-B, used for D.C. signal input, has full scale sensitivities of 5 millivolts and an input impedance of 1,000 megohms. Utilizing standard reference cells, this model provides drift-free operation. Available external reference voltages may be substituted. A plug connection is provided to facilitate the quick interchangeability of input sections.

now FOR SIMPLIFIED OPERATION

Precision Vernier Dials provide an accurate method for obtaining fine adjustment during operation. Optional point plot or continuous line plotting is a feature of both models. Selection is by front panel manual control. A new, simplified pen of one-piece design—used for point or continuous plotting—eliminates bottles and tubes, permits rapid changing of ink colors. Independent action of the X and Y axis is achieved with Librascope's unique "Floating Gear Train." No cables, tapes or lead screws to cause lost motion, cable stretching or drifting out of alignment. The 120° concave cylindrical plotting surface provides full visibility... is completely illuminated.

now FOR WIDER APPLICATION

These fast, dependable general purpose plotters feature 0.1% accuracy, are suited for wide applications where rapid graphic presentation of data is required, such as: laboratory testing, computers, data handling systems, wind tunnel, missile tracking and quality control testing of transistors and other electronic components. Input selection includes Punched Card and Tape Converters, Decimal Keyboards and Binary Converters. Model 200-A can plot from Flexowriter tape in any code or directly from the Tape Punch cables of many digital computers. Subchassis can be supplied to handle time-shared X versus Y plots, or other special circuitry. Write today for details.

LIBRASCOPE X-Y PLOTTER

HIGHEST ACCURACY FOR GRAPHIC DATA HANDLING



Greater input flexibility

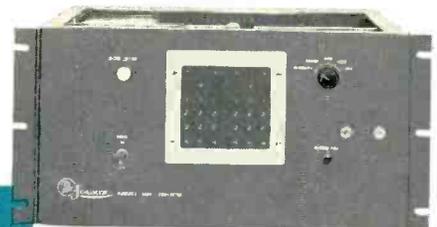
For desk or rack mounting



NEW LIBRASCOPE PUNCHED TAPE CONVERTER
Operates from a punched tape reader—Specially designed for Librascope X-Y Plotters—This unit is adaptable to other plotters.



LIBRASCOPE X-Y DECIMAL KEYBOARD
Consists of three-decimal bank for each axis with associated plus minus keys. Features Librascope designed positive-action self-wiping contacts.



LIBRASCOPE PUNCHED CARD CONVERTER
Converts punched card data to analog form for input to X-Y Plotters. Automatic Position for feeding 50 punched cards per minute.

LIBRASCOPE INCORPORATED • 808 WESTERN AVENUE • GLENDALE, CALIFORNIA



Bourns

new **CARBON TRIMPOT**®

provides...

**INFINITE RESOLUTION
HIGHER RESISTANCE**

**20,000 OHMS TO 1 MEGOHM
POWER RATING 0.2 WATT**

Bourns new carbon *TRIMPOT* is identical in size and configuration to the popular wirewound *TRIMPOT* which is approved as a standard component by engineers in aircraft, missile and electronic industries. Outstanding features are:

Compact size 1/4" x 5/16" x 1-1/4"
 Adjustment 25-turn, self-locking
 Mounting Single or stacked with #2-56 screws
 Vibration 10-20 G; 10-2,000 cps
 Acceleration (steady state) 100 G
 Optional features Teflon leads, extended shaft

INSTRUMENTS SHOWN ACTUAL SIZE



Side Mounting Bracket No. 120-20-2

MOUNTING BRACKETS
AND #2-56 SCREWS
CARRIED IN STOCK



End Mounting Bracket No. 120-20-1

Bourns manufactures other precision potentiometers to measure Linear Motion; Gage, Absolute and Differential Pressure and Acceleration.



Bourns LABORATORIES
6135 MAGNOLIA AVENUE · RIVERSIDE, CALIFORNIA

Technical Bulletin on Request, Dept. 12

© B. L.

known. For the case where the sides of the triangle are exponential in form, the maximum output error, expressed as a fraction of the full-scale output of the instrument, is approximately equal to one-fifth of the fractional change in slope.

Applications

The circuit shown in Fig. 1 has an output equal to zero for negative input signals. If the input signal e_1 is available balanced to ground, a circuit operative for positive and negative values of signal voltage may be constructed as shown in Fig. 3. This circuit acts as a true square-law device. Output is equal and of the same sign for both positive and negative signals of the same magnitude.

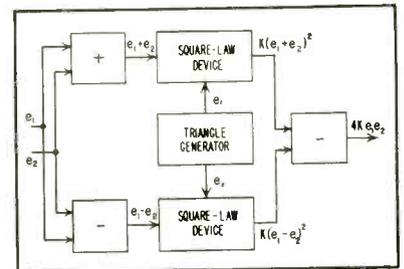


FIG. 4—Circuit to multiply e_1 and e_2

Since the output characteristics of this circuit are determined only by the magnitude of the triangular wave form, a second circuit with identical characteristics may be easily constructed with the reference wave forms for each circuit derived from the same source. A pair of devices with identical characteristics will accept both positive and negative input signals.

They may be combined, therefore, to form a multiplier of the quarter-square type depending on the relation

$$(e_1 + e_2)^2 - (e_1 - e_2)^2 = 4e_1e_2$$

Since matching of the characteristics of the two square-law devices is automatically maintained, satisfactory operation of such a multiplier is insured. A block diagram of such a multiplier is shown in Fig. 4.

Practical Results

The operation of the square-law device shown in Fig. 3 has been tested both qualitatively and quantitatively. Characteristics of the square-law device for d-c input sig-

Engineering

Design

Research

Development

ad.vance'ment (*ad.vans'ment*), n.,
promotion to a higher place or dignity; progression, improvement.

new advancements and new concepts in aeronautics and related fields now under development at Goodyear Aircraft Corporation —

mean advancement and rewarding futures for qualified engineers who apply themselves to progressive research and development at Goodyear Aircraft in the following fields:

<i>Electromechanical</i>	:	<i>Pulse Techniques</i>
<i>Microwave</i>	:	<i>Weapons Systems</i>
<i>Servomechanisms</i>	:	<i>Antenna Design</i>
<i>Electronic Packaging</i>	:	<i>Miniaturization</i>

at Goodyear Aircraft you'll have one of the world's largest electronic computation laboratories at your disposal — and invitation to a creative future which offers security and interesting diversification!

write today for application form or send complete resumé to: C. G. Jones, Personnel Department, Goodyear Aircraft Corporation, Akron 15, Ohio.

They're doing big things at

GOOD YEAR AIRCRAFT

THE TEAM TO TEAM WITH in AERONAUTICS

The NEW American Beauty

Bantams

ELECTRIC
SOLDERING
IRONS WORTH
"Crowing"
ABOUT!



Cat. No. 3120 $\frac{3}{16}$ " Tip Diameter 30 Watts



Cat. No. 3120-SCP $\frac{3}{16}$ " Tip Diameter 30 Watts

Not just another "bantam"—but a true American Beauty "Bantam" backed by the most famous name in electric soldering for over 60 years.

American Beauty "Bantams" feature:

- Indestructible stainless steel casing that insures against undue loss of heat and keeps handle cool.
- Highest quality nickel-chromium heating element with genuine mica insulation.
- Tapered spool nose for maximum visibility and projection-free casing to assure easy access to hard-to-get-at places.
- Available in $\frac{1}{8}$ " and $\frac{3}{16}$ " tip diameters with either pencil type handle or standard handle and with long or short casing. Diamond point tip is standard—chisel type if specified.

For the finest quality in ALL TYPES of Electric Soldering Irons—Check with American Beauty first.

AMERICAN ELECTRICAL HEATER COMPANY



DETROIT 2, MICHIGAN

nals was found to be accurate within the limits of accuracy set by available measuring instruments, about 0.2 percent of full scale for a range of input signals between 10 and 50 volts.

Response of the device for a-c signals was tested in a qualitative manner by observing the output of the device with a cathode-ray oscilloscope. Using for e , a triangular wave of 1,200 cps, the frequency of the input signal could be raised to about 135 cps without noticeable distortion of the output.

The research described was supported by a grant from the Office of Naval Research, Contract NR-11 705.

REFERENCES

- (1) M. B. Stout, *Basic Electrical Measurements*, p 432, Prentice Hall, N. Y. 1950.
- (2) R. D. Campbell, *ELECTRONICS*, p 93, July 1950.
- (3) R. Kelner, W. Proctor, and F. B. Berger, *Waveforms*, p 315, Rad. Lab. Series, 19, McGraw-Hill, N. Y. 1949.
- (4) B. Chance et al, *Rev Sci Inst*, p 683, 22, 1951.
- (5) B. O. Marshall, *Nature*, Jan. 6, 1951.
- (6) A. S. Soltes, *ELECTRONICS*, p 122, Aug. 1950, and J. A. Miller, A. S. Soltes, R. B. Scott, *ELECTRONICS*, p 160, Feb. 1955.
- (7) Raytheon Comp. Tube QK-329.
- (8) F. B. Berger and D. MacRae, Jr., *Waveforms*, p 681, Rad. Lab. Series, 19, McGraw-Hill, N. Y. 1949.
- (9) R. Kelner, J. W. Gray, and E. F. MacNichol, Jr., *Waveforms*, p 333, Rad. Lab. Series, 19, McGraw-Hill, N. Y. 1949.

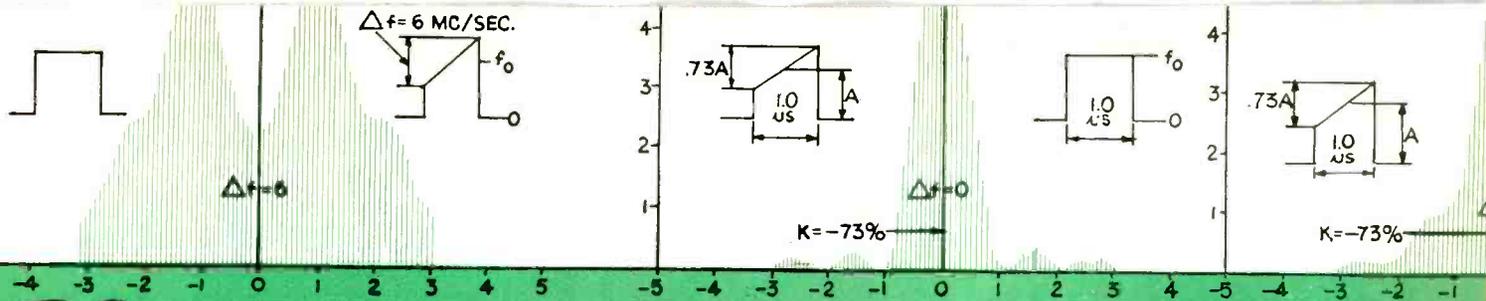
Aeronautical Communications Recommendation

RADIO COMMUNICATIONS for domestic aviation encompass several agencies. Air-to-ground communications are furnished by Aeronautical Radio, Inc. (Arinc), Interstate Airways Communication Stations (INSACS) and Air Route Traffic Control Center (ARTCC) radio stations. Point-to-point service is handled by CAA and the airlines.

Besides these facilities there are airport tower stations for local control.

Based on 1953 volume of air-to-ground contacts in Federal airways, it has been predicted that the number may well double in the next ten years. Point-to-point communications can increase to a projected 2.65 times the 1953 volume.

In a study for Aeronautical Radio, Inc., Arthur D. Little, Inc. has produced a two-volume report entitled "Engineering and Economic



Lavoie LA17 Spectrum Analyzer

- ★ Finer Resolution . . . 10 Kilocycles
- ★ Complete in one unit . . . no extra tuning heads required
- ★ Single Dial tuning . . . Use of stable triode oscillators eliminates klystrons
- ★ Smooth tuning without backlash
- ★ Ruggedized to military specifications
- ★ Simplicity of operation permits use by production line personnel
- ★ Usable to 34,000 megacycles

SPECIFICATIONS

DIMENSIONS

25-7/16" high by 20 1/8" wide by 19 1/8" deep.

WEIGHT

150 pounds

PRESENTATION

5CPIA 5" cathode-ray tube (other persistences available).

SENSITIVITY

At signal to noise ratio 2:1, and spectrum width 25 megacycles:
 - 75 dbm at 10 mc to
 - 50 dbm at 16,000 mc

RANGE

10 megacycles to 16,000 megacycles calibrated. Usable 1 to 34,000 megacycles.

ACCURACY

Dial accuracy $\pm 1.0\%$ at the operating frequency of the local oscillator.

SPECTRUM WIDTH

0.5 to 25 megacycles

RESOLUTION

10 kilocycles

TEMPERATURE RANGE

Operating - 40 to + 130° F

HUMIDITY

90% RH.

SHOCK

(Non-operating in transit case.) One 12G impact, 10 msec duration on each face. One 37G impact, 10 msec duration on each face.



Lavoie Laboratories, Inc.

MORGANVILLE, NEW JERSEY

Call The Lavoie Representative nearest you for complete information on The LA 17 Spectrum Analyzer and other Lavoie equipment.

Albany, New York
 J. A. Reagan Co.
 51 Summit Avenue
 Phone: 4-7676

Atlanta, Georgia
 Southeastern Industrial Instruments
 374 Hascall Road, N.W.
 Phone: Exchange 7801

Baltimore, Maryland
 Thomas L. Taylor
 2100 St. Paul Street
 Phone: Belmont 5-9126

Chicago, Illinois
 R. Edward Stemm
 5681 West Lake Street
 Phone: Columbus 1-2227

Denver, Colorado
 Allen J. Williams Company
 124 West 12th Ave.
 Phone: Main 3-0343

Flint, Michigan
 Sam Robbins, Inc.
 230 East First Street
 Phone: Cedar 5-7310

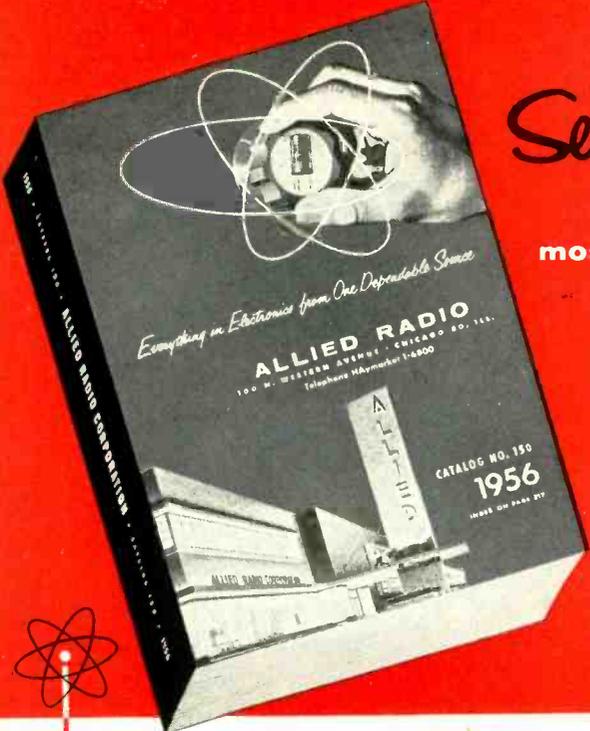
Fort Worth, Texas
 Mitchell Spears Co.
 P.O. Box 11033
 1929 Chatburn Court
 Phone: Webster 8811
 Sunset 3784

Hartford, Conn.
 M. S. Coldwell
 289 Fairfield Avenue
 Phone: Jackson 2-5832

Los Angeles, California
 T. Louis Snitzer
 5777 West Pico Boulevard
 Phone Webster 1-5566
 Louis A. Gorten & Associates
 25 Valley Road
 Phone Montclair 3-0257

San Mateo, California
 R. L. Pflieger Co.
 126 25th Avenue
 Phone: Fireside 5-1134

St. Louis, Missouri
 Edwin H. Murty
 3505 Ridgedale Avenue
 Phone: Evergreen 5-7728



Everything in Electronics from One Dependable Source

ALLIED RADIO
100 N. WESTERN AVENUE - CHICAGO 80, ILL.
Telephone WYamwacker 1-6800

CATALOG NO. 150
1956
HERE ON PAGE 277

Send for the
most widely used
Electronic
Supply
Guide
free
on request

ALLIED'S 1956 324-PAGE CATALOG

World's largest Stocks OF ELECTRONIC SUPPLIES FOR INDUSTRY

Here's how to simplify and speed the purchasing of all your electronic supplies and equipment: send your orders to ALLIED—the reliable one-supply-source for all your electronic needs. We make fastest shipment from the world's largest stocks of electron tubes (all types and makes), transistors, test instruments, audio equipment, electronic parts (transformers, capacitors, controls, etc.) and accessories—*everything* for industrial and communications application, for research, development, maintenance and production. Our expert Industrial supply service saves you time, effort and money. Send today for your FREE copy of the 1956 ALLIED Catalog—the complete Buying Guide to the world's largest stocks of quality Electronic Supplies for Industrial and Broadcast use.

ultra-modern facilities
for the fastest service
in Electronic Supply



100 N. Western Ave., Dept. 11-J-5, Chicago 80, Illinois.

one complete
dependable source for
everything in electronics

ALLIED RADIO

Recommendations for Future Aeronautical Communications". Among many recommendations it is urged that the air-transport industry and CAA jointly implement an aeronautical communications system to provide, through exchanges (each one not unlike a telephone central office) all air-to-ground channels for traffic control, weather, flight information and air-carrier operational communications.

A further recommendation suggests that the air carriers and CAA explore the possibility of a microwave point-to-point communications system where economically justified, based on a rate structure that will yield \$500 per system mile, to be amortized over a 10-year period.

Alternatively, these services might be procured from established common carriers.

Various new techniques can be used to advantage, including selective calling arranged to turn on a receiver for the desired communications channel. Visual displays could also be employed.

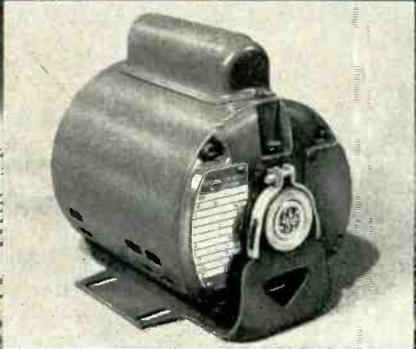
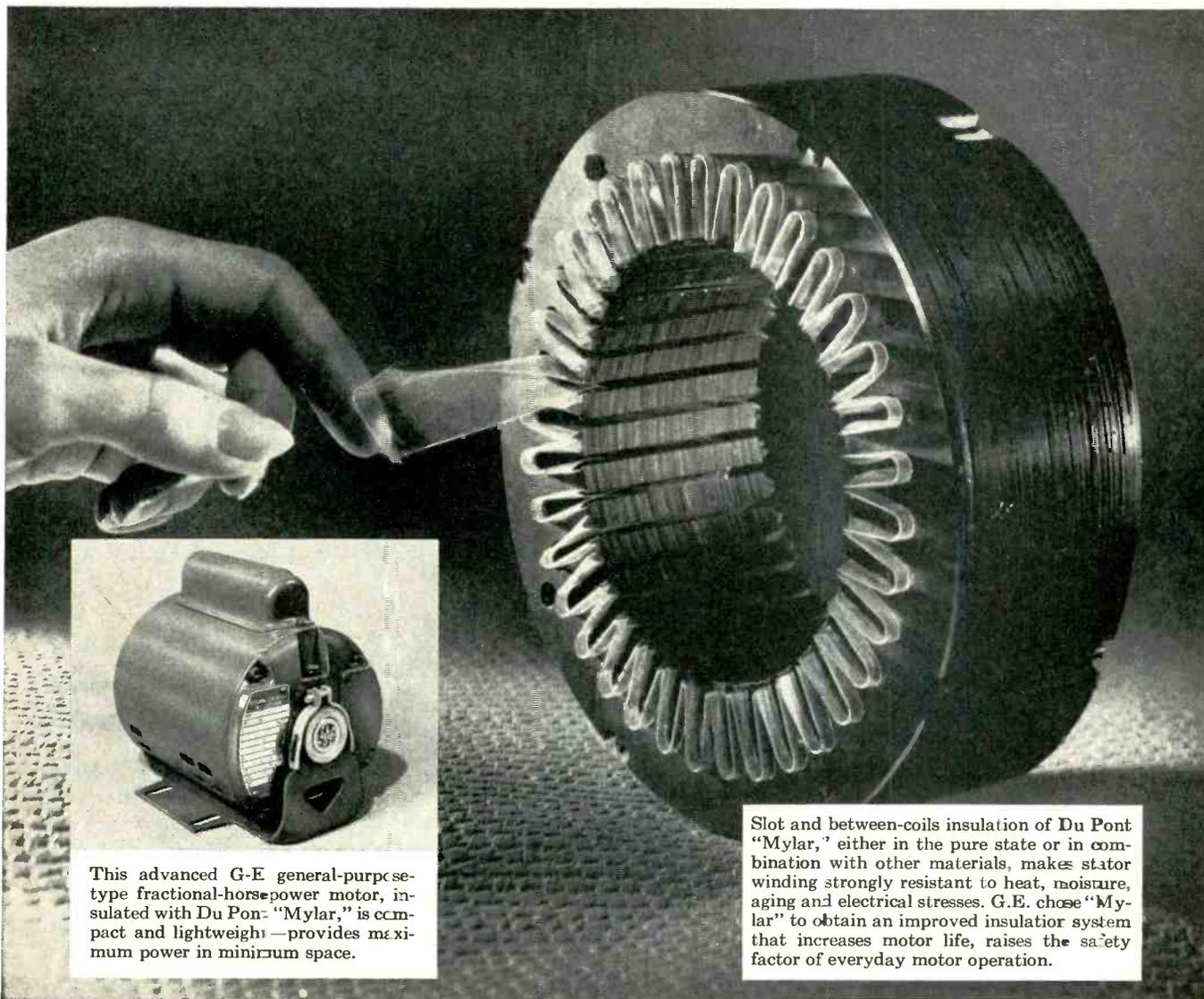
The Little organization further suggests a change in the corporate

WOR Master Control



Recently installed at radio station WOR is a program switching system under the control of studio operators but having the advantages of a master control system. In the station's twelve-studio, four-channel operation, a control box located in each of the studios permits selection of any or all of the four channels. Heart of the system is the electro-mechanical switching unit at the left compared with the former manual master control. Developed by Standard Electronics, the new equipment is expected to save \$60,000 a year in operating expenses.

SUPERIOR... Electric Motors Insulated With Du Pont MYLAR*



This advanced G-E general-purpose fractional-horsepower motor, insulated with Du Pont "Mylar," is compact and lightweight—provides maximum power in minimum space.

Slot and between-coils insulation of Du Pont "Mylar," either in the pure state or in combination with other materials, makes stator winding strongly resistant to heat, moisture, aging and electrical stresses. G.E. chose "Mylar" to obtain an improved insulator system that increases motor life, raises the safety factor of everyday motor operation.

CHALLENGING to industry: countless opportunities for product improvements with this versatile new film.

Combining high dielectric strength and moisture resistance, Du Pont "Mylar" polyester film helps General Electric obtain a superior insulating system. "Mylar" is now used as slot and between-coils insulation of the G-E advanced motor line—helps make possible a modern, improved type of insulation that increases motor life and insures better motor protection. "Mylar" gives these motors maximum protection against heat, moisture and deteriorants.

These G-E motors are an outstanding example of the way industry is putting versatile "Mylar" to profitable use. "Mylar" is the strongest of all plastic films—has an unusual combination of physical, electrical, chemical, and ther-

mal properties never before available in a plastic film. In a remarkable diversity of fields, Du Pont "Mylar" is making possible better products, lower costs.

It may take only a little creative re-

search to show you where you can use Du Pont "Mylar" to develop or improve a product. Mail coupon for free copy of a booklet that gives you the details on this valuable film.

*"Mylar" is the registered Du Pont trade-mark for its brand of polyester film.

DU PONT

MYLAR®

DU PONT POLYESTER FILM

Better Things for Better Living...through Chemistry

E. I. du Pont de Nemours & Co. (Inc.)
Film Department, Room 7E, Nemours Bldg.
Wilmington 98, Del.

Please send me sample and further information on "Mylar" polyester film.

Name _____

Firm _____

Street Address _____

City _____ State _____

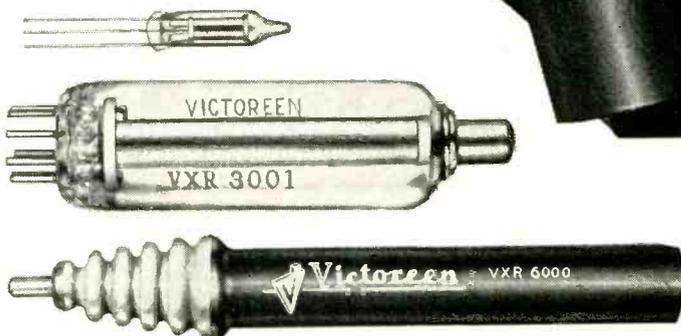
VICTOREEN VOLTAGE REGULATORS HAVE PERFORMANCE AND SAFETY FEATURES YOU SHOULD KNOW ABOUT

This voltage regulator was designed to supplant filament type components and thus eliminate the hazards of voltage build-up resulting in the case of failure in these early types of voltage regulating components.

Under unusual conditions, should the Victoreen voltage regulator be damaged, the result would cause a lower than normal voltage in the circuit, thus preventing damage to other components. In addition to the "fail safe" feature, the use of Victoreen voltage regulators, eliminates the use of related voltage regulating components, provides close tolerance limits, better performance and long, trouble free, service life.

Write for bulletin 3023 for full details.

**VICTOREEN
BUILDS VOLTAGE REGULATORS
FROM 50 TO 50,000 VOLTS**



COMPONENTS DIVISION



The Victoreen Instrument Co.

3810 PERKINS AVE. • CLEVELAND 14, OHIO

structure of Arinc with a revision of the charter to permit the company to operate as a limited communications carrier for aeronautical traffic.

Microphonics In Transistors

REPORTS by engineers working with transistors indicate that there is evidence of noise and microphonic effects resulting from environmental conditions that cause these effects in electron tubes.

Since construction and properties of transistors are somewhat similar to those of an accelerometer, it would not be surprising that the devices should sometimes act like crystal accelerometers.—A. A. MCK.

British Color TV Tests

EXPERIMENTAL color tv transmissions were initiated during August by British Broadcasting Corporation. Emanating from Alexandra Palace, a number of different systems are being tried out with a view towards compatibility with the existing monochrome system. Program content is designed for the tests and not as entertainment. Transmissions are made after normal viewing hours. It is not expected that final decisions on the eventual system to be employed will be made before 1958.

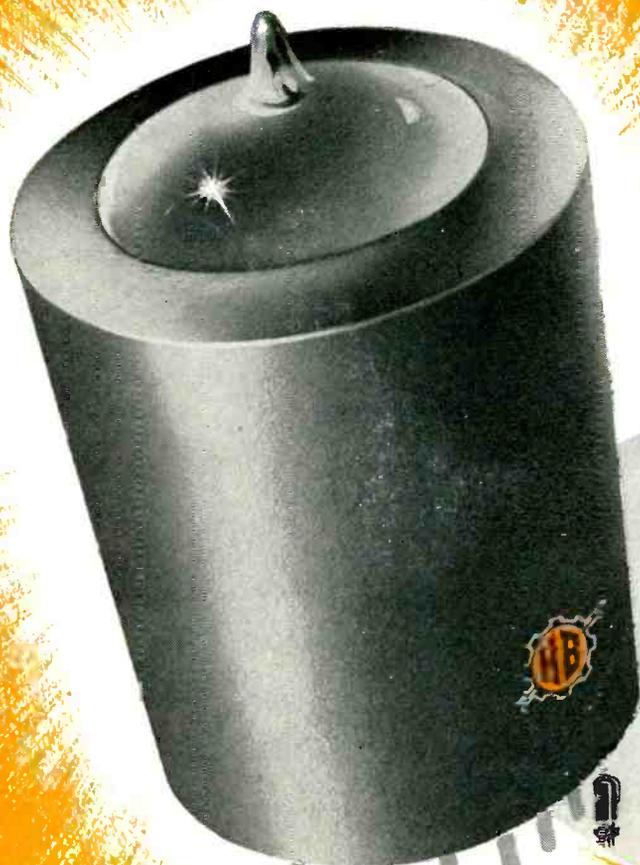
Commercial television using black-and-white will start in Britain on September 22. Rate of expansion of commercial stations, which is subject to certain controls by the Postmaster-General, is expected to be three stations a year or less until some 20 stations may be in operation by 1964, according to information from McGraw-Hill World News.

Pertinent Patents

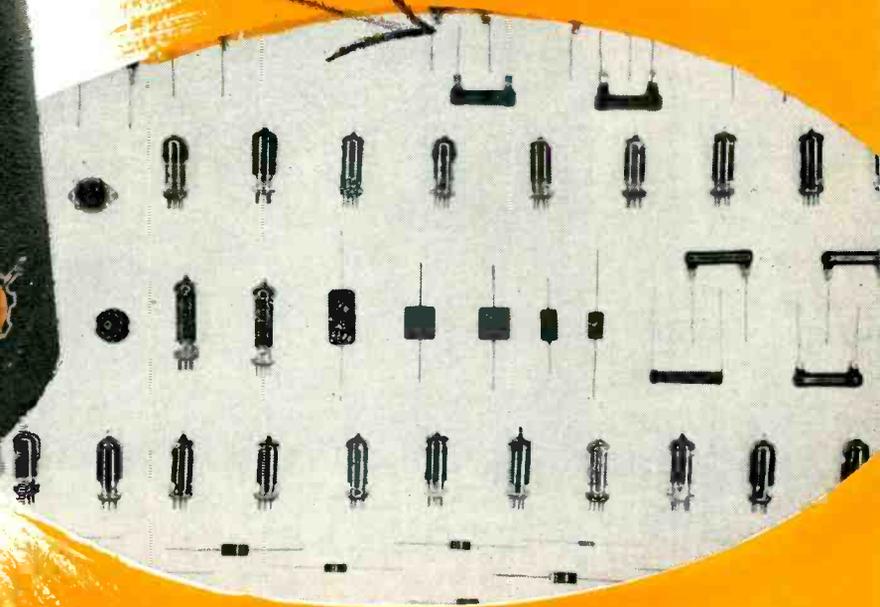
By NORMAN L. CHALFIN
Hughes Aircraft Co.
Culver City, Calif.

PRODUCTION of cold by electrothermic means seems a particularly appropriate topic during summer

LOOK!



here's
what
it takes



THE HAYDU BEAM SWITCHING TUBE offers these other unique advantages for various equipment including:

VARI COUNT

complete versatility... can use arbitrary numbers of positions

COUNTER DISTRIBUTOR

operate singly... or one tube will operate others in unlimited combinations

BEAMPLEXER

can be operated by DC, sine wave or pulsed inputs

RADAR and LORAN

reduce overall circuitry and related costs

AIRCRAFT CODER

decrease space, weight and heat—a new standard in high vacuum reliability

SEND FOR COMPLETE INFORMATION

Write today for copies of illustrated technical literature and applications data on Haydu Magnetron Beam Switching Tubes.

TO EQUAL

ONE BEAM SWITCHING TUBE!

20 pentodes — 2 triodes — 22 sockets — 10 condensers — 98 resistors. 152 separate components plus related circuitry are required to duplicate all the functions of a standard MBS Tube circuit!

The Haydu Magnetron Beam Switching Tube* permits drastic reductions in the total number of tubes and other components required in most electronic systems. It is compatible with transistors and magnetic core circuitry... while performing a greater number of functions at much higher frequencies! In an unlimited number of electronic applications, the new Haydu MBS Tube switches between multi-outputs many times faster, more simply and more reliably than standard vacuum tubes, diodes or transistors... and in any sequential, simultaneous or random switching pattern. Each position is capable of producing a functional output able to operate relays *without amplification.*

*MBS (Trademark)

HAYDU

BROTHERS OF NEW JERSEY

PLAINFIELD, NEW JERSEY

SUBSIDIARY OF BURROUGHS CORPORATION



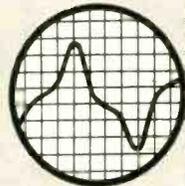
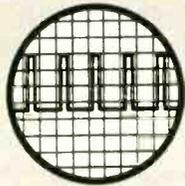
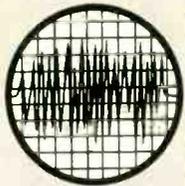
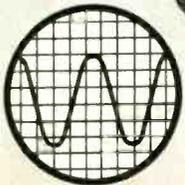
Now Measure

ELECTRONS AT WORK

(continued)

TRUE RMS

from 100 microvolts to 320 volts
REGARDLESS OF WAVEFORM
with the Ballantine Model 320 Voltmeter



REPRESENTING:

A distinctly new departure in VTVM design.

FEATURING:

A built-in calibrator; — easily read 5-inch log meter; — immunity to severe overload; — useful auxiliary functions.

BRIEF SPECIFICATIONS:

- VOLTAGE RANGE:.....100 microvolts to 320 volts
- DECIBEL RANGE:..... — 80 dbv to + 50 dbv
- FREQUENCY RANGE:.....5 to 500,000 cycles per second
- ACCURACY:.....3% from 15 cps to 150KC; 5% elsewhere
Figures apply to all meter readings
- MAXIMUM CREST FACTORS: 5 at full scale; 15 at bottom scale
- CALIBRATOR STABILITY: .0.5% for line variation 105-125 volts
- INPUT IMPEDANCE:....10 M.Ω and 25 μf, below 10 millivolts
 10 M.Ω and 8 μf, above 10 millivolts
- POWER SUPPLY:..... 105-125 volts; 50-420 cps, 75 watt
Provision for 210-250 volt operation
- DIMENSIONS: (Portable Model)..... 14 3/8" wide, 10 1/8" high,
 12 3/4" deep—Relay Rack Model is available
- WEIGHT:.....21 lbs., approximately

PRICE: \$375

Write for the New Ballantine Catalog describing this and other instruments in greater details.

weather in the temperate zone. This as well as means for measuring temperature and the description of a diode gating circuit are among patents chosen for review this month.

Electronic Cold

That a current of electricity passing through a metallic substance results in its being heated by the current is well-known. Likewise the fact that certain junctions of dissimilar metals generate an electric current that varies in accordance with temperature is also known. There are thermoelectric effects, apparently by which these processes are reversed.

Such an effect is the subject of patent 2,685,608 for a "Thermoelement, particularly for the Electrothermic Production of Cold," awarded to E. Justi of Braunschweig, Germany. The patent is assigned to Siemens-Schuckertwerke Aktiengesellschaft, of Berlin-Siemensstadt, Germany.

This inventor explains that inter-metallic compounds of certain bin-

Ordering Airline Tickets

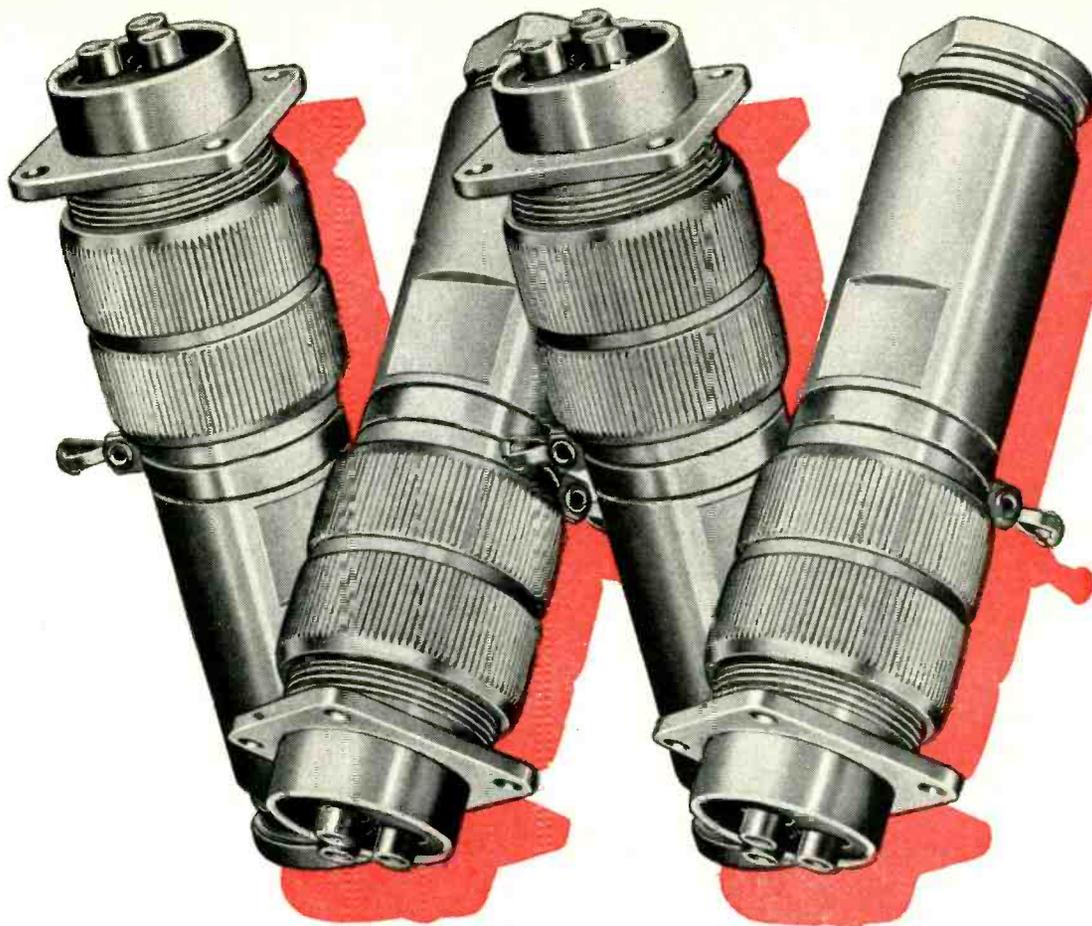


Unisel, Unitran, the Ticketeer and teleprinter all work together to speed purchase of airline tickets from United Air Lines. Five Unitran facsimile transmitters like that shown above have recently been installed by Western Union in UAL offices throughout New York City. They funnel reservations into a central point where space availability is checked by Unisel. Tickets are produced by the Ticketeer in a few moments. Space-sold information is distributed throughout the system by teleprinter that is actuated from punch-card information

BALLANTINE LABORATORIES, INC.



100 FANNY ROAD, BOONTON, NEW JERSEY



**For long life under extreme conditions of shock,
vibration, corrosion, humidity and temperature**

Bendix **W** **type HEAVY-DUTY**
ELECTRICAL CONNECTOR

Here is the electrical connector designed and built for maximum performance under rugged operating conditions.

Intended for use with jacketed cable and not requiring ground return through mating surfaces, this connector incorporates sealing gaskets at all mating joints.

W-Type Bendix* Connectors also incorporate standard Scinflex resilient inserts in established AN contact arrangements. Shell components are thick-sectioned high-grade aluminum for maximum strength. All aluminum surfaces are grey anodized for protection against corrosion.

For the real tough jobs, be sure to specify the W-Type Electrical Connector. Our Sales Department will gladly furnish complete specifications and details on request.

*TRADE-MARK

SCINTILLA DIVISION



SIDNEY, NEW YORK

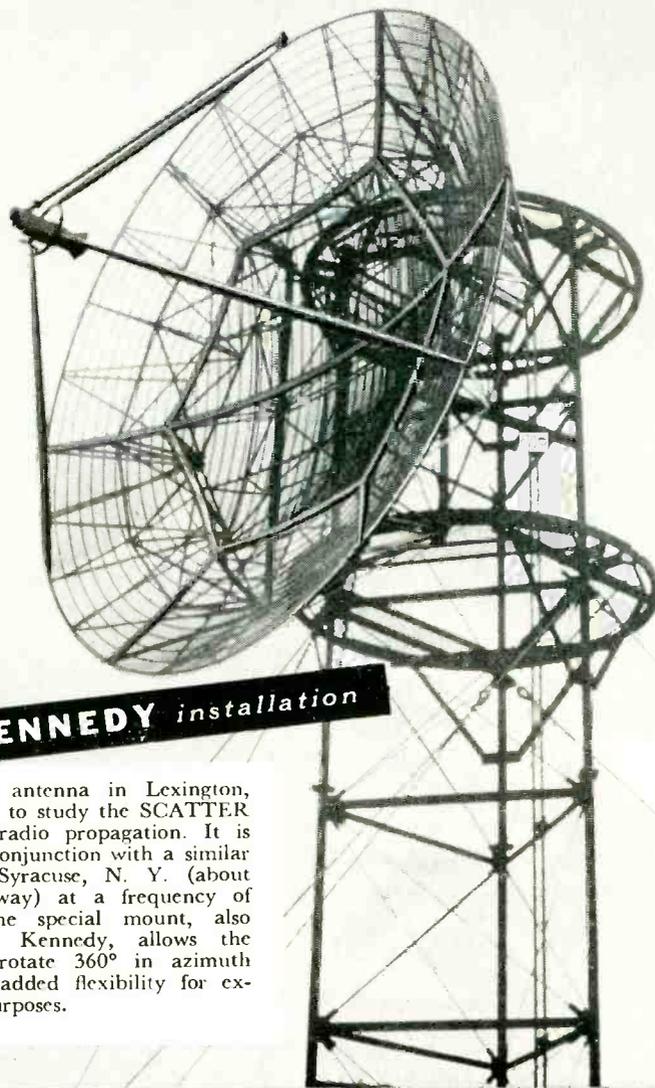
Bendix

Export Sales: Bendix International Division • 205 East 42nd Street, New York 17, N. Y.

FACTORY BRANCH OFFICES: 117 E. Providencia Ave., Burbank, Calif. • Stephenson Bldg., 6560 Cass Ave., Detroit 2, Mich. • 512 West Ave., Jenkintown, Pa. • Brouwer Bldg., 176 W. Wisconsin Ave., Milwaukee, Wisc. • American Bldg., 4 S. Main St., Dayton 2, Ohio • 8401 Cedar Springs Rd., Dallas 19, Tex.

28 foot TRANS-HORIZON ANTENNAS available **NOW**

Field proven for two years in over 50 installations, this versatile, rugged antenna is currently available from stock.



another **KENNEDY** installation

This 28-foot antenna in Lexington, Mass. is used to study the SCATTER principle of radio propagation. It is operated in conjunction with a similar antenna in Syracuse, N. Y. (about 250 miles away) at a frequency of 915 mc. The special mount, also designed by Kennedy, allows the antenna to rotate 360° in azimuth which gives added flexibility for experimental purposes.

ANTENNA EQUIPMENT

D. S. KENNEDY & CO.

COHASSET, MASS. — TEL: CO4-0699

ary alloy systems, such as the bismuth-antimony system are known to have very high differential thermoelectric power values and high values of specific resistance.

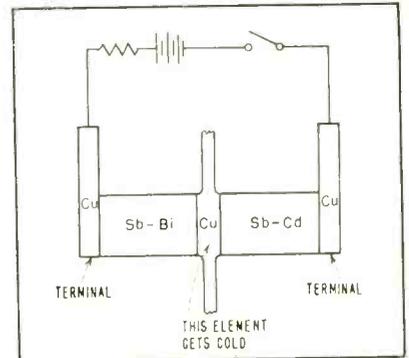


FIG. 1—Detail of thermal junction

The behavior of these compounds resembles that of semiconductors. By slightly disturbing the perfection of the binary compounds through the addition of certain impurities or departing slightly from the normal stoichiometric composition, the intermetallic compounds are converted into semiconductors with increased conduction over the perfect intermetallic compounds without showing much change in the differential thermoelectric effect.

As shown in the drawing of Fig. 1, the thermoelectric cold generator of this invention comprises a structure including a copper central element and outer elements of antimony-bismuth and antimony-cadmium intermetallic alloys respectively. The intermetallic alloys are specially prepared to have impurities to about 2 percent.

The result of the structure and circuit shown was that in passing current through the cell a temperature reduction of 27 C was effected at the central copper element.

Measuring Heat

A "Temperature Measuring Apparatus" merited patent 2,641,931 for R. F. Wild of Wilmington, Delaware, who assigned the patent to Minneapolis-Honeywell Regulator Company, of Minneapolis, Minnesota.

Usually, thermocouple voltage-measuring systems for temperature indication employ a thermocouple bridge arrangement in which by a vibrator sampling device the ther-

ANOTHER FIRST BY

Greenleaf...

VITAL to Passenger and Aircraft SAFETY



New Self-Balancing Strain Gauge System With Direct Reading Remote Indicator

Now, for the first time in aviation history, the pilot can know, while in flight, the exact load being placed on his aircraft at strategic points due to severe weather, air shocks, etc. Strain gauges can be placed on all essential parts of the aircraft, and a direct reading obtained from the indicator in the cockpit.

The maximum deviation of the system from a straight line does not exceed 0.1% full scale. Overall accuracy is less than 1% under all conditions and repeatability is within 0.1% of full scale. Inputs of 10 to 50 m.v. display full scale deflection.

This system has been thoroughly tested and proven in service—it is designed to meet military specifications. The total volume of the entire system is less than 125 cubic inches and weight is under 10 lbs.

Use of this system will improve safety, reduce maintenance hours and provide stress or strain information prior to structural failure. Write, wire or 'phone today.

ENGINEERING • DEVELOPMENT • PRODUCTION

THE

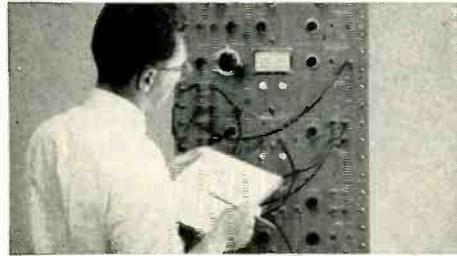
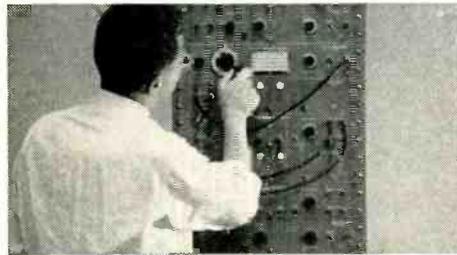
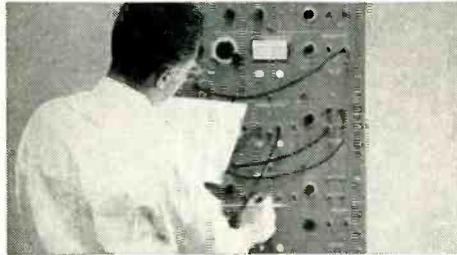
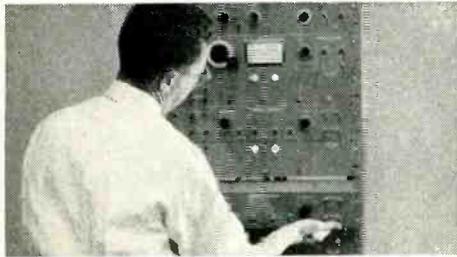
Greenleaf

MANUFACTURING COMPANY

7814 Maplewood Industrial Court • Saint Louis 17, Missouri

Producers of the HIG-3 and HIG-4 Gyros, Rate and Free Gyros, Differential Pressure Mach Meters, Air Speed Indicators, Computers, Switches and many other precision-built components.

How BURROUGHS PULSE UNITS help engineers get more done



1. Save time getting started

Lose no time designing and building special pulse test equipment. To form the pulse system you need—simple or complex—simply connect together Burroughs Pulse Units. Units mount in a standard rack. Use standard cables. It only takes minutes.

2. Try new ideas

Burroughs Pulse Units are so easy to use you can try many new ideas you might otherwise never find time for. If you work with pulses, you need these new engineering tools.

3. Correct errors fast

Now if you discover an error in planning your pulse system, you lose none of your equipment investment. Simply reconnect the cables and correct the error. Burroughs units let you experiment with different arrangements.

4. Speed completion of engineering

Every day lost in engineering postpones product delivery. Save valuable engineering time. Equip your laboratory with Burroughs pre-engineered pulse units. Make it easier to meet your deadlines.

5. Use equipment over and over again

There's no waste with Burroughs Pulse Units. Usually you save on the first application. Then you can use them over and over again on different future projects—saving many times more over the life of the equipment.

CAN BURROUGHS HELP YOU ?

If you have an engineering problem involving pulses, write Burroughs. Without charge, we'll engineer your system for you, showing what Burroughs Pulse Units you need and how much they cost. Prove to your management how much you can save and how much more you can get done. Write today or send coupon.

ENGINEERS: The Electronic Instruments Division of the Burroughs Corporation now offers excellent opportunities to experienced electronic development engineers. Write Engineering Manager.

Burroughs CORPORATION

ELECTRONIC INSTRUMENTS DIVISION

Dept. 3-J, 1209 Vine St., Phila. 7, Pa.

Send me literature on Burroughs Pulse Units.

Name.....

Position.....

Company.....

Street.....

City.....Zone.....State.....

mocouple voltage is compared with a capacitor charge. It has been found in such systems that the cold junction temperature upsets the charge conditions and impairs the accuracy of the measurement.

This inventor has inserted a capacitor of the appropriate temperature coefficient in the cold junction area of the thermocouple, which changes the balancing capacitor in such fashion as to compensate the cold junction variation.

A circuit diagram of a complete temperature measuring system is shown in Fig. 2. Capacitor C_s is the compensating capacitor. It is in parallel with variable capacitor C_v , which is controlled by a motor. The motor is controlled by the potential across capacitor C when the circuit is unbalanced.

Vibrator D alternately applies the voltage from the thermocouple to charge and discharge capacitor C , across capacitor C . Vibrator E performs a similar function in charg-

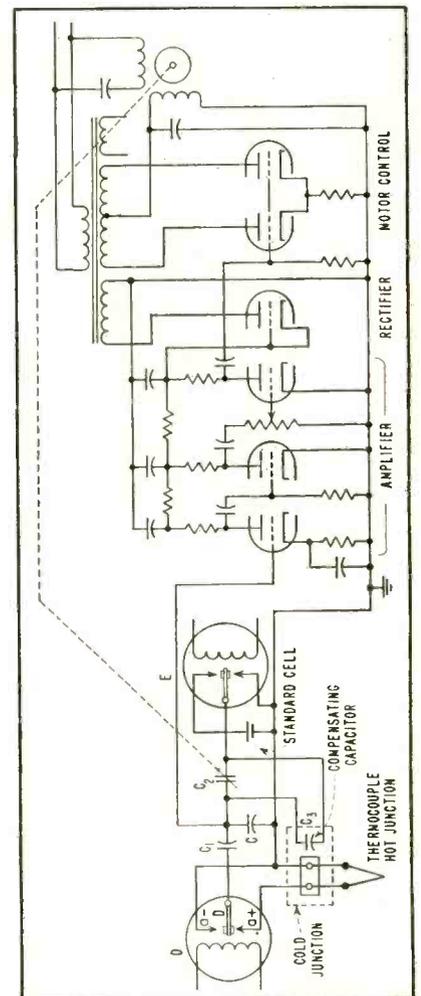
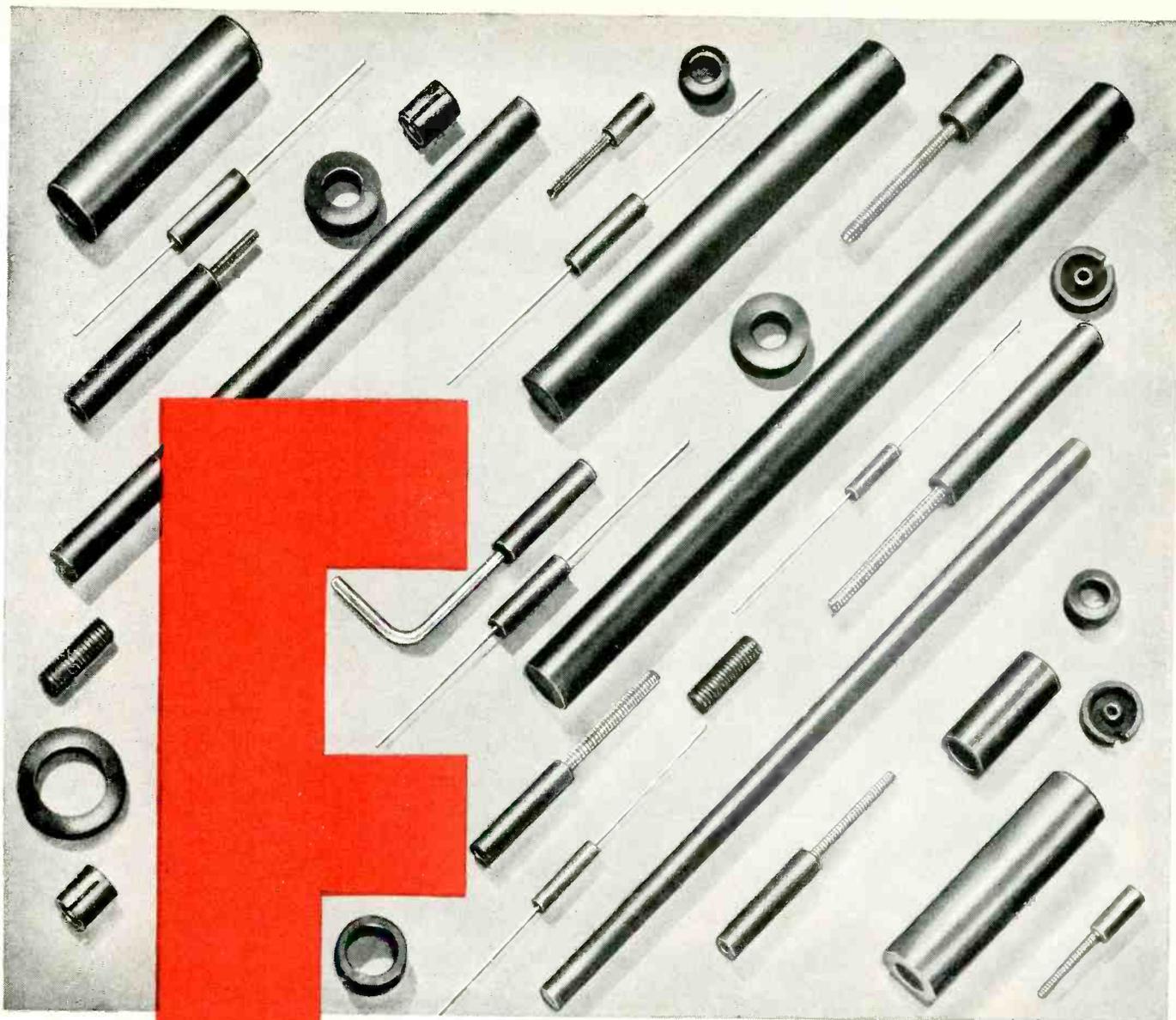


FIG. 2—Complete temperature measuring system



FERRITES

by Moldite ...

Whatever you need in Ferrites

- Antenna Rods Sleeves
- Toroids Threaded Cores
- Cups Coil Forms
- Cores

There is a MOLDITE quality engineered product perfect for your application.

also Magnetic Iron Cores
Molded Coil Forms
(iron & phenolic)

Send for our catalog NM No. 110

Robert T. Murray Co. Jerry Golten Co. William A. Franklin
604 Central Avenue 2750 W. North Ave. 3 Holly Road
East Orange, N. J. Chicago 22, Ill. North Syracuse, N. Y.

... and backed by MOLDITE'S reputation for highest quality and guaranteed uniformity from first to last.

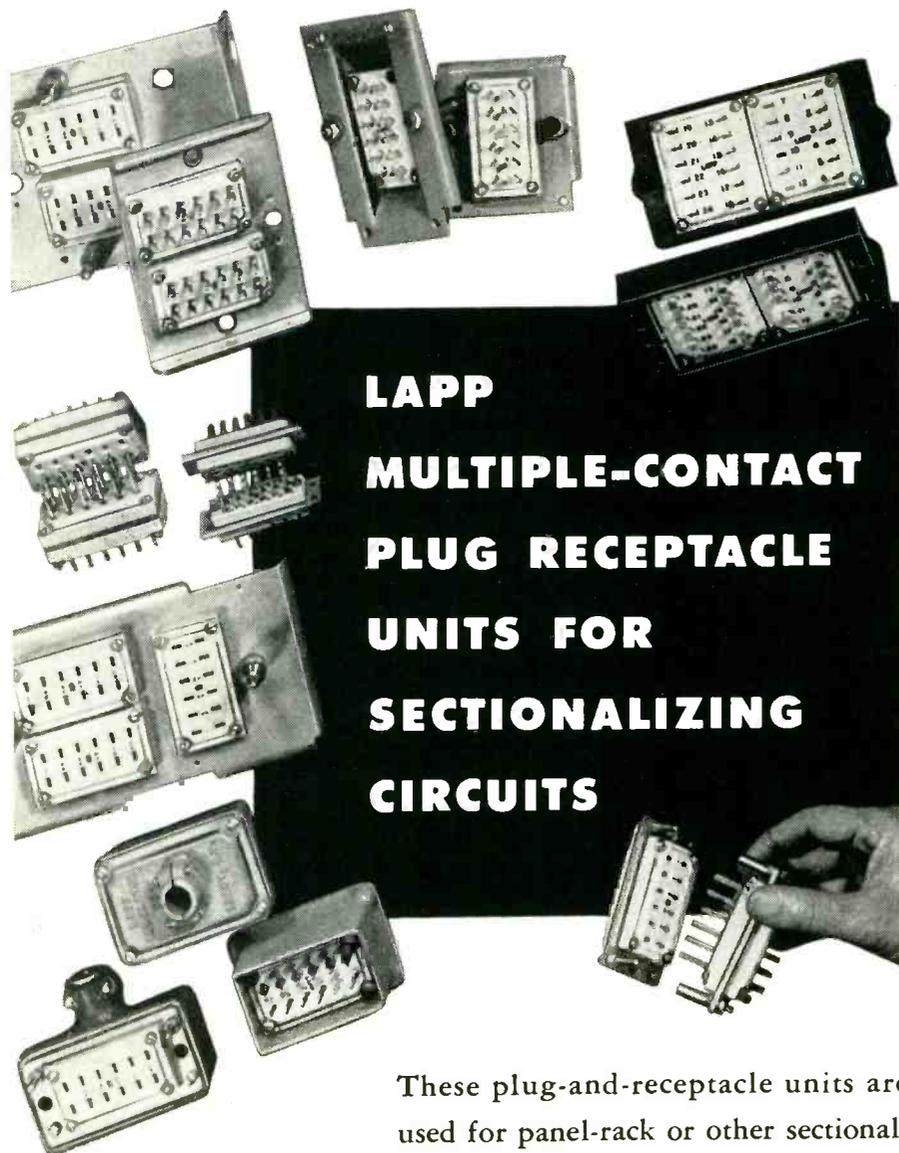
The use of a MOLDITE ferricore properly designed into a specific coil has the following advantages.



- Lower losses (eddy current)
- Smaller sizes for more compact construction
- Higher efficiency
- Higher permeability
- Lower operating temperatures
- Less corona effect
- Lighter weight
- Lower cost

1410 CHESTNUT AVE., HILLSIDE 5, N. J.

Perlmuth-Colman & Assoc. Jose Luis Ponte John S. Plewes Co.
2419 South Grand Ave. Cardoba 1472 52 Humbercrest Blvd.
Los Angeles Cal. Buenos Aires Toronto 9, Ontario



LAPP MULTIPLE-CONTACT PLUG RECEPTACLE UNITS FOR SECTIONALIZING CIRCUITS

These plug-and-receptacle units are used for panel-rack or other sectionalized circuits where a number of connections must be made or broken. Any number of contacts can be provided (in multiples of twelve). Male and female contacts are full-floating for easy alignment and positive contact. Contacts are silver-plated brass and phosphor bronze with terminals tinned for easy soldering. Ceramic blocks are steatite, white glazed . . . non-carbonizing even under leakage flash-over caused by contamination, moisture or humidity. Write for specifications of available units or engineering recommendations for your requirement. Lapp Insulator Co., Inc., Radio Specialties Division, 241 Sumner Street, LeRoy, New York.

Lapp

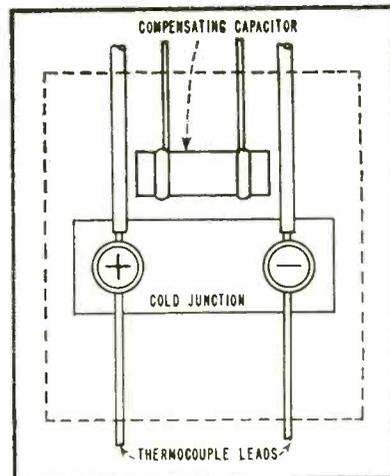


FIG. 3—Arrangement of the cold junction

ing and discharging capacitor C_2 in parallel with C_3 across capacitor C with the voltage of the standard cell.

Whenever the temperature varies, capacitor C_2 is rebalanced by the motor in response to the error voltage across C . Since C_3 is in parallel with C_2 and has a predetermined temperature coefficient the rebalancing necessary for C_2 will be a function of the capacitance of C_3 in terms of the cold junction temperature.

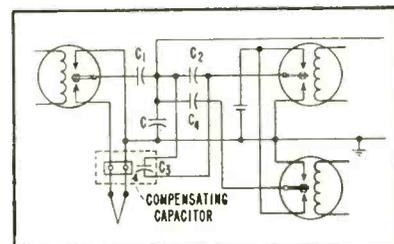


FIG. 4—Additional vibrator and capacitor explained in text

In Fig. 3 there is shown the physical arrangement of C_3 at the cold junction.

In Fig. 4 an additional vibrator is shown and an additional capacitor C_4 arranged to be alternately connected with C_2 so that C_2 and C_4 are in series with each other and with the standard cell to oppose the charge on C_1 by the difference in charges on C_2 and C_4 .

When the thermocouple voltage drops to zero and there is no charge on C_1 the balancing adjustment of C_3 will make the charge equal to that of C_4 . A negative voltage will result in a smaller charge on C_4 than

KOCH...World's largest fabricator of moulded Fiberglas products
PRONOUNCED "KOKAY"



What's going on here?

What's going on here is that carrying cases containing valuable equipment are being shipped without crating or exterior protection of any kind. And cases and contents will arrive undamaged. Thousands upon thousands of actual case histories prove it.

These are Koch Fiberglas carrying cases, the newest and most effective way to protect valuable equipment from damage in shipping, handling and storage.

The Koch Fiberglas case will not dent. It will not corrode. Cushioning material inside the case is moulded to fit perfectly the contours of the equipment, giving maximum protection against vibration and shock.

The Koch case is absolutely airtight, and under

severe tests has maintained a vapor and moisture transmission rate of zero. Equipment is safeguarded from fungus and mildew.

Sixty thousand Koch Fiberglas cases are now in service with the U. S. Air Force and BuAer all over the world. To date there has not been a single casualty to a case or the equipment it contains.

If you manufacture a product that needs this kind of protection, we will be glad to place our knowledge and experience at your disposal. Address Dept. EKC.



KOCH FIBERGLAS

Pioneer in reusable Fiberglas containers

CORTE MADERA, CALIFORNIA

precision plumbing for microwave transmission

With unequalled experience in all of the accepted waveguide metals, Technicraft's thorough, stage-by-stage inspection and measurement policy assures delivery of only the most precise plumbing, both electrically and mechanically.

Technicraft employs the most advanced attaching techniques, including dip brazing. Manufacturing standards under constant supervision of experienced microwave engineers. Extensive lab facilities available for development and production tests.

For complete details and characteristics ask for our specification sheets.

TECHNICRAFT LABORATORIES

INCORPORATED

1550 THOMASTON RD. • THOMASTON, CONNECTICUT

Designers and Manufacturers of Rigid and Flexible Waveguide Assemblies, Microwave Test Plumbing and Components, Waveguide Systems.

C_2 and a positive voltage the reverse condition. In either case C_3 will perform the same compensating function previously described.

Diode Gate

Patent 2,685,039 for "Diode Gating Circuits" was awarded A. D. Scarbrough and E. E. Bolles of the Hughes Aircraft Company. The patent is assigned to the company.

In the past various diode gating circuits have been devised that normally pass pulses of a particular level that coincide with control pulses at a particular level but inhibit the passage of pulses that are not coincident or are coincident with some other lower level of control pulses.

The problem faced by engineers employing the prior art circuits was that they were ineffective at high speeds and any attempts to improve the operation so as to obtain fast turn-on and turn-off of the gates resulted in excessive loading of the signal sources. Either defect limits the effectiveness of diode gates.

These inventors claim to have devised diode gating circuits that overcome the above disadvantages.

According to this invention, as shown in Fig. 5 and 6, a diode is interposed between the input and output terminals of the gating circuit. The diode conducts only in the forward direction from the input to the output terminals. A d-c reference potential is applied to one diode electrode while the other is varied in accordance with the incoming signals from the control pulse source.

By arranging the biasing potentials so that the diode is backbiased for all potential values of the control signal other than the passing potential, the gating circuit passes only those pulses that occur simultaneously with the passing potential of the control signal.

The circuit of Fig. 5 illustrates an arrangement in which the gating circuit passes negative pulses when the potential of the control signal is at a low voltage level. Here the diode anode is connected to the reference potential source. The reference potential is substantially equal to the low voltage level of the control signal, so that when the control signal is at its low level the

20% less reverse current!

with **Federal** germanium power rectifiers

The benefits of Federal's exacting standards of fabrication and testing are now within reach of every user of germanium rectifiers. Federal craftsmanship assures at least 20% lower reverse current than the RETMA specifications for every IN91, IN92, and IN93 rectifier.

FEDERAL, pioneer developer and manufacturer of semi-conductor products, has just completed a major expansion of its germanium rectifier production facilities . . . NOW, production quantities of diffused junction rectifiers are available for general industrial use.



types: IN91 • IN92 • IN93 • IN368

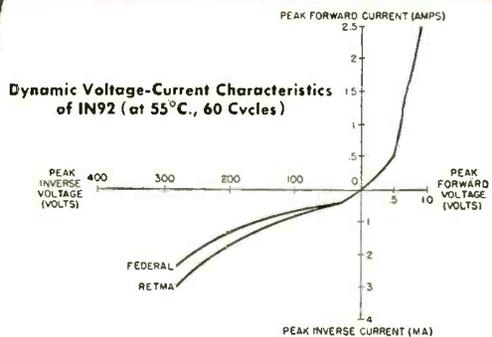
ELECTRICAL RATINGS

(based on 55° C ambient T., resistive loads, 60 cycle input)

CHARACTERISTIC	IN91	IN92	IN93
Peak Inverse Voltage, Max. (volts)	100	200	300
RMS Input Voltage (volts)	70	140	210
RMS Input Voltage (capacitive load) (volts)	35	70	105
DC Output Current, Max. (ma.)	150	100	75

*Leakage Current at Rated Peak Inverse Voltage (ma) (Retma Limits) *2.7 *1.9 *1.2

*Limits established by Federal assure at least 20% less leakage.



100% OF FEDERAL GERMANIUM RECTIFIER PRODUCTION IS 100% TESTED

For more information about Federal Germanium Diffused Junction Power Rectifiers call Nutley 2-3600, or write to Dept. F-713.

IN368 Designed for magnetic amplifier and blocking applications where very high forward-to-reverse current ratios and high efficiencies are required. *Meets all RETMA specifications!*

IN368 ELECTRICAL RATINGS

Maximum Peak Inverse Voltage	200 volts
Maximum DC Output Current	100 ma
RMS Voltage	140 volts
Continuous Reverse Working Voltage	150 volts
Max. Leakage Current at 150 Volts Reverse DC	300 microamps DC



Federal Germanium Rectifier (actual size)

Federal



A DIVISION OF



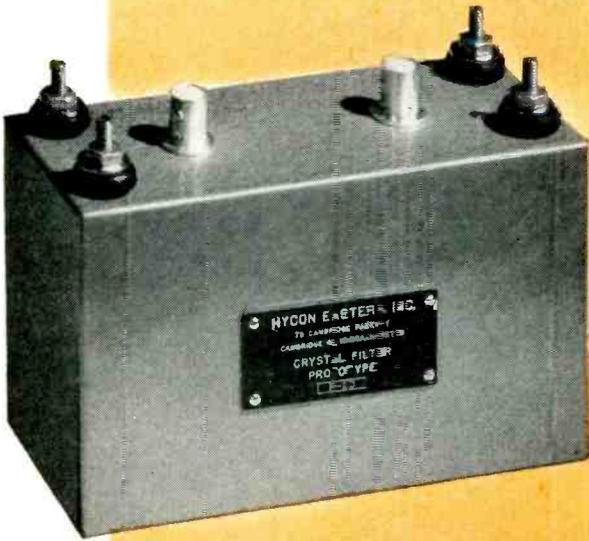
Federal Telephone and Radio Company

A Division of INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
COMPONENTS DIVISION • 100 KINGSLAND ROAD • CLIFTON, N. J.

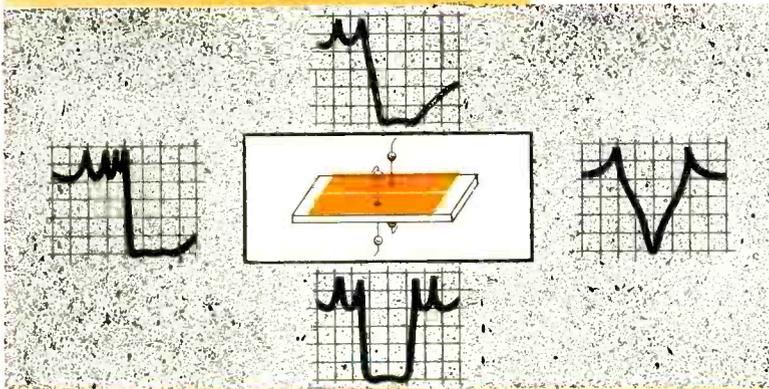
In Canada: Standard Telephones and Cables Mfg. Co. (Canada) Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., New York

HYCON EASTERN

a complete facility for
DESIGN • ENGINEERING • PRODUCTION



CRYSTAL FILTERS



FREQUENCY RANGE: 10 kilocycles to 10 megacycles for all types of filters.

BANDWIDTH RANGE: 0.01% to 14% of center frequency.

APPLICATIONS: Carrier Communication Systems; Telephone Channel Filters, Pilot Selection Filters, Telemetering Channel Filters, Teletype Channel Filters, Other Frequency Multiplexing Systems. Single Side Band Filters. High Selectivity Amplifiers. Noise and Sound Analysers. Carrier Current Systems. Harmonic Selection.

ANNOUNCEMENT is made of a new technique for the synthesis of crystal filters which resolves many of the problems heretofore associated with their design and production. High initial cost and long lead time have been eliminated. System design no longer need be compromised because of the limited number of existing filters. Filters can be produced on short notice in large or small quantities to meet exact performance requirements. Curves shown above suggest the wide variety of characteristics. *Your inquiry is invited.*



HYCON EASTERN, INC.
75 Cambridge Parkway, Dept. A, Cambridge 42, Massachusetts

negative pulses are passed by the diode. When the control signal is at a higher level the diode is back-biased and blocks the pulses.

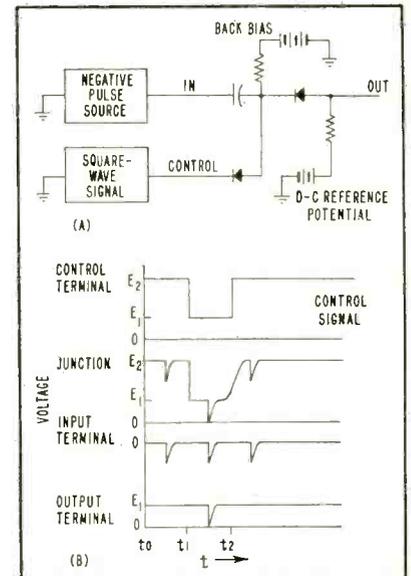


FIG. 5—Connections (A) and waveforms (B) for negative pulses

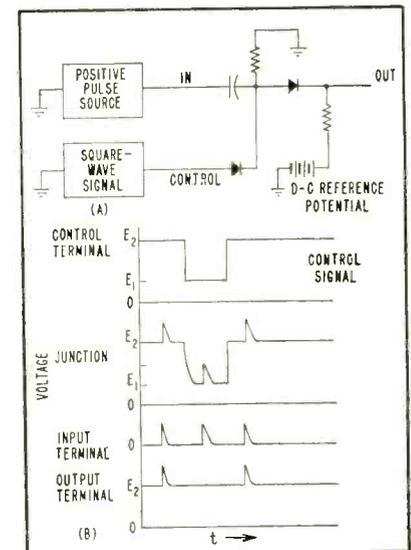


FIG. 6—Diode orientation (A) and waveforms (B) for positive signals

In Fig. 6 the passing diode connection is reversed. Here the gating circuit passes positive signals when the potential is at a high voltage level. The reference potential is connected to the cathode of the passing diode. The voltage of the reference potential is equal to the high voltage level of the control signal. Positive pulses are passed when the potential of the control signal is at a low voltage level.

The pulse diagrams of Fig. 5B and 6B clearly illustrate the operation of these diode gating circuits.

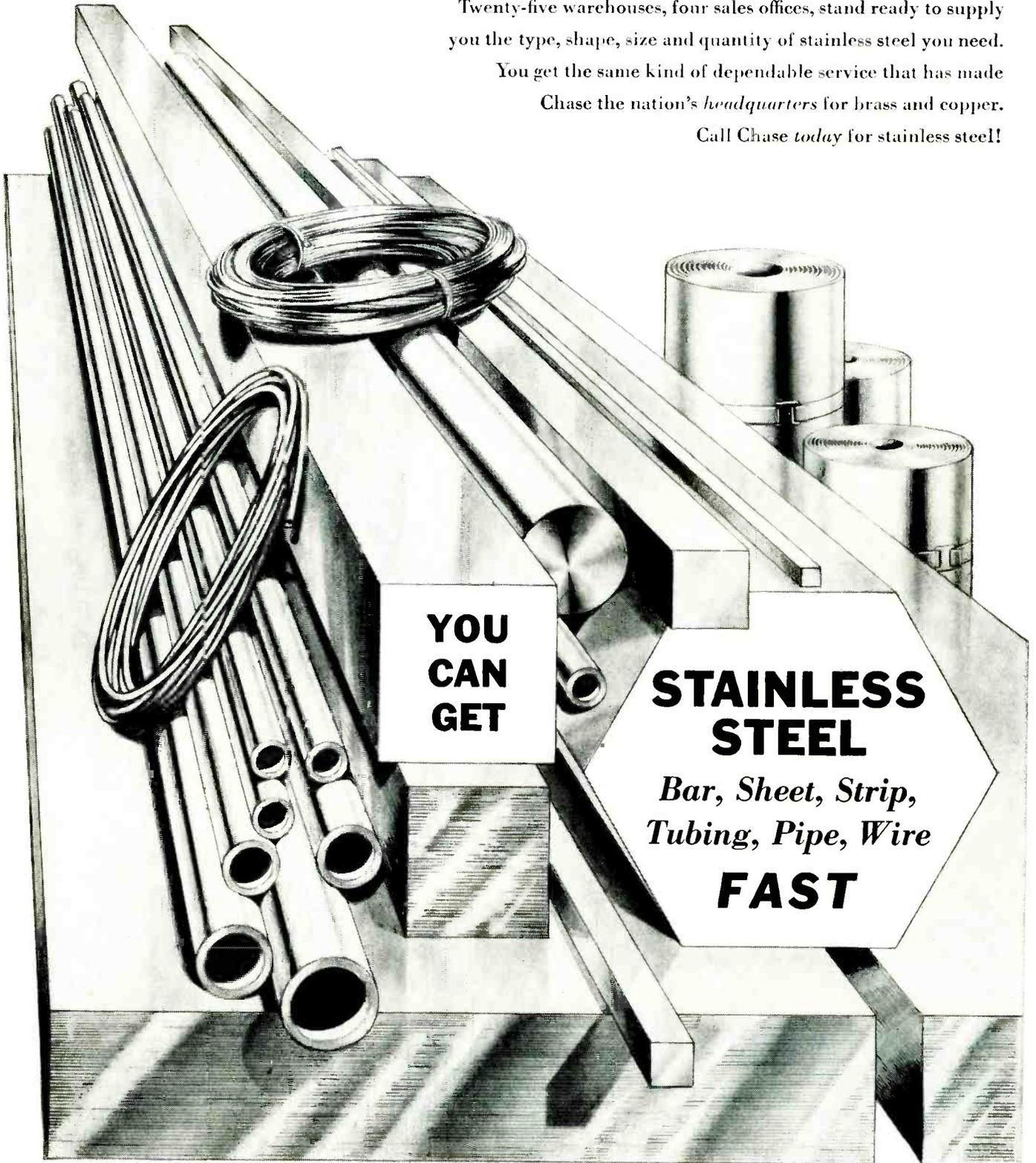
FAST SERVICE IS CHASE'S SPECIALTY FOR STAINLESS STEEL!

Twenty-five warehouses, four sales offices, stand ready to supply you the type, shape, size and quantity of stainless steel you need.

You get the same kind of dependable service that has made

Chase the nation's *headquarters* for brass and copper.

Call Chase *today* for stainless steel!



**YOU
CAN
GET**

**STAINLESS
STEEL**

*Bar, Sheet, Strip,
Tubing, Pipe, Wire*

FAST

Chase 
BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper (†sales office only)

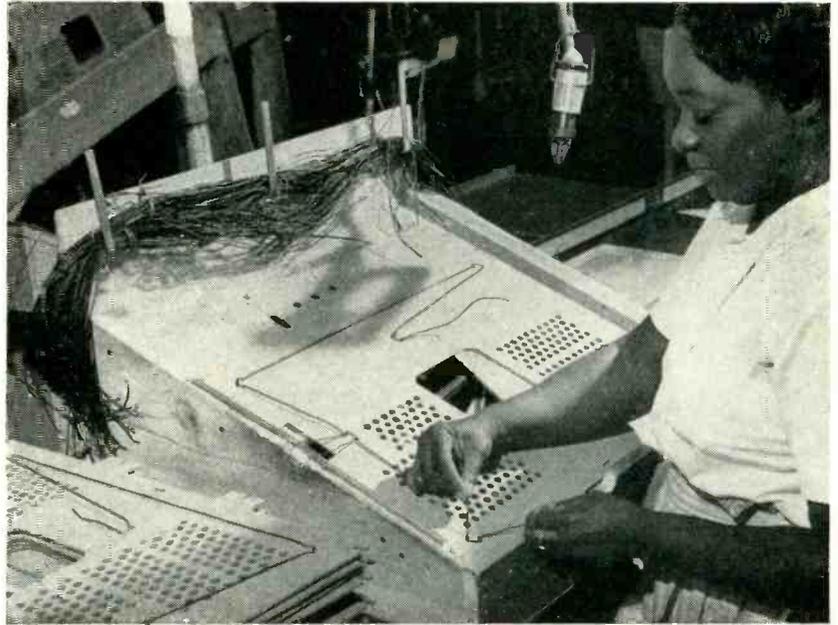
Albany†	Chicago	Detroit	Los Angeles	New Orleans	Rochester†
Atlanta	Cincinnati	Grand Rapids†	Louisville†	New York	St. Louis
Baltimore	Cleveland	Houston	Milwaukee	Philadelphia	San Francisco
Boston	Dallas	Indianapolis	Minneapolis	Pittsburgh	Seattle
Charlotte	Denver	Kansas City, Mo.	Newark	Providence	Waterbury

Punched Slots in Back Cover Anchor Built-in TV Antenna

INSULATED wire used to form a dipole antenna is uniquely attached to back covers of tv sets by looping through C-shaped punchouts in the covers, in a technique used in Emerson's Jersey City plant. Only two staples are needed to anchor the antenna.

As the first step, the operator places an empty board on a slanting wood frame resting on the bench. Precut wires for the antenna are stored on metal straps projecting upward at the back of this frame. Picking up the first wire, she temporarily anchors its spade-terminal end between the turns of a coil spring that is fastened on the left side of the frame. In four quick movements, she pushes a loop of this wire down into each of the four punchouts in turn, pulling the wire taut each time.

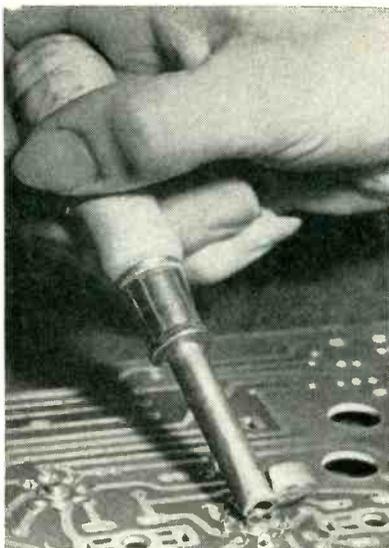
The procedure is repeated for the second wire, which crosses the first at the first punchout. The loose ends of the two wires are then stapled to the pressed-wood back cover with an air stapler made by Duo-Fast



Pulling antenna wire taut after inserting loop of it in C-shaped punchout in back cover. Air stapler is suspended conveniently within reach overhead for use in anchoring ends of leads after threading operation

Fastener Corp., Franklin Park, Ill. A $\frac{1}{4}$ -inch thick strip of aluminum crosses the opening in the wood frame directly under the stapling locations, to serve as an anvil or backing plate for the stapler.

Tool Spreads Lugs of Socket on Etched Wiring Board

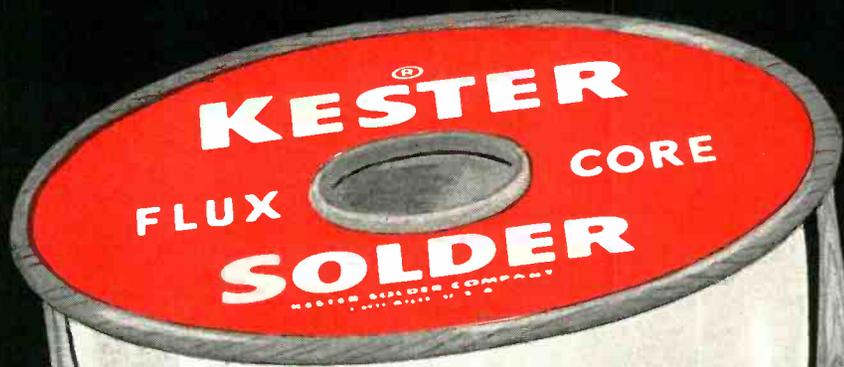


Placing tool over center pin of socket after inserting socket from other side

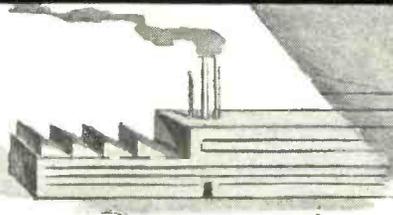
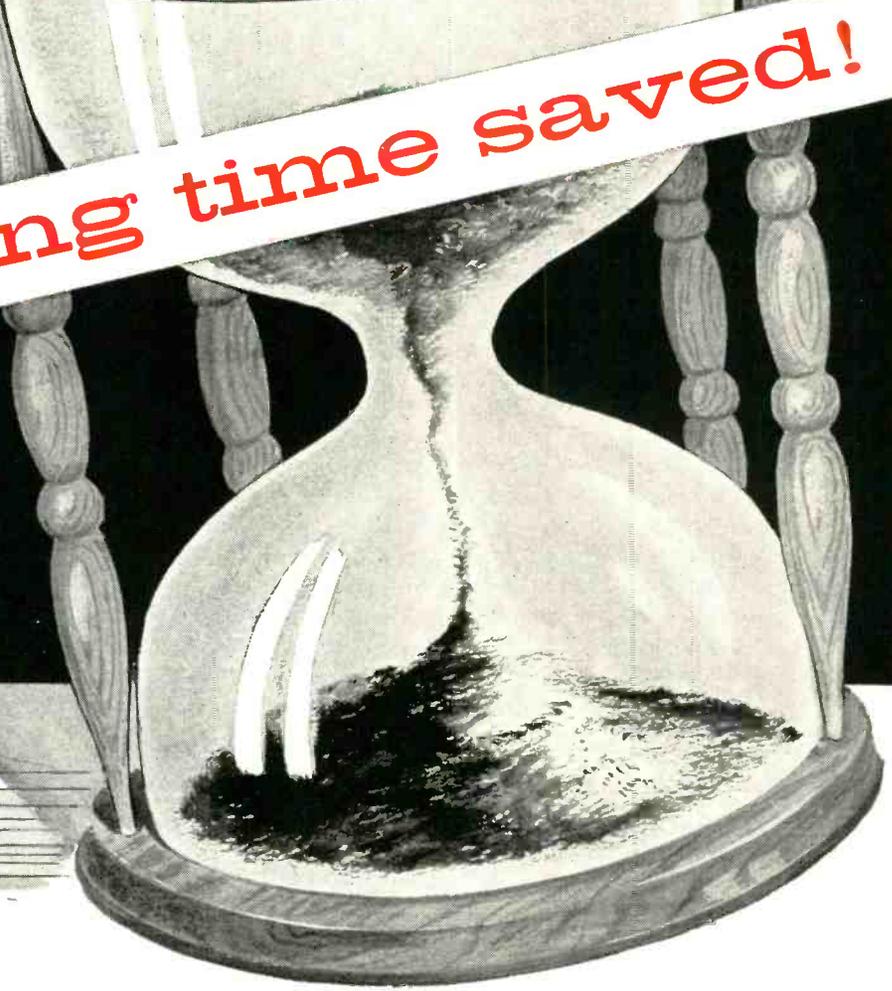


Method of holding tool while rotating wiring board, for spreading lugs

A QUICK spin of a simple screwdriver-like tool spreads socket terminal lugs out flat against etched wiring board after the socket has been inserted in the punched holes. The tool is used in Emerson's Jersey City plant during assembly of a table model radio using an etched wiring panel. The operator inserts a socket in the terminal holes with correct orientation, places the hollow-shaft tool over the socket center-pin with the wing of the tool at the missing-pin position, then presses straight down on the tool with one hand while rotating the board with the other hand. During this operation the lugs are flattened out one by one to anchor the socket and bring the lugs into optimum



soldering time saved!



KESTER "44" RESIN, PLASTIC ROSIN AND "RESIN-FIVE" FLUX-CORE SOLDERS are tried-and-proved remedies for almost every production situation where soldering time gets out of hand. Kester's great adaptability to widely divergent soldering requirements has time and again helped

so many manufacturers combat rising production costs. It could be the solution you've been looking for!

THIS IS IT . . . the informative 78-page free Kester text-book "SOLDER . . . Its Fundamentals and Usage." Send for your copy today!

KESTER SOLDER

COMPANY

4204 Wrightwood Avenue, Chicago 39, Illinois; Newark 5, N. J.; Brantford, Canada

positions for dip-soldering.

The tool was made by sawing off the socket of a hollow-shaft spin-type socket wrench, then brazing

the lug-flattening wing onto the end of the tool.

This tool greatly reduces the time required for manual assembly and

clenching of sockets on wiring boards, pending the arrival of automatic assembly machines for this purpose.

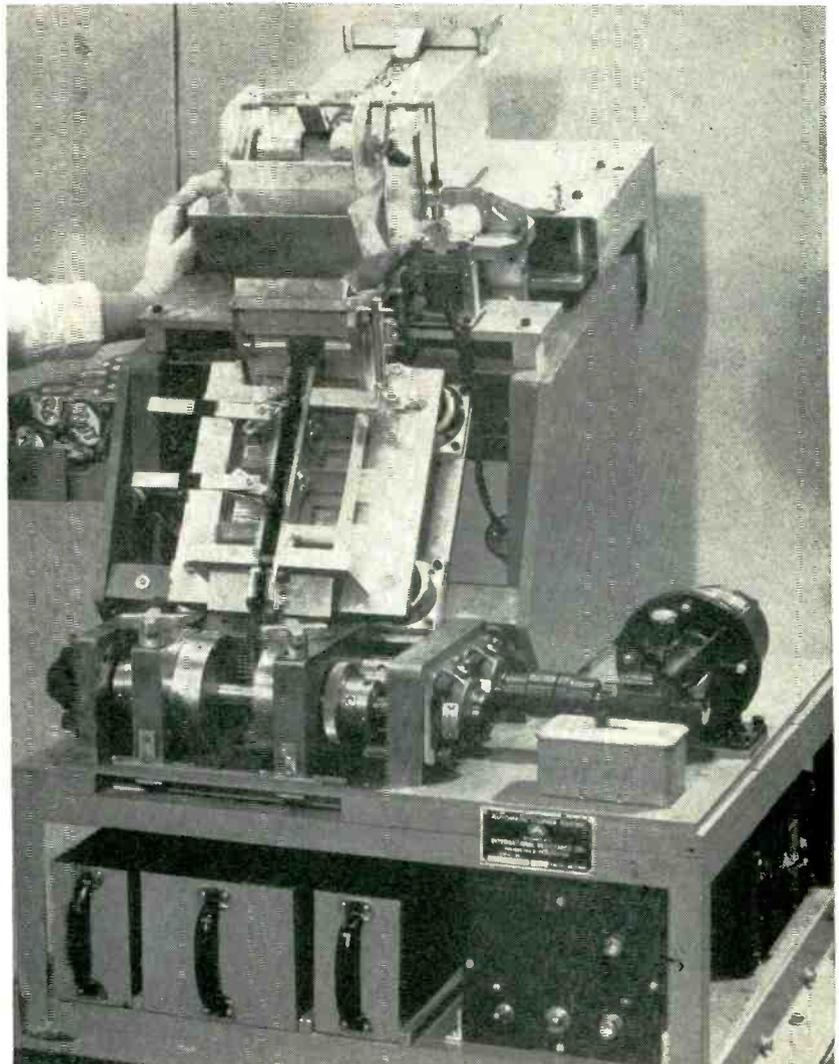
Hopper-Fed Automatic Lead Cutter for Carbon Resistors

LEADS of carbon resistors are cut to desired lengths at speeds of 30,000 resistors per hour by the new automatic hopper-fed lead cutter developed and built by International Resistance Co. Operation is automatic once the standard IRC Automation Package of 2,500 resistors has been loaded into the holder at the top of the machine. Trimmed resistors drop into one tote box underneath and the cut-off leads drop into smaller tote boxes on each side.

The loading operation involves sliding an opened package of resistors into the holder, removing the vertically ribbed cardboard spacers from the sides of the carton, then placing metal plates over the top of the carton and anchoring them with holding clamps. These plates prevent the resistors from pushing up out of the box under the force of the pusher-type unloading plate that is next inserted in the far end of the carton. This pusher plate is attached to a heavy weight. The entire carton holder slants forward and is subjected to a shaky motion by an electric motor and eccentric cam underneath. The pusher plate thus moves down during unloading through the combined forces of gravity and shaking motion.

How It Works

When the machine is started, the resistors are pushed out over the edge of their package through an oscillating gate into a funnel from which they emerge transversely in single file into the downward slanting hopper that brings them through the cutting blades. Two light sources direct beams across this hopper to phototubes below for controlling the flow of resistors into the hopper. When the resistor level in the hopper is high enough to block the upper light beam, the carton unloader gate closes and remains so until the re-



Latest model of automatic resistor lead cutter. Motor on base at right drives cutters



Inserting weight-loaded pusher plate



Inserting full carton of resistors

FOR COOLING ELECTRONIC EQUIPMENT

- ★ Spot cooling of electronic tubes where local high temperatures arise.
- ★ Heat removal from pressurized or hermetically sealed units.
- ★ Heat removal where space is so restricted that natural ventilation is insufficient.
- ★ Maintaining correct temperatures for fire control equipment.
- ★ Radio Gear, Magnetrons, Countermeasures.

Only JOY AXIVANE[®] FANS offer All These Advantages

LIGHTWEIGHT STRENGTH

Aluminum and magnesium one-piece casting construction permits absolute minimum weight, with the ruggedness to withstand severe shock and vibration, and maintain exact balance tolerance.

COMPACT VANEAXIAL DESIGN

The inherent compactness of vaneaxial design permits easy installation in any location. True airfoil-design blades and straightener vanes impart a smooth, direct airflow, with efficiencies above 85%, giving high-capacity performance with low horsepower expenditure.

PRECISION MANUFACTURE

All rotors are dynamically and statically balanced, and each fan thoroughly tested at the factory. Minute tip clearance heightens efficiency and reduces noise. Each of the eighty standard models can be modified for exact conformation to any specifications.

UNIQUE DEPENDABILITY

Successful operation has been proved in many unusual, demanding, electronic applications; under low and high pressures; at altitudes above 50,000 feet; and in temperatures below -100°F .

SPECIAL ACCESSORIES

A variety of drives and powers are available, as well as cooled or explosion-proof motors; beaded or flanged connections; anodization; and heating elements that comprise a complete blower-heater package.

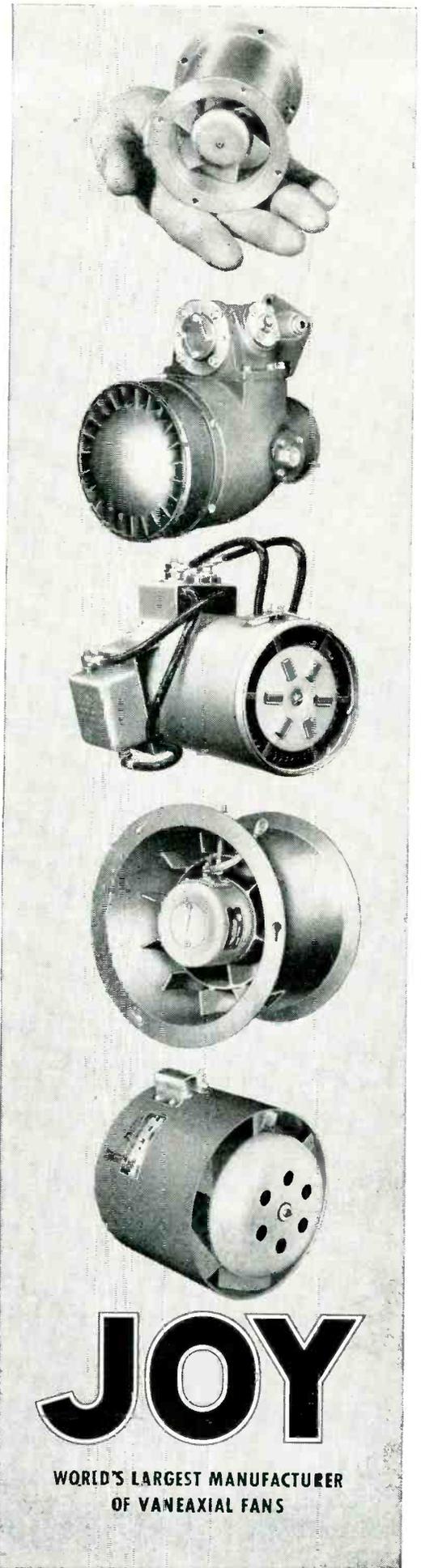
For complete information, write for Bulletin J-614.
Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.
In Canada: Joy Manufacturing Company (Canada) Limited,
Galt, Ontario.

Consult a Joy Engineer



Over 100 Years of Engineering Leadership

WED 15646



JOY

WORLD'S LARGEST MANUFACTURER
OF VANEAXIAL FANS

**Fastest GROWING Name
in ELECTRONICS**

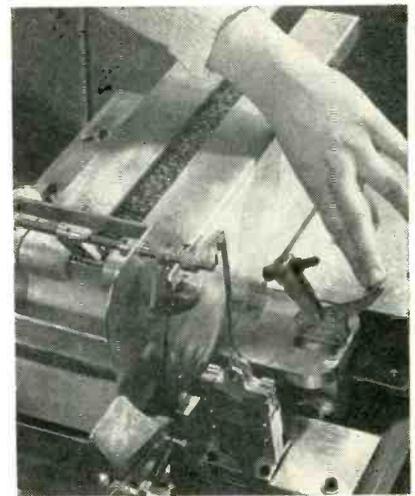


DESIGN, DEVELOPMENT, DELIVERY

- **SERVO MOTORS**
- **TACH GENERATORS**
- **SYNCHROS**
- **GYRO PICK OFFS**
- **TEST EQUIPMENT**
- **MIN. SUB. FRAC. MOTORS**
- **SPECIALIZED SYSTEMS**



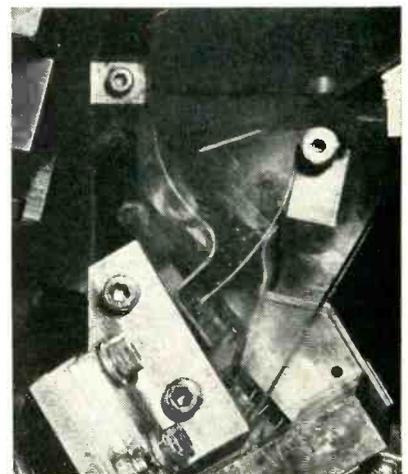
INFRA ELECTRONIC CORPORATION
ROSELAND, NEW JERSEY



Pushing down clamps to hold top plates over carton of resistors. Solenoid at bottom pulls down intermittently when resistors are called for, holding finger-like gate open over hopper for about 1/3 second at a time. This allows up to seven resistors to come up over edge of carton and drop into funnel below

sistor level in the hopper falls below the lower light beam. This then serves to open the gate to initiate the next feed cycle.

Zigzag slots in the side walls of the hopper, through which the resistor leads project, help to keep the resistors in a horizontal position as they come down. The hopper brings the resistor leads between the two pairs of cutter wheels. The rear wheel of each pair has teeth, to insure positive feed of the leads down through the cutters. The front wheel overlaps the rear slightly to give the desired shearing action. Each pair of cutter wheels is mounted on a frame that can be



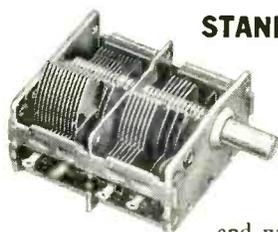
Side view of funnel into which resistors drop from carton, for feeding into top of hopper one at a time. Transparent side plates allow operator to watch for jams

TUNE IN ON RADIO CONDENSER

For Variable Capacitors Tuners Electromechanical Assemblies

The experience of Radio Condenser in producing tuners and variable capacitors to individual requirements has consistently proved its value to manufacturers through the right combination of quality and cost. However unusual a problem may be, chances are that R/C specialists have faced a similar problem and solved it.

The products shown on this page are only a brief sampling of units designed, engineered, and manufactured by Radio Condenser. A more complete description of products in each category is given in our catalog, available on request. Or, we will be happy to arrange a direct interview with a Radio Condenser Engineer at your convenience.



STANDARD HOME RADIO TYPE CAPACITORS

R/C units cover every standard application, including AM-FM receivers. Each is a product of high quality, performance-proved, and well adapted to rapid, low cost quantity production.



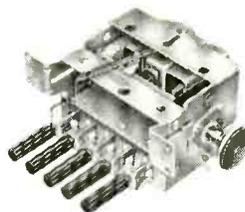
CAPACITORS FOR LIMITED SPACE

Among the most recently announced R/C developments is a miniature variable capacitor for transistorized radio receivers, also adaptable to color TV phasing control. R/C accomplished important reductions in size with no sacrifice of stability or calibration accuracy.



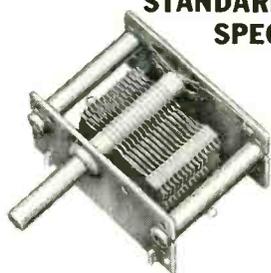
UHF AND VHF TELEVISION TUNERS

R/C has provided tuners for major TV manufacturers since the earliest days of commercial TV. While most such tuners are secret designs, R/C has recently developed low cost standard tuners in several styles for UHF and VHF TV.



AUTOMOTIVE RADIO TUNERS

Approximately one-third of all American automobiles are equipped with R/C tuners. Because every automobile radio tuner is an individual case, R/C custom manufacturing experience is an important asset to the radio manufacturer in this specialized field.



STANDARD CAPACITORS FOR SPECIAL APPLICATIONS

Always an important part of R/C activities, design and manufacture of variable capacitors of a special nature are handled by a special division. Products include units for every type of military service, test equipment, etc.

ELECTRO- MECHANICAL ASSEMBLIES

As a contract manufacturer of electromechanical assemblies for industrial and military electronic equipment, automatic data processing systems, etc., R/C also offers engineering assistance in development and modification, leaving you completely free of production worries and details. Complete information on this well-qualified division is available on request.



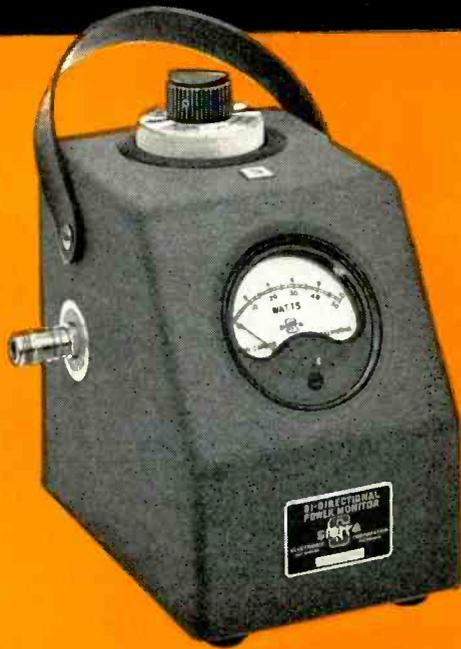
RADIO CONDENSER CO.

Davis & Copewood Streets • Camden 3, New Jersey

EXPORT: Radio Condenser Co., International Div., 15 Moore St., N.Y. 4, N.Y. CABLE: MINTHORNE

CANADA: Radio Condenser Co. Ltd., 6 Bermondsey Rd., Toronto, Ontario

New Bi-Directional Power Monitor



25 to 1,000 mc

10 to 500 watts

Only 2 plug-in elements

MODEL 164

Quickly measures incident or reflected power, simplifies matching loads to lines

New Sierra Model 164 is a compact, versatile, bi-directional monitor for intermittent or continuous measuring of incident or reflected power, or convenient and precise matching of loads to lines. The instrument offers unequalled measuring ease and economy, since only two plug-in elements are required for coverage of all frequencies 25 to 1,000 mc and wattages 10 to 500 watts. Two plug-in elements cover, respectively, 25 to 250 mc and 200 to 1,000 mc. Both have 4 power ranges: 10, 50, 100 and 500 watts. Accuracy is $\pm 5\%$ full scale. No auxiliary power is required to operate the instrument.

Because of its compact size and wide range, Model 164 is ideal for portable applications (mobile, aircraft, etc.) as well as laboratory use. It is supplied in a sturdy carrying case (one or both plug-in elements supplied as ordered) and both meter and directional coupler may be removed from the case for remote monitoring. The monitor may be equipped for most connectors normally employed with 50 ohm lines. A twist of the wrist selects incident or reflected power, or any power range, without requiring removal of power. No exchange of plug-in elements is necessary to read low levels of reflected power.

TENTATIVE SPECIFICATIONS

Power Ranges: 10, 50, 100 and 500 watts full scale direct reading

Accuracy: $\pm 5\%$ of full scale.

Insertion VSWR: Less than 1.08.

Frequency Ranges: 25 to 1,000 mc. Two plug-in elements.

Low Frequency Elements: 25 to 250 mc.

High Frequency Elements: 200 to 1,000 mc.

Impedance: 50 ohm coaxial line.

Data subject to change without notice.

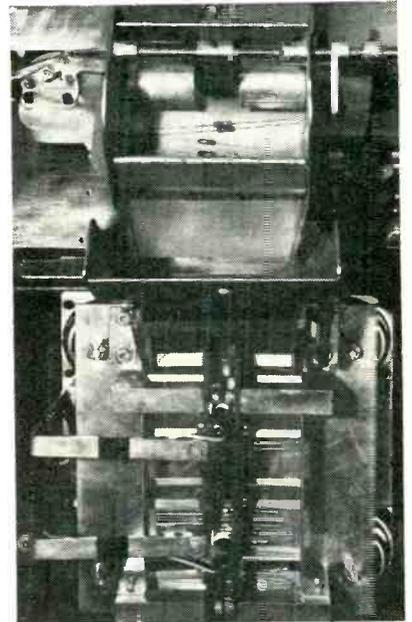
sierra



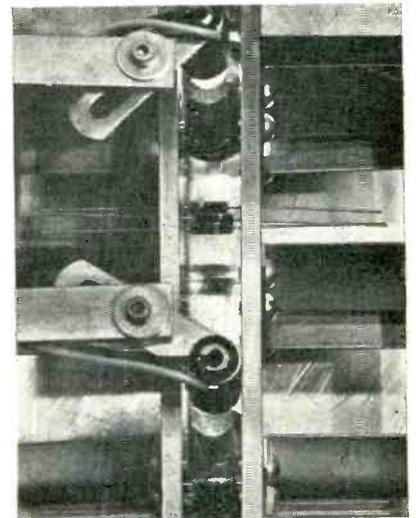
Sierra Electronic Corporation
San Carlos 2, California, U. S. A.

Sales representatives in major cities
Manufacturers of Carrier Frequency Voltmeters, Wave Analyzers, Line Fault Analyzers, Directional Couplers, Wideband RF Transformers, Custom Radio Transmitters, VHF-UHF Detectors, Variable Impedance Wattmeters, Reflection Coefficient Meters.

slid in or out simply by loosening a knob on top. All four cutters are driven by a single electric motor through a reduction gear and ap-



Front view of cutting machine, showing resistors dropping into funnel at top. Lamps, supported on metal straps below, direct light beams through resistors in hopper to phototubes behind



Closeup of hopper down which resistors slide when called for by photoelectric feed control. Lucite rods running to the phototubes can be seen behind lamps

propriate auxiliary gearing that gives a cutting speed of about 15 rpm. Pointers on the cutter supports move against a scale on the bed of the machine, calibrated to indicate lead length. Machine settings can thus be changed in a matter of minutes.

A Syntron vibrator is mounted under the hopper to produce a smooth downward flow of the resistors even when operating at the

new

1 1/4" P.M. MOTOR

smaller · more efficient
minimum radio noise
MEETS MIL-M-8609 SPECS

Oster®



ACTUAL SIZE

a complete new line of 1 1/4" P.M. Motors

- **Smaller:** 5 oz. weight, 2.14" L, 1.25" OD. (A typical example—Type AM-210).
- **Exceptionally High Torque** due to unique, simpler magnet design.
- **Radio Noise Minimized.**
- -55° C to +71° C temperature range.
- 6000 to 20,000 RPM motor speed range. Speeds controllable to ±1% over a voltage range from 24V to 29V by using a governor.
- Altitude-Treated Brushes have exceptionally long life.
- Specially Designed Metal Brush Holders avoid sticking in environmental tests and do not protrude into outside housing, permitting full design freedom.
- Available with gear train, governor, brake or any combination thereof. For gear train ratios, see chart.
- Applications: radio, radar, actuators, drive mechanisms, antenna tilt-motors, tuning devices, blowers, cameras and many others. Write for further details today.

PERMANENT MAGNET MOTOR GEAR TRAIN DATA

Motor can be designed for speeds from 6000 RPM to 20,000 RPM. Length of motor will vary according to power.

Length of gear train will vary according to gear ratio required—

1000:1 to 33,000:1	6 stages
300:1 to 5,900:1	5 stages
100:1 to 1,000:1	4 stages
40:1 to 183:1	3 stages
15:1 to 32:1	2 stages

Other products include Actuators, AC Drive Motors, DC Motors, Fast Response Resolvers, Servo Torque Units, Servo Motors, Synchros, Reference Generators, Tachometer Generators and Motor Driven Blower and Fan Assemblies.

TORQUE AT OUTPUT SHAFT OZ. IN.	GEAR RATIO OF GEAR TRAIN
25	15:1 to 33,000:1
100	15:1 to 33,000:1
300	15:1 to 33,000:1
400	15:1 to 5,500:1
600	15:1 to 5,500:1

John Oster

MANUFACTURING CO.

Your Rotating Equipment Specialist

avionic division

RACINE, WISCONSIN

circuit protection



- * Overload Protection
- * Over Voltage Protection
- * Under Voltage Protection
- * Low Frequency Protection

with new

G-V thermal sensing relays



G-V Sensing Relays operate contacts when current or voltage to their heaters exceeds or drops below the operating point.

Operating quickly on heavy changes but tolerating slight changes until they become dangerous, the G-V relay provides better protection for your valuable equipment.

G-V sensing relays can be selected with a response rate paralleling the action of your equipment.

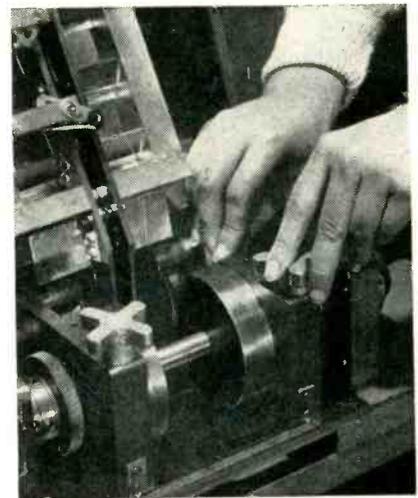
*Meets Military Requirements
Hermetically Sealed Miniature Size*

*Light Weight
Currents .015 to 5 Amps—Voltage 1 to 230 Volts*

Write for Engineering Assistance and complete technical Data. Ask for Publication 70.

G-V CONTROLS INC.

24 Hollywood Plaza
East Orange, New Jersey



Loosening locking knob for right-hand pair of cutters. Scale at bottom center indicates lead length to which cutters are set

maximum speed. The mounting plate of the hopper is shock-mounted to keep this vibration independent of that which acts on the carton unloader.

When the photoelectric control system calls for resistors, the feeder gate is opened and closed at the rate of about 50 times per minute. The gate solenoid holds the gate open for about $\frac{1}{3}$ second each time, allowing from two to seven resistors to dribble through. The opening action occurs an average of six times for each resistor call by the phototubes.

Since the hopper is under vibration, neither the lamps nor the phototubes are mounted on it. The lamps are on brackets that come up around the vibrating plate to the front of the hopper. The phototubes are mounted on a fixed plate at the rear of the vibrating plate. Lucite rods are run through holes in the vibrating plate to bring the light beams to the phototubes.

Masking and Fluxing for Dip-Soldering

TO PREVENT uneven buildup of solder around mounting and grounding holes of the etched wiring board used in Emerson's home radio, tabs of Scotch masking tape are placed over these holes before applying flux with a paint brush and dip-soldering in the firm's Jersey City plant.

The tape is cut on an automatic

For Your File! **IMPROVED PLATING TECHNIQUES**
By Baker & Adamson®

How You Can Make "Printed Circuits" Faster and Better Than Ever!



Use B&A Copper Fluoborate for High-Speed Electroforming—The time required for the copper plating of thick, high quality circuits is reduced sharply by high purity B&A Copper Fluoborate.



Get the Excellent Solderability Produced by B&A Lead-Tin Fluoborate—Assembly is expedited through the use of B&A Lead-Tin Fluoborate giving a 60:40 tin-lead deposit of maximum solderability.

FREE! Technical Bulletins on the Production of Printed Circuits. Mail coupon for them today!



BAKER & ADAMSON® *Fine Chemicals*

GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.



The trend throughout the electronics industries is to low-cost "printed circuits" . . . for radios, for television sets, for more and more types of products with electric circuits.

Now these economical circuits can be made better and faster than ever, your products improved, your costs lowered, with the use of B&A Fluoborates. These high purity plating solutions come in concentrated solution form, require no mixing or dissolving, give stability in bath composition and practically 100% anode and cathode efficiencies.

B&A technical bulletins describing these improved plating techniques are available on request. Send coupon for them today.

BAKER & ADAMSON PRODUCTS

General Chemical Division
Allied Chemical & Dye Corporation
40 Rector Street, New York 6, N. Y.

Please send technical bulletins on the use of B&A Fluoborates in the production of printed circuits.

Name _____

Company _____

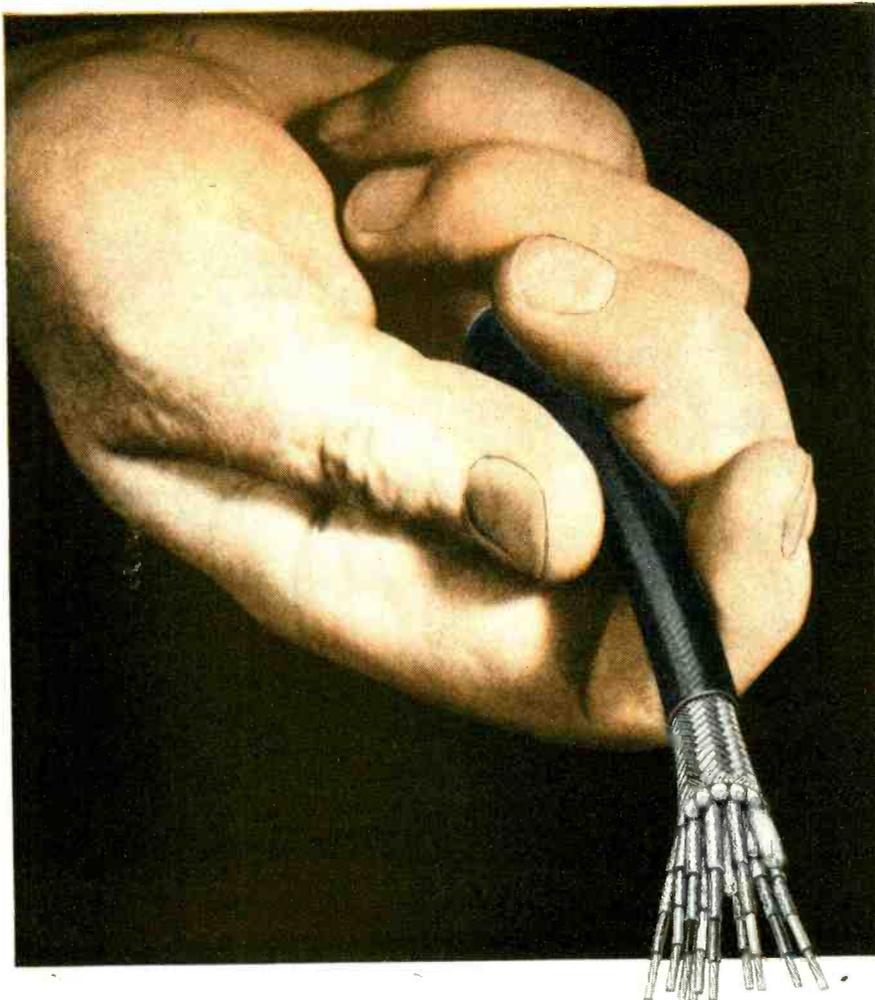
Title _____

Address _____

City _____ Zone _____ State _____

EL-9

Phalo Cables are Customer-Made...



...Ask Any of Our "Custom" Customers!

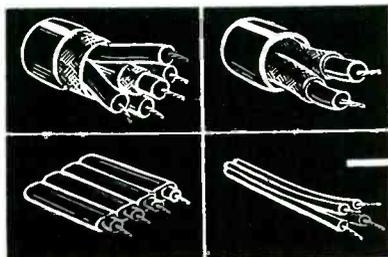
Because this statement could be made by many Phalo customers who saw us turn "specs" into a custom cable built for their express purpose, we have not shown the personality behind this statement.

We can, however, show you some very interesting examples of the scope of

Phalo's custom cable operation . . . and we can translate your "specs" however complex and exacting they are.

If you're holding cable specs that are holding up progress and you wish you were holding the finished custom cable, get hold of your Phalo man.

Ask For The Complete Phalo Catalog



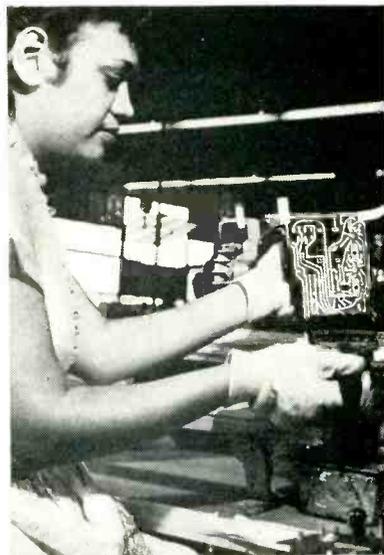
PHALO

PLASTICS CORPORATION

The Custom Cable House

CORNER OF COMMERCIAL STREET
WORCESTER, MASS.

Insulated Wires, Cables - Cord Set Assemblies



Method of holding finished wiring board, after masking its corners, for applying activated rosin flux with ordinary paint brush

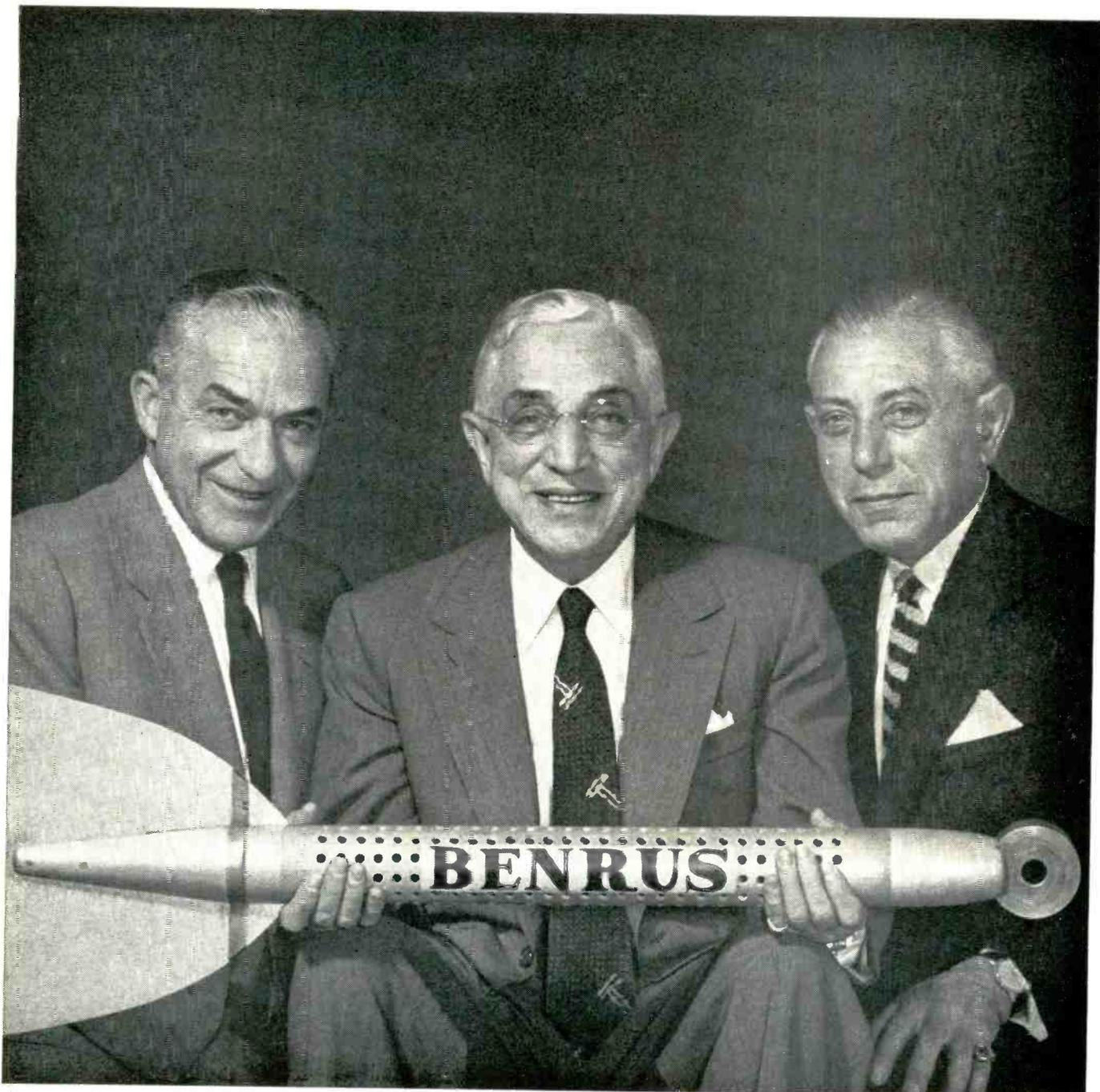
dispensing machine that rests on a shelf just behind the slide-along line for these boards. A downward pull of the lever brings out two cut pieces for easy pickoff and transfer to the board. Another pull gives two more pieces to complete the masking of the four mounting holes on a board.

Flux is applied by brushing vigorously in two directions with an ordinary paint brush. The board is then placed on an egg-crate partition, fluxed side downward, to prevent the flux from running into parts mounted on top of the wiring board.

The four masking tape tabs are intentionally long so that they can be pulled off easily after dip-soldering by an operator wearing heavy gloves.

Automatic Sorting of Paper Capacitors

COMPLETELY automatic testing and sorting of capacitors is achieved with a new air-operated machine developed by Industrial Instruments, Inc., Cedar Grove, N. J. The tester makes high-voltage breakdown tests between leads, between leads and can, and then sorts capacitors by predetermined tolerances in up to eight categories at the rate of approximately one capacitor per second. The equipment is so synchronized that when set up to predetermined standards unskilled labor



Benjamin, Oscar and Ralph Lazrus, brothers who head the Benrus Watch Company, ask . . .

“Have you seen the Benrus torpedo?”

“Within its perforated shell, three of our self-winding waterproof watches were towed from Gibraltar to New York, submerged in the turbulent wake of a fast trans-Atlantic liner. When the torpedo was opened — every watch was on time to the tick!

“Then came the job of delivering 56,000 more of those same Benrus watches to jewelers all over the country, before the nationwide TV promotion date.

“We called Air Express—and every watch arrived on time.

“We depend on Air Express. They handled over 11,000 shipments for us last year. Not one was lost, late or damaged.

“Yet Air Express usually costs us less than would any other complete air service. 15 lbs., for instance, from New York to Atlanta, Ga., is \$5.63. That’s the lowest rate in the field by \$1.27. Add it up on several thousand shipments!”



Air Express



GETS THERE FIRST via U.S. Scheduled Airlines

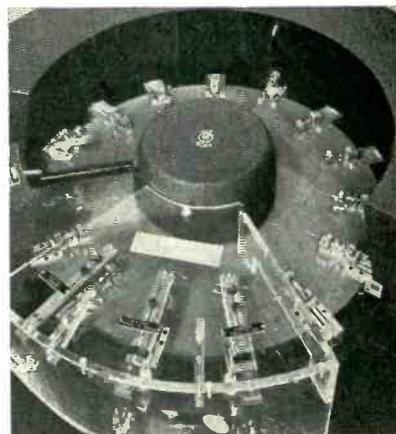
CALL AIR EXPRESS . . . division of RAILWAY EXPRESS AGENCY

may operate it with no difficulty.

Capacitors of the coaxial lead type may be tested with or without leads. Other types may be tested through special test fixtures. The capacitors are loaded by dropping into a loose-fitting V-block arrangement as they pass the operator. This positions the units so contact



Method of loading capacitors on turntable of automatic tester. After testing, these are automatically ejected into approximate sorting or reject bins



High-voltage test stations are in foreground on turntable and eight sorting stations are at rear. Solenoid-operated pusher flips up V-block to toss capacitor into correct bin, as at rear center

can be made at later positions, where spring blades under overhead terminal strips push the capacitor body down.

The first test stage is a high-voltage terminal-to-case breakdown test, the second is a terminal-to-terminal test and the third discharges the capacitor through a current-limiting resistor. All units showing breakdowns in either of the two high-voltage tests are automatically rejected into a bin by a memory system after discharge.

The next eight stages are tolerance selections according to capacitance. Eight bins are provided for

Don't DO IT YOURSELF...

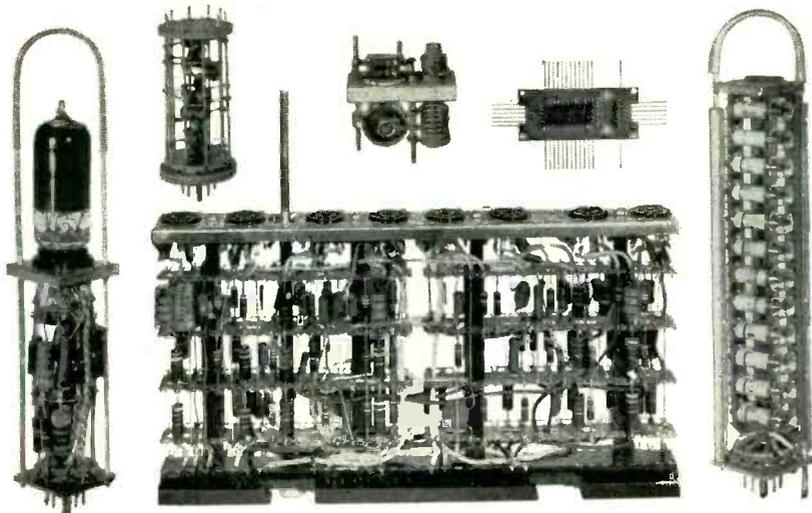
let **ERIE** TRADE MARK

BUILD YOUR ELECTRONIC AND MECHANICAL CUSTOM ASSEMBLIES

ERIE has the unique combination of facilities for producing electronic components, molded plastic parts, metal stampings and embossed wiring boards, for Electronic and Mechanical Custom Assemblies. Such assemblies are essential in the design of Computers, Business Machines, Automatic Industrial Controls, Electronic Organs, Communication Equipment, Guided Missiles and Ordnance Materiel.

A definite trend has been toward unitized assemblies that help speed production and insure a minimum of down time on end use equipment. Through research, design and actual production of component packaging for a number of years, ERIE has kept pace with this fast growing industry. By subcontracting certain basic assemblies to ERIE, you, the manufacturers, can devote more of your engineering time to the design of new equipments and development of end use systems, and save on your final unit costs.

The Electro-Mechanical Division of Erie Resistor will welcome the opportunity to consult with you on the possible economies to be gained through the use of ERIE assemblies.



Typical ERIE Electronic and Mechanical Assemblies

- Pluggable and Modular Units
- Unitized Multiple Component Networks
- Transistorized Assemblies and Assemblies for Military Use
- Memory Matrix Devices
- Panel Wiring and Cabling

ERIE

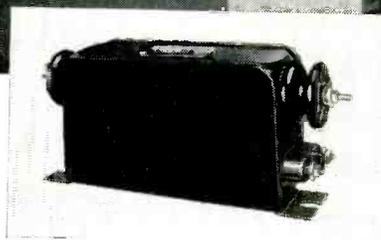
electro-mechanical

ERIE ELECTRO-MECHANICAL DIVISION

ERIE RESISTOR CORPORATION

Main Offices: ERIE, PA.

Factories: ERIE, PA. • LONDON, ENGLAND • TRENTON, ONTARIO



Battery Of Leeson No. 108 Coil Winders installed in the plant of Acme Electric Corporation, Cuba, N. Y. The most advanced hand-feed coil winders ever designed, Leeson No. 108's wind 4 to 30 paper insulated coils in stick form simultaneously. Note how conveniently the controls are located for quickly changing to a new coil spec — one of many advantages for speeding production on long or short runs. Inset shows an Acme Electric precision-wound luminous tube transformer which features coils that provide 18 MA 12000 volt secondary.

At ACME ELECTRIC...Leesona coil winders provide new production advantages

Manager credits No. 108 machines with vital share in increasing output

Transformers made by Acme Electric Corporation are used in a wide range of equipment, including radio, TV and other electronic apparatus, rectifiers, neon signs and fluorescent lighting. To meet increased demands for its products, Acme Electric recently replaced old hand-feed coil

winding equipment with new Leeson No. 108 Hand-Feed Coil Winders. Plant Manager W. F. Koubek of Acme Electric sends the following report:

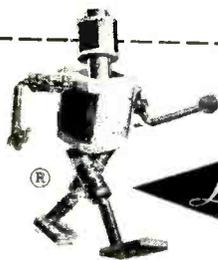
"Leeson No. 108 Winders are doing a great job of expanding our production. For short runs on a wide variety of coil types, the quick-change features of these machines are unequalled. We're getting excellent results in both quality and quantity from the accuracy, easy operation and fast winding speed of our new 108's."

Many similar reports prove how Leeson No. 108 Coil Winders — the most accurate, flexible and economical hand-feed winders ever developed — are bringing important benefits that can save you time and money, too.

Get the Whole Story

The coupon below will bring you complete facts on Leeson No. 108 Coil Winders, together with other helpful coil winding information. Why not check and mail it today?

23B.4.6



FOR WINDING COILS
IN QUANTITY...
ACCURATELY... USE
LEESONA WINDING MACHINES

Post-Show Demonstration

Oct. 8-15 (inclusive) Hotel Biltmore
Los Angeles, Cal.

Private showing to keep you informed of latest coil winding equipment and methods. You are invited to come or send your people. Hours 9 a. m. to 6 p. m. Tuesday and Thursday until 10 p. m.

UNIVERSAL WINDING COMPANY

P. O. BOX 1605, PROVIDENCE 1, RHODE ISLAND, Dept. 129

HIGH RESOLUTION LABORATORY STANDARD DC VOLTMETERS



For most applications these rugged portable, self-contained nulling voltmeters replace a potentiometer, voltbox, galvanometer and standard cell combination. They are suitable for laboratory use, production line testing and field service.

Model LVM-5

Voltage Range: 0-100 Volts DC
Resolution: At least 50 microvolts between 0 and 1 volt
500 microvolts between 1 and 10 volts
5 millivolts between 10 and 100 volts
Absolute Accuracy: $\pm 0.1\%$ of reading
Input Impedance: Infinite at null

Model PVM-4

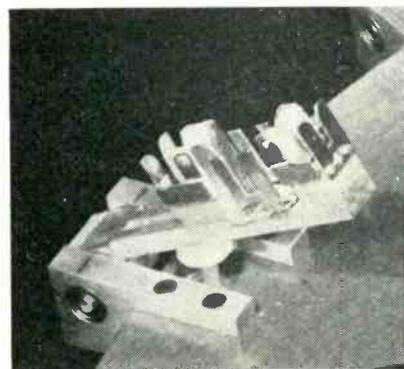
Voltage Range: 0-600 Volts DC
Resolution: At least 5 millivolts between 0 and 10 volts
50 millivolts between 10 and 600 volts
Absolute Accuracy: $\pm 0.1\%$ of reading
Input Impedance: Infinite at null

Computer Company of America, Division of Bruno-New York Industries Corp. also manufactures the IDA analog computers and accessories. Their usefulness in the field of dynamics has been proven over the years.

A complete line of standard computers, instruments and regulated power supplies is supplemented by the ability to design and manufacture specialized equipment for your particular applications. Your inquiries are invited.

The Model LVM-5 may also be used as a deflection potentiometer, a sensitive null indicator and a precision millimicroammeter. Write for catalog PL which describes these instruments completely. Address Dept. E9D

COMPUTER COMPANY OF AMERICA
Division of BRUNO-NEW YORK INDUSTRIES CORP.
460 WEST 34TH STREET • NEW YORK 1, N. Y.



Hinged V-block is pushed up by plunger on under-table solenoid to toss capacitor out into bin

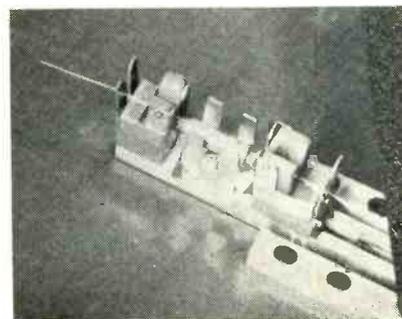
these stages. The system can be set up to use four or eight tolerance stages, with an increase in speed for four-stage testing.

All high-voltage stages are protected by a clear Lucite guard and interlocking switches. With minor modifications, the system may be adapted to testing of resistors, inductors or any combination of these.

The memory system under the metal housing at the center of the table uses the storage of voltage on a capacitor. The correct capacitor in the memory bank is charged at the test station; the bank of capacitors rotates with the indexing table and this voltage is used to fire a thyatron at the correct eject station. Capacitors are ejected by an air-operated plunger which is controlled by a solenoid air valve in the plate circuit of the thyatrons.

The test voltages in the breakdown tests are continuously variable from 100 to 5,000 volts. The capacitance measurements range from 40 μf to 5 μf with an accuracy of plus or minus 0.3 percent. Setup time is kept to a minimum. An insulation resistance test station may be added if desired.

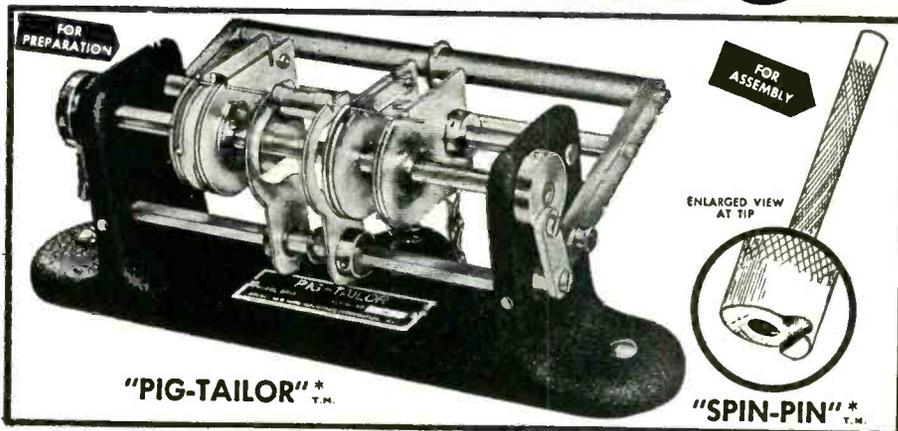
The air-operated, electrically controlled table is satisfactory for the



Capacitor in V-block fixture on turntable

"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. E9-P

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



Broadband RF Power Meters

THE CHOICE OF ALL ARMED SERVICES
FOR MICROWAVE POWER MEASUREMENTS

POWER: PULSE and CW — $5\mu\text{W}$ to 5W average

FREQUENCY: 20MC — 10,000MC

ACCURACY: 5% Absolute at all ranges,
frequencies, temperatures

- **INDICATIONS:** Direct Reading
- **CALIBRATION:** Compensates for All Variables
- **R-F COMPONENTS:** 3, 6, 10 and 20db Attenuators, Bolometer Mount and Elements, R-F Cable
- **BOLOMETER:** Broadband, High Overload Capacity
- **PLUMBING:** $\frac{3}{8}$ " and $\frac{7}{8}$ " 50-ohm Coaxial
- **POWER SOURCE:** 115VAC $\pm 15\%$, 50-1000 cps
- **CONSTRUCTION:** Rugged, meets all JAN, MIL requirements

TYPICAL APPLICATIONS

Microwave Links . . . Television . . . Communications . . .
Radar . . . Telemetry . . . Signal Generators . . .
Laboratory Standards.

Write for descriptive literature to Department E9-M

Bruno - New York Industries Corporation
DESIGNERS AND MANUFACTURERS OF ELECTRONIC EQUIPMENT
460 WEST 34th STREET • NEW YORK 1, N. Y.

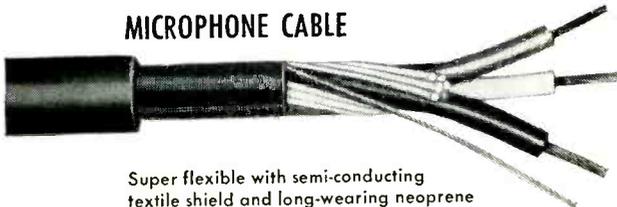


WHITNEY BLAKE CORD and CABLE



FOR POWER SUPPLY, COMMUNICATIONS AND ELECTRONIC APPLICATIONS
ADVANCED DESIGN, HIGHEST QUALITY

MICROPHONE CABLE



Super flexible with semi-conducting textile shield and long-wearing neoprene jacket. Cadmium copper conductors for long flex life, insulated with high dielectric strength rubber. Noisy circuits are eliminated. Other types also available.

SPEECH INPUT AND SOUND SYSTEM CABLES



Semi-rigid polyvinyl chloride Types. Solid or stranded conductors with bare or tinned copper shield. And, with cotton braid or Plastite® jacket. Also, Enamel Textile Types.

SIGNAL WIRES



Bare soft copper conductors insulated with high dielectric strength polyvinyl chloride insulation. Underwriters' Laboratories approved for fire and burglar alarm system internal wiring.

INTERCOMMUNICATIONS CABLES



TELECABLE® Multiconductor Paired Inside Wiring Cable
Semi-rigid polyvinyl chloride insulation, brown or ivory polyvinyl chloride jacket. Light weight, easy to install, unaffected by humidity.

PORTABLE CORDS



Underwriters' Laboratories approved — for power supply on electrical equipment. Neoprene jacketed DYNAPRENE® and rubber jacketed types.

CORD SETS AND CABLE ASSEMBLIES

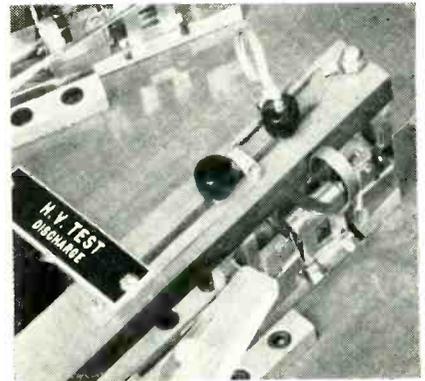
Custom-built to customer's requirements. Using either standard cordage or cord designed to fit your particular application, Whitney Blake can furnish regular line cords or special purpose cords having attached or integrally molded rubber or Plastite fittings.

Well Built Wires Since 1899



© 1955
WHITNEY BLAKE COMPANY

New Haven 14, Connecticut

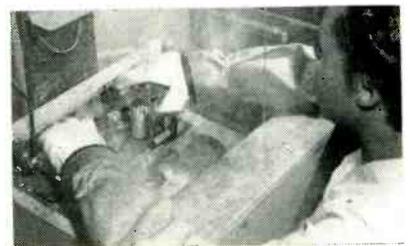


Test station on turntable

lower operating speeds but on faster equipment the table is driven by a variable-speed electrical drive through a Geneva indexing mechanism. This drive operates at higher speeds with a minimum of shock.

Radio is Dip-Soldered with Tubes in Sockets

INSERTING the miniature tubes in the sockets of a printed-circuit home radio before dip-soldering allows for proper positioning of tube pins in sockets. The procedure contributes to product quality in the Jersey City plant of Emerson Radio and Phonograph Corp. When soldering was done before tube insertion, these clips were sometimes suffi-

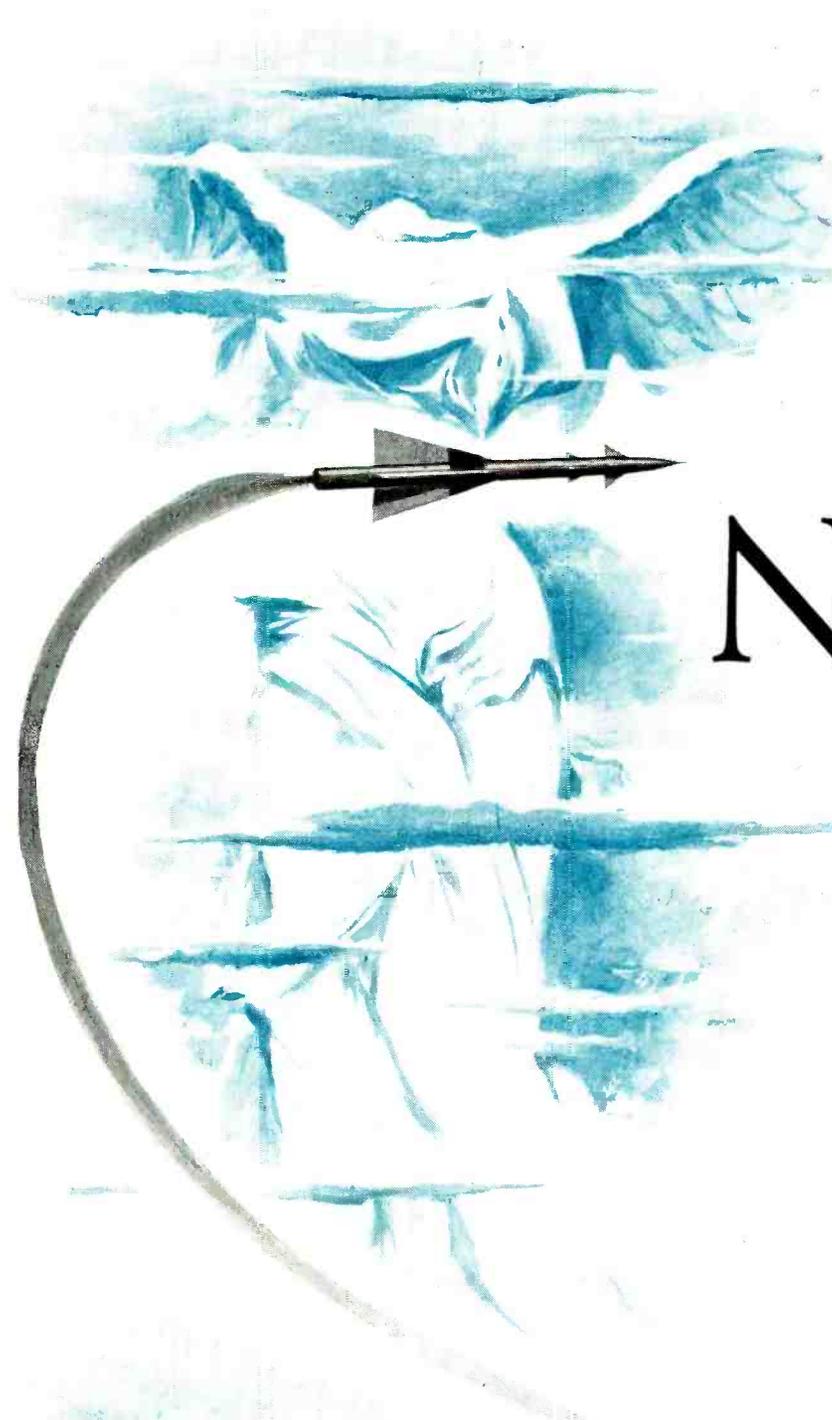


Asbestos gloves and heavy canvas sleeves protect operator during dip-soldering. Lucite shield in front of face gives further protection. Handle of dross-wiping blade can be seen at left of operator's left hand

ciently out of position to make insertion of tubes difficult or impossible.

The cycle used for dip-soldering is 9 seconds at 460 F. Just as a radio is lowered into the solder, the operator presses a foot switch to start a preset timer. This automatically rings a bell at the end of 9 seconds to signify the end of the soldering interval.

Before each soldering operation,



“She not only thinks—she even dreams!” These are the words which express the full implication of NIKE, the new guided missile that has a vital part in defense planning. NIKE seeks, locates, and destroys an airplane... another missile... anything that flies. The deadly reliability of her guidance system depends in part on *SYNCHROS* which translate electrical impulses into positioning data.

NIKE

Based on their experience, research facilities, and performance in volume production, the Precision Components Division of Norden-Ketay was chosen by Western Electric Company, prime contractor, to develop and produce special *SYNCHROS* for NIKE. Norden-Ketay also serves most of the other leaders in automatic control.

Look to Norden-Ketay for
SYNCHROS • SERVO MOTORS •
DIGITAL CONVERTERS • RATE
GENERATORS • RESOLVERS •
MAGNETIC AMPLIFIERS • GEAR
TRAINS • POTENTIOMETERS •
NAVIGATIONAL SYSTEMS •
FIRE CONTROL SYSTEMS • SERVO
MECHANISMS • AIRBORNE
INSTRUMENTS • BOMB DIRECTOR
SYSTEMS • AIR DATA INSTRUMENTS •
COMMUNICATION EQUIPMENT •
COMPUTERS • PRESSURE GAUGES •

“Winged Victory” is the familiar name of this Greek statue of NIKE, goddess of victory, found at Samothrace, (circa 300 B.C.). Her name (pronounced ‘Ny-Key’) was selected by Army Ordnance as most appropriate for the ground-to-air missile developed for them by Bell Telephone Laboratories. Norden-Ketay is proud to have been chosen as an integral part of the team which produced NIKE.

NORDEN-KETAY CORPORATION
99 Park Avenue, New York 16, N. Y.

RESEARCH & DEVELOPMENT LABORATORY:
The Norden Laboratories, White Plains, N. Y.

MANUFACTURING DIVISIONS:
Precision Components Division, New York, N. Y.
Commack, Long Island, N. Y., Hawthorne, California
Instrument and Systems Division, Milford, Connecticut

SUBSIDIARIES: *Nuclear Science and Engineering Corporation, Pittsburgh, Pa.*
Vari-ohm Corp., Amityville, Long Island, N. Y.
Scientific Specialties Corporation, Boston, Mass.

the operator moves a stainless-steel wiper blade across the surface of the solder to remove dross. This blade has wood handles at each end that rest on and slide along the sides of the solder pot, so that the blade can be left in the pot at all times.

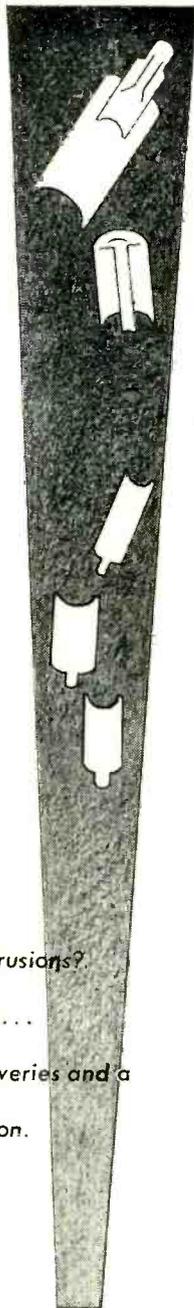
Welding Taps of Precision Windings

PRODUCTION WELDING of tap lead wires to precision windings of 0.0007 to 0.025-inch-diameter resistance wire is being achieved with an electronic tapwelder made by the Hanjohn Co. of Pasadena, California. Terminal definition is maximum, since only one turn of the element may be selected for termination.

The welding technique involves a capacitor discharge at a specified voltage through a circuit which includes both the particular element turn to be tapped and the tap lead wire itself.

The negative lead touches the designated element turn. The positive lead consists of surgical tweezers holding the lead wire which is to be welded thereon. The microsecond of arc resulting from depression of the foot switch and touching of the tap lead wire to the element turn causes a true arc-flow weld, fusing the two wires in a precise, homogeneous juncture.

Positioning of the positive lead on the element-turn to be tapped is achieved by either linear measurement, radial or arc measurement or electrically by a bridge circuit;



Problem shape impact extrusions?

A source . . .

with sure deliveries and a

28 year old reputation.

SunTube
CORPORATION

HILLSIDE, NEW JERSEY

IMPACT EXTRUSIONS • CONDENSER CANS AND SHELLS

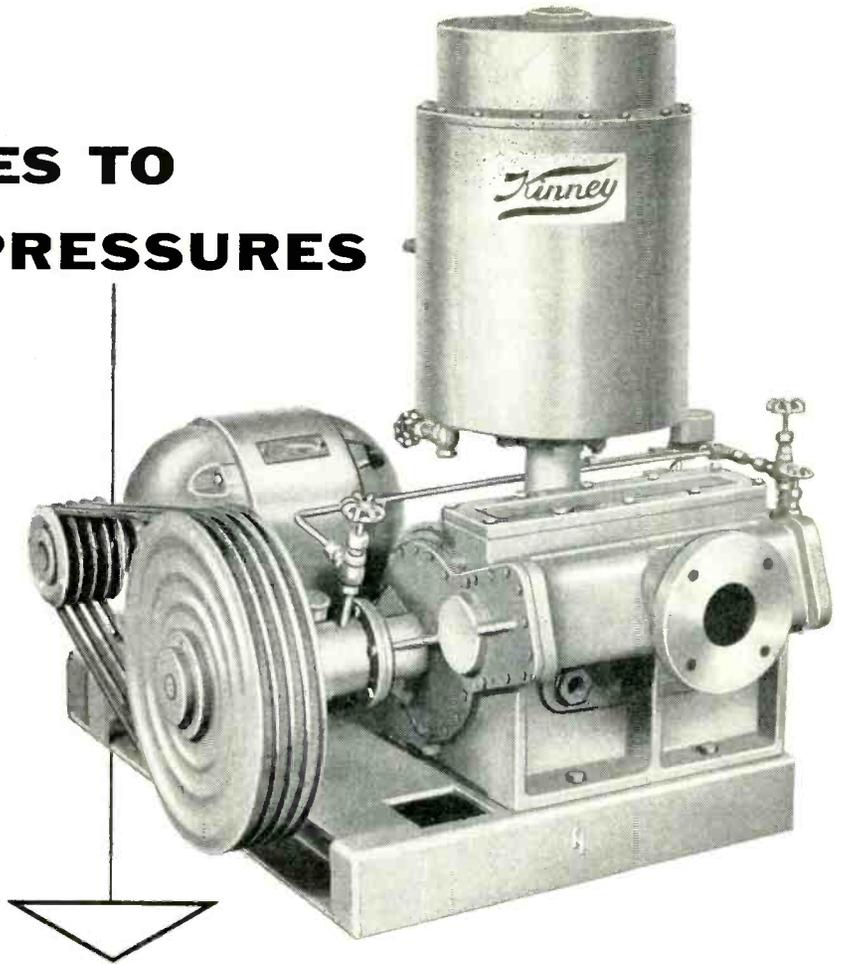


ALUMINUM • ZINC • LEAD • TIN • SILVER



Method of using binocular microscope to aid in welding tap to single turn of resistance wire. Lamps held on microscope with rubber bands illuminate work area. Microscope base slips under wood fixture holding potentiometer

WHEN IT COMES TO LOW PRESSURES



COME TO KINNEY

KINNEY VACUUM PUMPS are at work in hundreds of the nation's foremost vacuum processing systems. Their versatility of application, low maintenance and thorough dependability answer every requirement of the laboratory or pilot plant. Virtually continuous operation can be maintained in the presence of water vapor since the pumps are effectively gas ballasted. For mobile applications, Kinney Pumps, dynamically balanced to reduce vibration, are ideally suited

for use on dollies and carts. Come to Kinney for the right pump for your special requirements — we have the largest line of vacuum pumps in the world from the 2 cu. ft. per min. ¼ h.p. unit to the 780 cu. ft. per min., 40 h.p. model.

Mail the coupon or consult the competent vacuum specialists in our district offices—in Boston, New York, Philadelphia, Cleveland, Chicago, and Los Angeles. Inventory and shop facilities available at Los Angeles.



KINNEY MFG DIVISION
THE NEW YORK AIR BRAKE COMPANY
3565 WASHINGTON STREET • BOSTON 30 • MASS.



Please send Bulletin 425 describing the complete line of Kinney Vacuum Pumps.

Our vacuum problem involves _____

Name

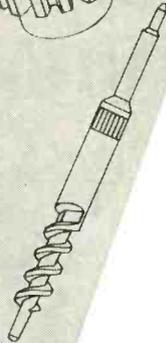
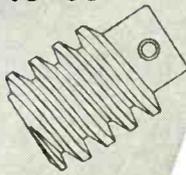
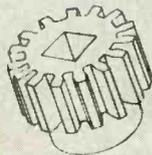
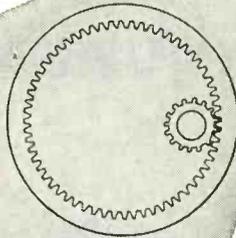
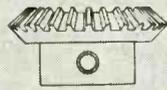
Company

Address

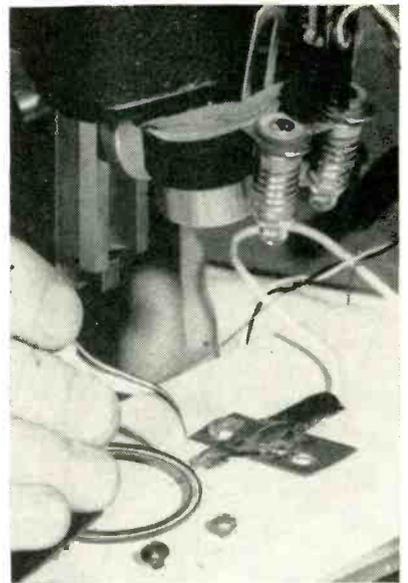
City State

GEARS

DIAMETERS .125" to 60"



*We
invite
your
inquiry*



Turn to be tapped rests on negative electrode of welder. Tap wire is held in tweezer-type positive electrode

where probing is necessary to determine on which element turn the positive lead is making contact, the built-in continuity meter may be used.

In anticipation of the microscope work generally necessary on the extremely small wire, the machine is provided with jacks for plugging in spotlight-type lamps that may be taped onto the microscope. Fracturability of the right-angle weld on very small wires is avoided in practice by applying a drop of adhesive to the completed weld.

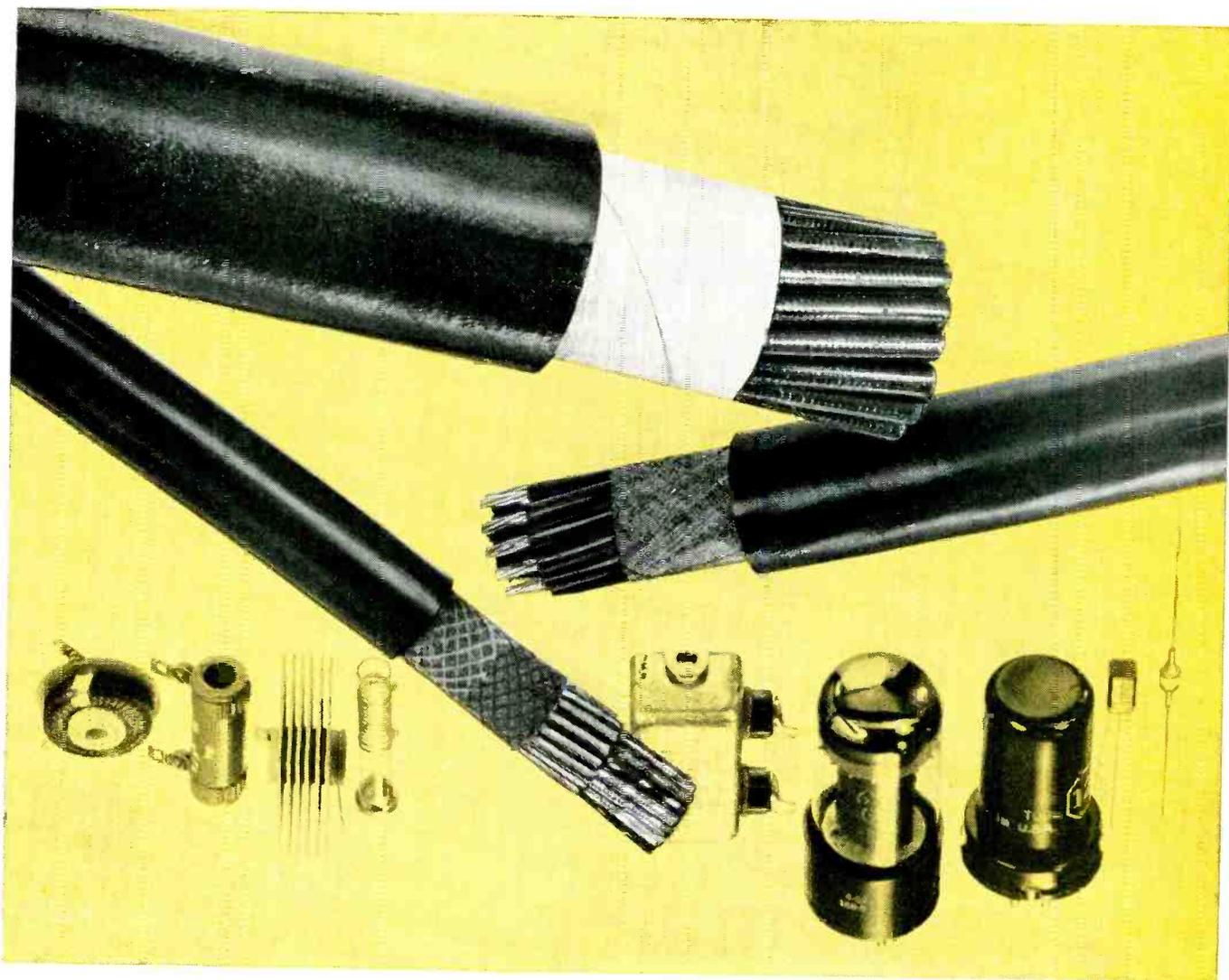
Precise control of certain factors is necessary. Cleanliness of the weld area is imperative. Welding voltages and gage and alloy of tap wire for given gages and alloys of element wire are provided in chart form for commonly used precision resistance alloys.

Installing Electrolytics on Etched Wiring Boards

CONVENTIONAL electrolytic filter capacitors with flexible insulated leads are being successfully mounted on etched wiring boards and dip-soldered in Emerson's Jersey City plant. A capacitor-mounting clip riveted to the side of the gang tuning capacitor holds the electrolytic at such a position that its leads provide their own tension for staying in position during subsequent assembly of other parts on

QUAKER CITY GEAR WORKS
INCORPORATED

RED LION AND PHILMONT ROADS
BETHAYRES, PA., CHAPEL HILL 0800



In electronics... **cables are basic**

Proper choice of wiring material for electronic equipment involves a critical decision. As a component, it may well "make or break" product performance or design. Fortunately, there are guide posts to help you in the selection of a qualified supplier.

Look for essentials

Look, first, for *high quality*. Look for such essentials as full-sized copper, uniformly annealed and precisely stranded. Look, too, for insulations and coverings which have been proven to provide good workability and long-lived dependability.

Then, look... as *your* customers presumably do... for a supplier of responsibility. To qualify, such a

supplier should have (1) a thorough knowledge of electronic wiring problems, (2) engineering and research ability in the development of special cable constructions and (3) complete manufacturing facilities of modern design for the production of specification or custom-built cables.

Rome Cable has all of these things

For some 20 years we have served the electronic industry with complete satisfaction. Rome's high product quality and engineering ability

have gained wide recognition wherever exacting standards of performance are a requisite.

Fully approved

Rome Cable products, commercial and military, are manufactured in strict compliance with the requirements of approval agencies.

With Rome engineering and manufacturing experience, you get full value from your electronic cable dollar. *We will be happy to serve you.* For more details, write for Bulletin TR-5.

*It Costs Less
to Buy the Best*



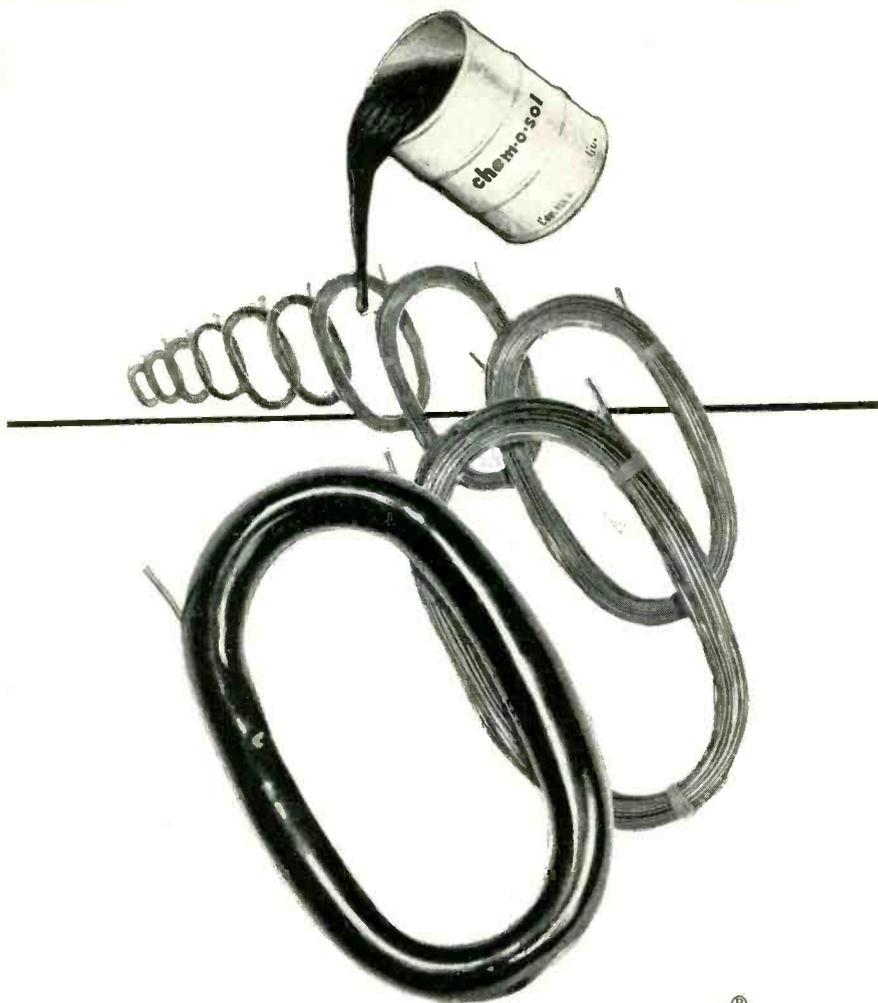
ROME CABLE

Corporation

ROME • NEW YORK

and

TORRANCE • CALIFORNIA



chem-o-sol[®]
 (a plastisol formulation)

**solves another problem
 by coating
 ELECTRIC COILS**

Our client required a tough, abrasion-resistant insulation which could be quickly and economically applied to these motor coils. Our formulating knowledge and experience allowed us to give them a chem-o-sol which not only had the necessary electrical and physical properties but also could be handled on a production line basis.

This particular chem-o-sol was applied by dipping. But this versatile basic material can also be molded, sprayed, die-wiped, and knife- or roller-coated—and comes in practically any color.

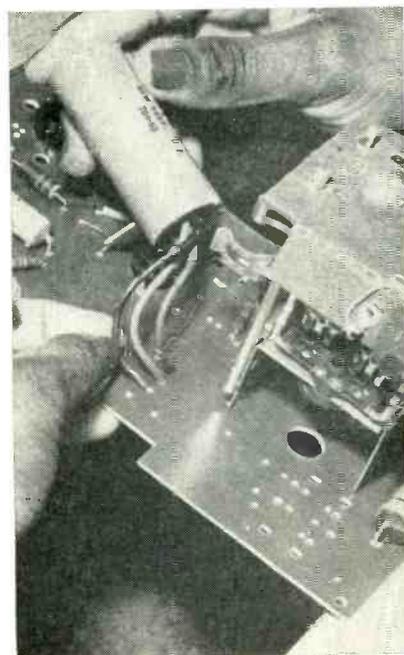
The possibilities of new and improved products through the use of chem-o-sol are unlimited.

Take advantage of our experience and laboratory facilities.

Write for Bulletin 141

Chemical Products CORPORATION

KING PHILIP ROAD • EAST PROVIDENCE, R. I.



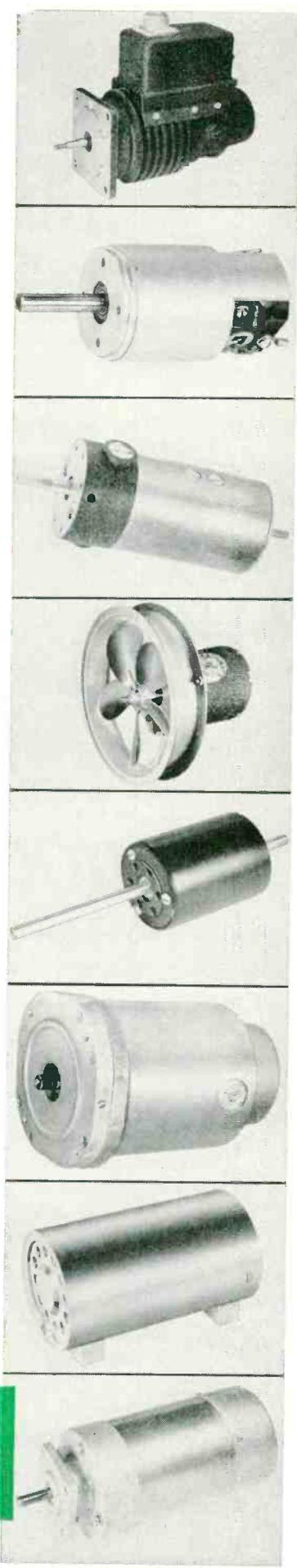
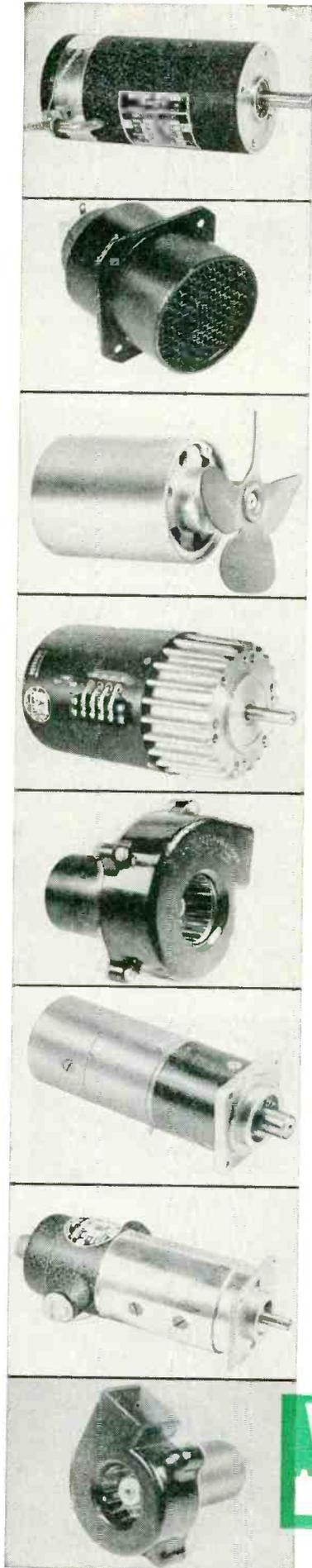
Method of holding filter capacitor while inserting its leads in punched holes of etched wiring board



Pressing capacitor into mounting clip after leads have been inserted in punched holes. Slide-along line with grooved hardwood ways permits insertion of parts having long untrimmed leads, which are cut and clinched manually by operators at end of this line

a slide-along assembly line for these home radio wiring boards.

Holding the capacitor in her right hand, the operator inserts its three leads one by one in the three punched holes allocated to them, then presses the capacitor into its mounting clip to complete the assembly. No preliminary prepara-



**BE SURE OF
RELIABILITY!
SPECIFY
WESTERN GEAR
MINIATURE
ELECTRICAL ROTARY
EQUIPMENT**

**HERE ARE
9 REASONS WHY!**

- die-cast aluminum housings for rigidity
- ball bearings throughout
 - stainless steel through bolts
- bonded stators for greater strength
- full protection against humidity and fungus growth
 - meet or exceed all AN specifications
- constant inspection and 100% performance testing
 - continuing research program to improve techniques and manufacturing methods
 - complete engineering service to insure correct application

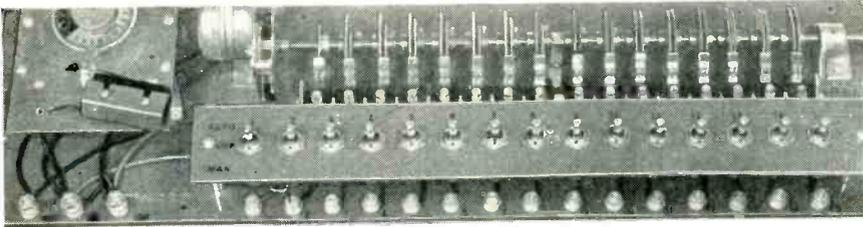
More than 50 basic motor designs, including axial and centrifugal blower designs, ranging from .001 to 2 HP, from 50 to 1,000 cycles, any voltage range, to fill virtually any specification. Please detail your requirements. Our engineers will make recommendations promptly. Write Executive Offices, Western Gear (Electro Products Division) P.O. Box 182 Lynwood, California.

*"The difference is reliability" * Since 1888*

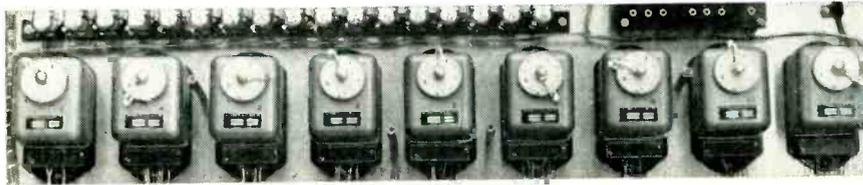
5568

WESTERN GEAR 
PACIFIC-WESTERN PRODUCTS | POWER TRANSMISSION
 GEARS • MACHINERY •

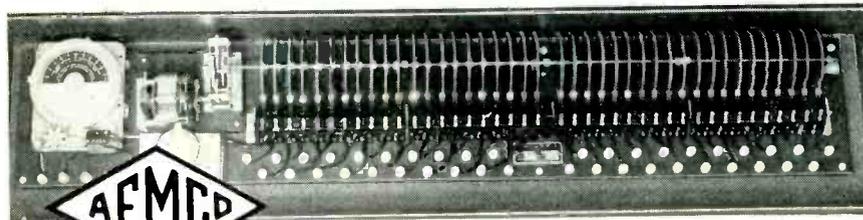
PLANTS AT LYNWOOD, PASADENA, BELMONT, SAN FRANCISCO (CALIF.), SEATTLE AND HOUSTON — REPRESENTATIVES IN PRINCIPAL CITIES



switching . . .



to automatic control?



has a complete line of relays,
timers and time
switches to assist

you

Specialists in the control field for more than 30 years, AEMCO engineering offers you fresh, new ideas . . . ideas that save you money in automatic control . . . ideas that save you valuable time. Yes, AEMCO is selling service as well as a complete line of relays and both automatic re-set and sequence timers.



RELAYS

At AEMCO we specialize in both the design and manufacture of relays to your mechanical and electrical specifications. Should one of hundreds of stock AEMCO relays fail to meet your specialized requirements exactly, we will design and build a unit not only to meet, but to exceed those specifications.

- Open or can types
- Miniatures and sub-miniatures
- Power Relays
- Delayed make or break types
- Circuit control relays
- Current and potential relays



For detailed information on the complete AEMCO relay line, write for your copy of Relay Catalog H.



AUTOMATIC RE-SET AND SEQUENCE TIMERS

Now control that vital operation . . . automatically! Available in many different models with automatic or manual reset, AEMCO industrial time controls help eliminate waste . . . help speed up production. Variations are available on standard cycling models . . . dials are easy to read, easy to set.

- AR and MAR—Automatically re-cycles at end of cycle
- ARD and MARD—Re-cycles with an interruption of current
- ARR—Repeating cycle
- MARA—Two circuits—both closed and open. Circuits completely adjustable
- No. 400—Sequence timer. Momentary start—automatic stop or continuous cycling. Any number of circuits.



For detailed information on AEMCO industrial time controls, write for your copy of AEMCO's Time Control Bulletin.



AUTOMATIC ELECTRIC MANUFACTURING CO.
14 STATE STREET MANKATO, MINNESOTA

tion is required, since the units are purchased from the vendor with leads cut to the right length, stripped and tinned.

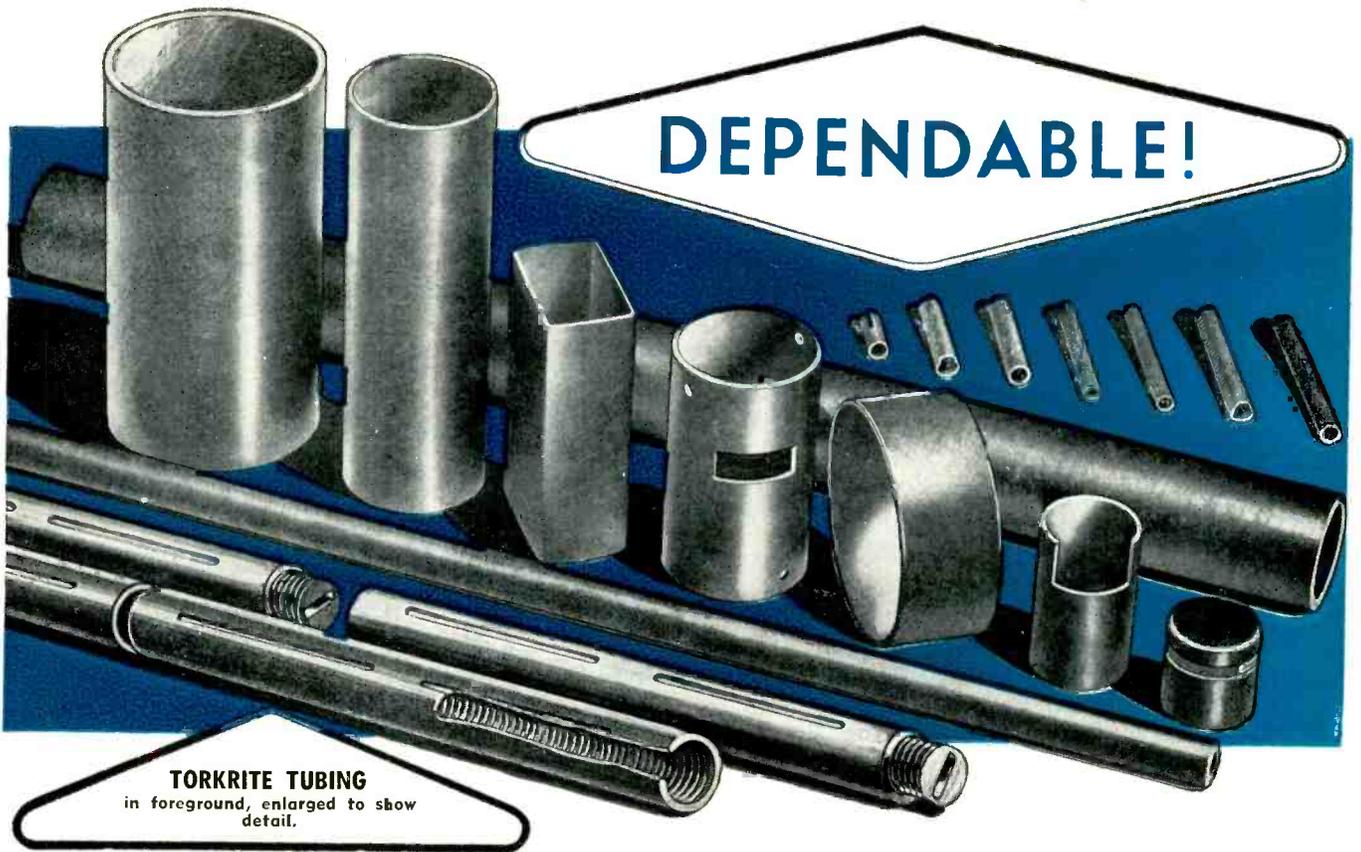
Cork Tape Cutter

ADHESIVE-BACKED cork tape used for cushioning at various points on the chassis and cabinet of an Emerson tv set is automatically cut to desired lengths by a special machine in the firm's Jersey City plant. The machine cuts through the cork without touching the protective cloth backing, so that the tape remains in strips for convenient transfer to the production line. There, the presence of the continuous length of backing strip makes it easy to remove the cork pieces one by one.

To start the operation, the operator loads a roll of tape of the desired width onto the removable pin that fits into slots in angle-iron uprights at the right end of the cutting board. The tape is threaded between idler rolls (since found unnecessary) and pushed through a guide slot up into the cutting wheel. Wheel slots are spaced $\frac{1}{2}$ inch apart along the circumference, in which can be set Stanley single-edge blades. An Allen screw locks each blade in position. With blades in every three slots, the strips are cut into $1\frac{1}{2}$ inch long pieces. Another cutting cylinder is available with slots $\frac{3}{8}$ inch apart along the cir-



Setup for cutting cork tape into pieces $1\frac{1}{2}$ inches long. Metal protective shield for cutter, on bench at left, has been removed to show method of mounting blades in cylinder



DEPENDABLE!

TORKRITE TUBING
in foreground, enlarged to show detail.



DO YOU HAVE TORQUE PROBLEMS?

More and more electronic engineers are specifying this newly designed, internally threaded, embossed tubing.

Torkrite permits use of lower torque as it is completely free of stripping pressure.

With Torkrite, torque does not increase after winding. The heavier wall acts to prevent collapse and core bind.

Investigate this outstanding coil form!



Write for your copy of the latest Clevelite brochure.



CLEVELITE*
Laminated Paper Base Phenolic Tubing

is dependable because of its better quality . . . proven performance . . . high insulation . . . uniformity . . . inherent ability to hold close tolerances.

Also, prompt service and dependable deliveries!

These many advantages assure you of greater economy.

WHY PAY MORE? For Good Quality . . . call CLEVELAND!

*Reg. U.S. Pat. Off.

THE CLEVELAND CONTAINER COMPANY

6201 BARBERTON AVE. CLEVELAND 2, OHIO

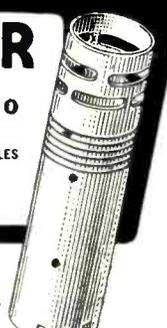
PLANTS AND SALES OFFICES:

CHICAGO • DETROIT • MEMPHIS • PLYMOUTH, WIS. • OGOENSBURG, N.Y. • JAMESBURG, N.J. • LOS ANGELES

ABRASIVE DIVISION at CLEVELAND, OHIO
Cleveland Container Canada, Ltd., Prescott and Toronto, Ont.

Representatives:

NEW YORK AREA: R. T. MURRAY, 604 CENTRAL AVE., EAST ORANGE, N. J.
NEW ENGLAND: R. S. PETTIGREW & CO., 62 LA SALLE RD., WEST HARTFORD, CONN.
CHICAGO AREA: PLASTIC TUBING SALES, 5215 N. RAVENSWOOD AVE., CHICAGO
WEST COAST: IRV. M. COCHRANE CO., 408 S. ALVARADO ST., LOS ANGELES

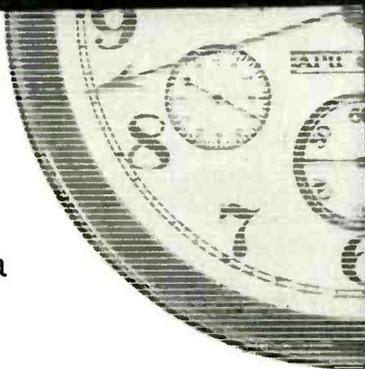




A GREAT NAME CONTINUES GREAT NEW ACHIEVEMENTS

Thomas A. Edison

How Edison achieves extraordinary timing accuracy in a **thermal relay**



By calibrating each 501 Thermal Relay *after* hermetic sealing, EDISON provides unequalled timing accuracy — assures absolute production uniformity. Circuit designers can realize *all* of the benefits of a thermal relay without concern for changes in atmospheric pressure — or the problems of relay maintenance.

This exclusive method of calibrating, developed in the world-famous EDISON Laboratory, is just one of the features that have earned the EDISON 501 Relay an outstanding in-use record. A high degree of vibration and shock resistance, extreme light weight and typical EDISON construction ruggedness are but a few of the other features of the EDISON 501 Relay that lend it to such applications as these:

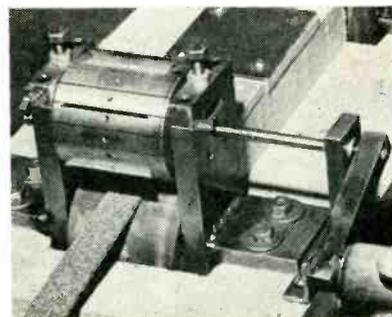
- ▶ Sustained over-current or over-voltage protection
- ▶ Integration of pulses or intermittent current
- ▶ Improving sensitive contact operation
- ▶ General control use
- ▶ Cathode protection
- ▶ "Holdover" circuits
- ▶ Motor starting



Send for complete information on the dependable EDISON 501 Thermal Relay — now.

Thomas A. Edison
INCORPORATED

INSTRUMENT DIVISION • 54 LAKESIDE AVENUE • WEST ORANGE, NEW JERSEY



Details of cutting wheel

cumference, to give in-between lengths of tape.

A machined Bakelite wheel mounted directly under the cutting cylinder serves as a precision rotating anvil, as required for cutting through the cork without cutting the protective cloth backing of the tape.

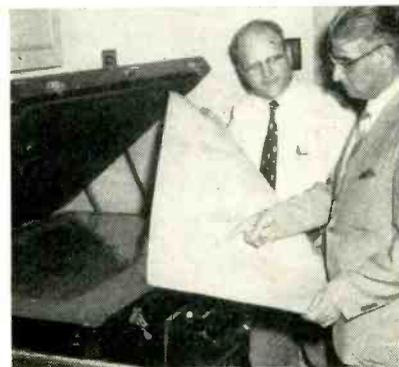
Turning the crank on a shaft of the cutting wheel serves to cut and feed the tape. An operator can cut an entire roll of tape in a few minutes.

Where narrower widths of tape are required, the standard 1/2 or 1-inch widths are run through a slitting blade on a separate cutting board first.

Printed Film Transparencies Reduce Drafting Time

A REDUCTION of more than 95 percent in time needed to produce engineering drawings has been achieved by General Electric in its Philadelphia plant. New and ingenious techniques in the use of photo-mechanical materials and processes now permit making in a matter of minutes a tracing which formerly took 6 to 18 hours.

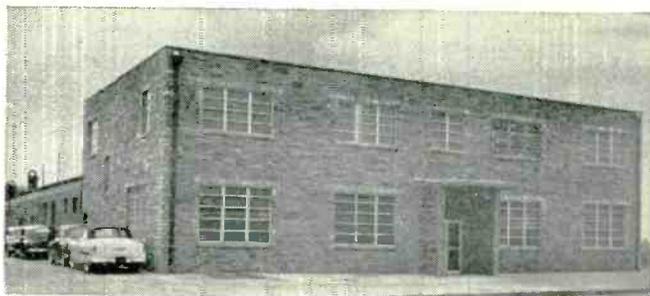
It is merely necessary for the engineer or draftsman to prepare



Examining finished autopositive made from composite film transparency on printing machine



Main plant of Superior Tube Co. located near Norristown, Pa. Cathodes are also manufactured at the Superior Tube Co. plant at Wapakoneta, Ohio.



Johnson & Hoffman factory and office at Mineola, L.I. Electronic and mechanical engineering consulting services are available to all customers.

Superior Tube adds Johnson & Hoffman as new associate—broadens line

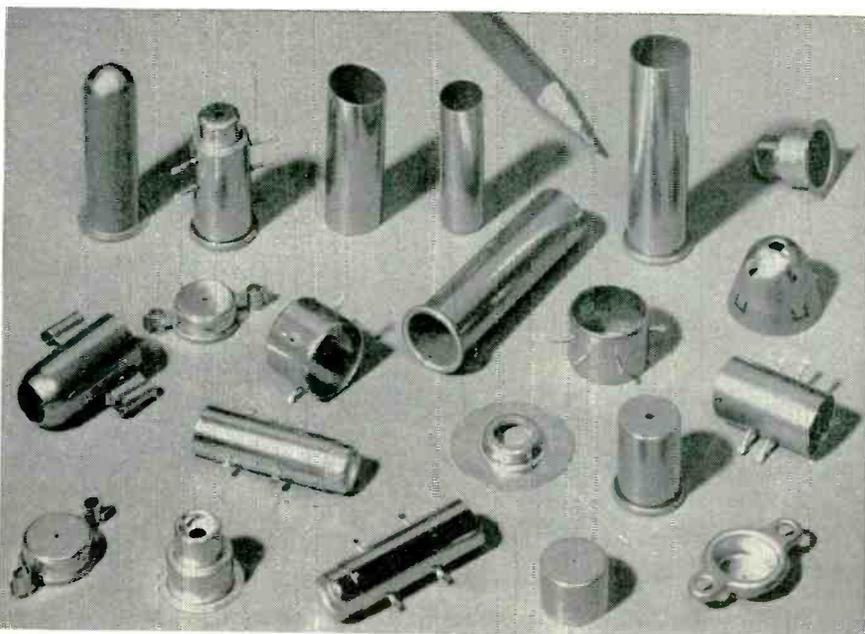
NEW PRODUCTION CAPACITY FOR TUBULAR PARTS: SEAMLESS, LOCKSEAM AND DEEP DRAWN

NORRISTOWN, Pa.—Superior Tube Company, world's leading independent supplier of cathodes for electron tubes, has just brought into its family the Johnson & Hoffman Co., of Mineola, L. I., with its personnel and manufacturing facilities.

Johnson & Hoffman supplies parts and subassemblies used in cathode ray guns to the major manufacturers of cathode ray tubes. It also specializes in general metal and mica precision stampings for other electronic applications.

The new associate will continue to handle its own orders directly with customers, and will be operated by the same management people. Now, with the addition of these new facilities, Superior Tube Co. can offer a broader and more diverse line of products and services than has ever been available before from one source. Write for specific information on tubular parts you need. Superior Tube Co., 2500 Germantown Ave., Norristown, Pa.

Superior Tube
The big name in small tubing



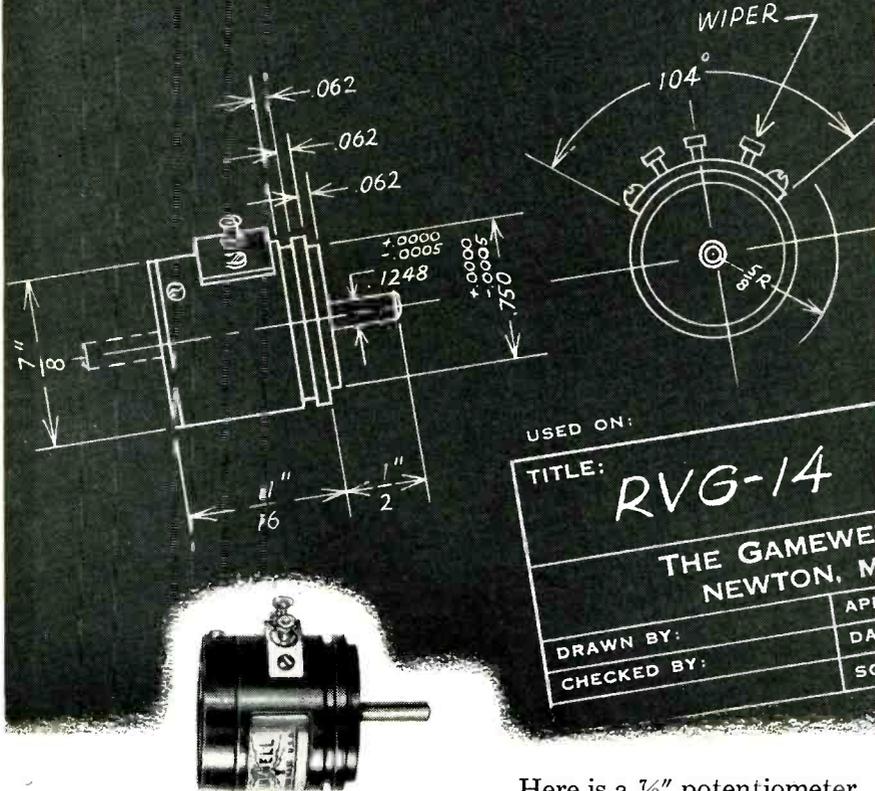
Tubular parts. Johnson & Hoffman anodes, grids and lens assemblies are produced on precision deep-drawing machines from high-quality strip material. Special processing produces high degree of smoothness and surface luster.



Cathodes. Typical electronic products of Superior Tube Co. New miniature disc cathode has significant space and power-saving advantages in cathode ray tube applications. Cathode sleeves are available to extremely close tolerances in Seamless, Weldrawn,* and Lockseam† form in any of a wide variety of cross-section shapes.

*T.M. Reg. U.S. Pat. Off., Superior Tube Co.
†Manufactured under U.S. patents

New 7/8" Precision Potentiometer by GAMEWELL



USED ON:
 TITLE: **RVG-14**
 THE GAMEWELL
 NEWTON, M.
 DRAWN BY: _____ APP
 CHECKED BY: _____ DA
 SC

Here is a 7/8" potentiometer that offers you the extreme precision found in larger sizes of Gamewell Potentiometers.

Body is of anodized aluminum and the shaft is made of stainless steel. Kohlrausch type winding provides excellent linearity and the unit meets MIL-E 5400 specifications as they apply.

The unit can be modified for special mounting. Write for additional information about the new 7/8" type RVG-14 precision potentiometer.

THE GAMEWELL COMPANY

NEWTON UPPER FALLS 64, MASS.



PRECISION POTENTIOMETERS

Manufacturers of Precision Electrical Equipment Since 1855

CONDENSED SPECIFICATIONS

Potentiometer Type No.	RVG-14
Diameter (inches)	7/8"
Rating (watts)	1
Torque, max. (ounce-inches)	0.25
Weight (ounces)	3/4"
Max. Resistance (ohms) ±5%	45,000
Min. Resistance (ohms) ±5%	25
Useful Angle (deg.)	354°
Min. Resolution (%)	0.06
Linearity (%)	±0.5

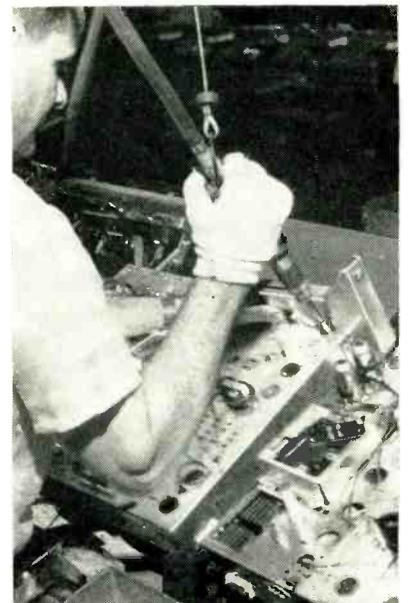
Multiple sections can be ganged; add 1/2" to overall length for each additional section. Better linearities can be obtained on special order.

a simple coded order for the blueprint section. This order embodies all necessary instructions for the preparation by a clerk of a composite film transparency, comprising reusable positive film overlays, from which a translucent auto positive is printed by conventional photo-mechanical methods. The auto positive, which thus becomes the original tracing, has many advantages. It is tougher than conventional tracing paper and can stand rough handling. It has sharper contrast with dense, crisp, black lines which permit high printing speeds. Erasures can be made quickly and easily by moistening the image and using a soft eraser.

A major advantage realized in use of this system is greater drafting accuracy with a saving in time of skilled engineers and draftsmen, due to the eliminating of a substantial amount of detailed sketching and checking.

Wings on Chassis Support 24-Inch Picture Tube

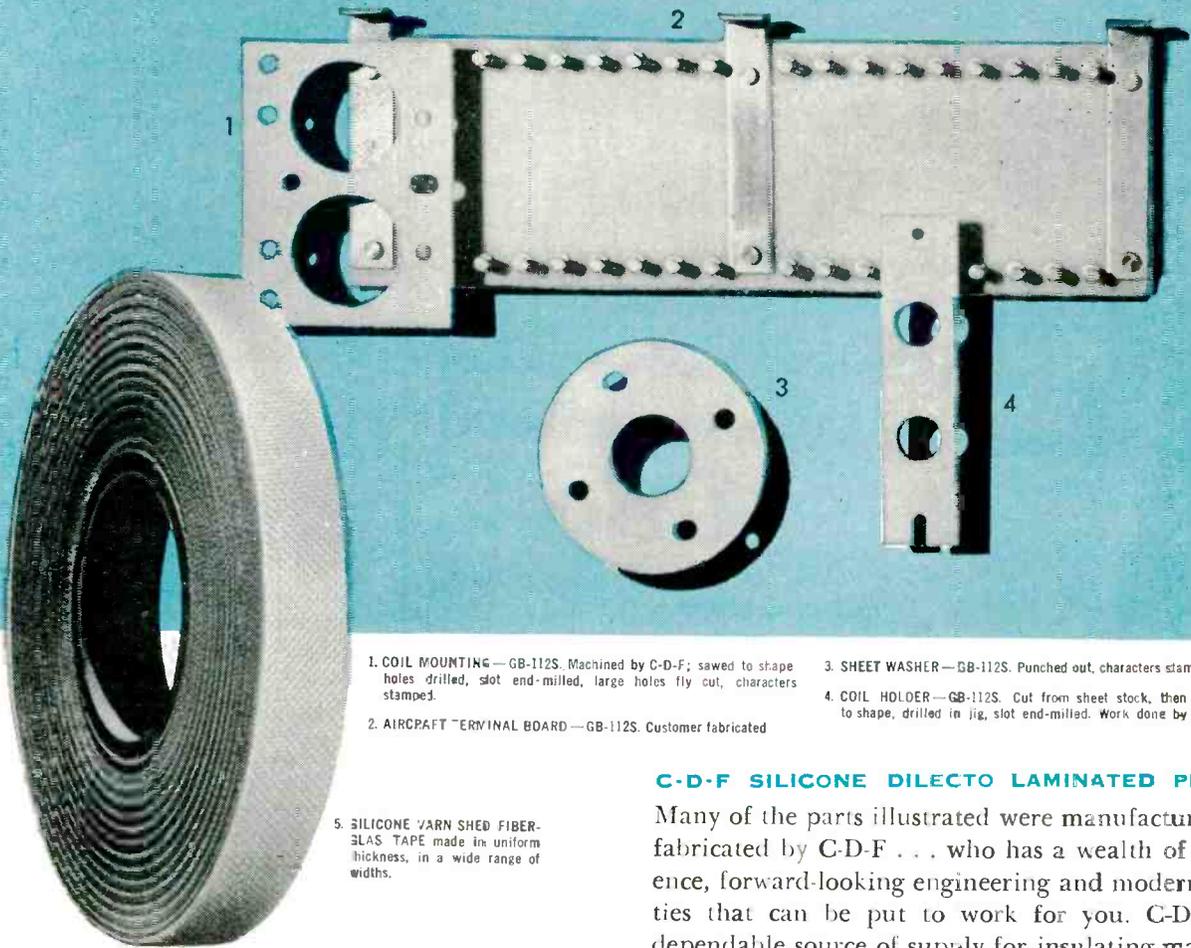
THE SAME belt conveyors and the same chassis units serve for making 21-inch and 24-inch television receivers simultaneously in Emerson's Jersey City plant. For the 24-inch sets, metal wings are fastened to the chassis with an air gun and



Method of using air gun to insert self-tapping screw for attaching wing to chassis to hold 24-inch picture tube. Sliding bread pans can be seen at lower center

C-D-F SILICONES

For high temperature electrical insulation



1. COIL MOUNTING—GB-112S. Machined by C-D-F; sawed to shape holes drilled, slot end-milled, large holes fly cut, characters stamped.

2. AIRCRAFT TERMINAL BOARD—GB-112S. Customer fabricated

3. SHEET WASHER—GB-112S. Punched out, characters stamped.

4. COIL HOLDER—GB-112S. Cut from sheet stock, then sawed to shape, drilled in jig, slot end-milled. Work done by C-D-F.

5. SILICONE VARNISHED FIBERGLAS TAPE made in uniform thickness, in a wide range of widths.

C-D-F SILICONE TAPES are recommended for Class H insulation. It's been proved that silicone insulation has 10 times longer life than Class B insulation, even at the temperature limits of Class H. There are two types of C-D-F Silicone Tapes and Sheets: (1) Silicone varnished fiberglass; (2) Silicone rubber fiberglass. Each has the following properties:

- High temperature resistance
- High dielectric strength
- Low dielectric loss
- Resistance to moisture
- High tensile strength
- Flexibility

Both grades meet A.I.E.E. Standard for Class H insulation. They resist mild alkalis, non-oxidizing acids, mineral oils, oxygenated solvents. Silicone rubber fiberglass is recommended for many applications requiring a flexible abrasion-resistant material with good thermal conductivity. C-D-F Silicone tapes and sheets are available in a wide range of sizes in continuous rolls. For complete details, write for Technical Bulletin #47.

C-D-F SILICONE DIELECTO LAMINATED PLASTIC

Many of the parts illustrated were manufactured and fabricated by C-D-F . . . who has a wealth of experience, forward-looking engineering and modern facilities that can be put to work for you. C-D-F is a dependable source of supply for insulating materials, and is noted for its fair pricing, for producing high quality products on schedule. Why not call in a C-D-F sales engineer on your problem. Or, write for Technical Bulletins:

#25—complete data on GB-261S, a fiberglass silicone laminate made of a staple filament woven fiberglass cloth and silicone resin in sheet form; #37—covers glass base silicone metal clad laminates; #42—post-forming grade of glass base silicone in sheet form; #23—GB-112S, fine weave continuous filament woven fiberglass with silicone resin, sheets, tubes, rods, molded shapes.

See our general catalog in Sweet's Design File for more data, the address and telephone number of your nearest C-D-F sales engineer. Also, write for technical bulletin and specific catalog, free test samples, or send us your print for quotation.



Continental-Diamond Fibre

CONTINENTAL-DIAMOND FIBRE DIVISION OF THE BUDD COMPANY, INC.
NEWARK 16, DELAWARE

self-tapping screws, to serve as out-rigger supports for the wider picture tube. These wings necessitate having 2 inches more space between chassis units on the moving belt. The required space is achieved automatically by running one belt conveyor faster than the other.

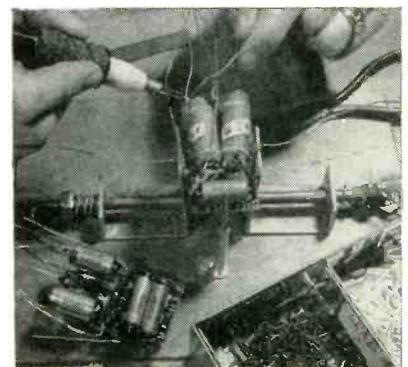
On the first conveyor belt, chassis units touch each other while upside down for insertion and soldering of under-chassis parts. At the end of this conveyor, an operator turns the chassis over in its steel pallet and moves it around the bend, for loading onto a similar belt conveyor running back down the other side of the long line. When 24-inch sets are going through, this second conveyor is speeded up just enough to get the required 2 inches of extra space for the wings.

A metal trough running down the entire length of the line on each side, in front of the operators, serves as a support for standard bread pans used for holding parts. These can readily be slid along the line, changed or removed as needed for production requirements. This trough arrangement has proved simpler and superior to a former arrangement wherein brackets riveted to the pans were slid along a steel strap bolted to the front of the line.

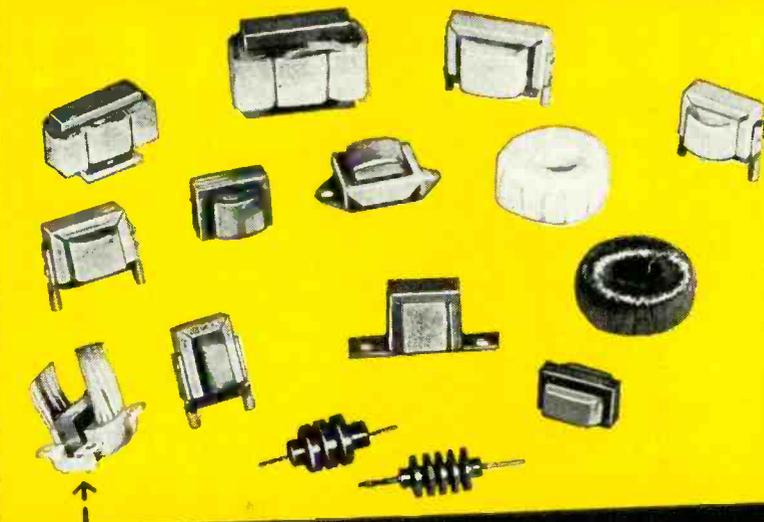
Building Potted Amplifiers

SECTIONS of airborne electronic equipment are assembled on small cards suitable for embedment in epoxy resin to form plug-in units, in the Broad Brook, Connecticut plant of Hamilton Standard.

During assembly and soldering,



Holding fixture for cards. Two-electrode resistance soldering iron is being used for assembly. Either holding plate can be pushed back against spring pressure for removing card



ADVANCED TRANSFORMERS AND MAGNETIC AMPLIFIERS

AT Celco

"Advanced" means the smallest, most modern and most efficient miniature components it is possible to make today . . . built to the most precise, demanding specifications of the electronics industry.

BETTER PERFORMANCE WITH LESS WEIGHT AND SPACE

1. Thin-gauged, grain-oriented nickel alloys yield improved magnetic properties.
2. Glass, asbestos, silicone, and polyester film insulations allow higher operating temperatures.
3. Skilled craftsmen using miniaturization techniques highly developed and applied at Celco.

MISSILE AND AIRCRAFT Miniaturized Components

Transformers

- Chokes
- Low Level Input
- Transistor Circuits
- Matching
- Output

Magnetic Amplifiers

- Demodulators
- Saturable Reactors
- Pulse
- Limiters
- Signal

Take advantage of the Celco design and production experience in this specialized field. Get a Celco estimate—improve your quality—reduce your cost.

Constantine Engineering Laboratories Co.

Island Avenue

Mahwah, N. J.



Puts your business on a cash basis

If you are an electronics manufacturer or a wholesaler with annual or potential sales of \$1,000,000 or more you can profitably use our kind of banking service to provide increased working capital without increased indebtedness or dilution of profits.

Why not investigate this modern approach to your money problems and learn how you can put your business on an all-cash basis, with wider opportunities for sales and profits.

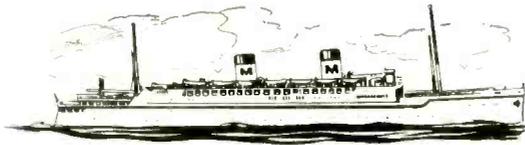
More than four hundred companies in various industries are now profitably using our banking services.



Textile Banking Co., Inc.

Providing operational financing for manufacturers and distributors of furniture, apparel, electronics, plastics and textiles.

55 Madison Avenue, New York 10, N. Y.



HYSOL 6000

goes to sea with RAYTHEON RADAR



The S. S. Lurline, one of the largest U. S. passenger liners, is the first big ship in the world to install Raytheon's new Model 1500 small boat radar. Scheduled for use as "standby" equipment, it will be used in conjunction with the regular 16-inch big ship "Mariners' Pathfinder" radar, shown in foreground and demonstrating comparative size. Chief Officer R. McKenzie inspects scope reading of the Model 1500.

HYSOL 6000 Epoxide Resins Used in Component Parts . . .

Complicated internal component parts of Raytheon radar equipment are formulated from HYSOL 6000 Series epoxide compounds because of their outstanding electrical and mechanical properties. In addition, HYSOL 6000 Series compounds provide a material which is economically molded into intricate shapes, including complicated inserts.

HYSOL 6000 Series compounds are made from the new epoxide resins and include a complete selection of room temperature and heat curing potting and casting compounds, easily machined sheets, rods and tubes, and coating and laminating varnishes.

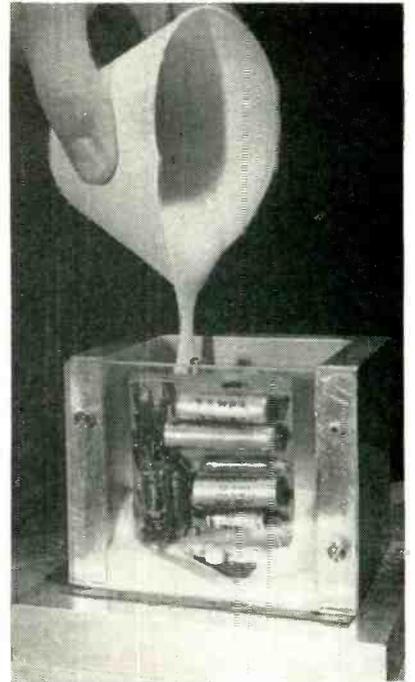
The Raytheon application of HYSOL 6000 may suggest to you other plastic uses now posing a problem in your design or production departments. Houghton Laboratories, Inc., is ready to assist you with these problems through the experienced services of our skilled research laboratory, design and production departments. Your investigation will be welcomed at no obligation. Write, wire or phone today!



houghton laboratories, inc.

100 BUSH STREET

CLEAN, NEW YORK



Cutaway mold with plastic window shows pouring operation

each card is held between spring-loaded metal plates and positioning pins, these guide the operator in keeping parts within space limits so they will not be too near the outer surface after embedment in the plastic. The positioning and holding plates are made up as U-shaped pieces sliding on a metal rod under spring loading. The threaded ends of the rod are bent at right angles and welded to a metal plate serving as a base for the fixture. The positioning pins have pedestals for holding the cards off the base, since parts are mounted on both



Plugging finished unit into chassis of fuel control unit which will calculate almost without time lag the exact amount of fuel left in all tanks of a plane

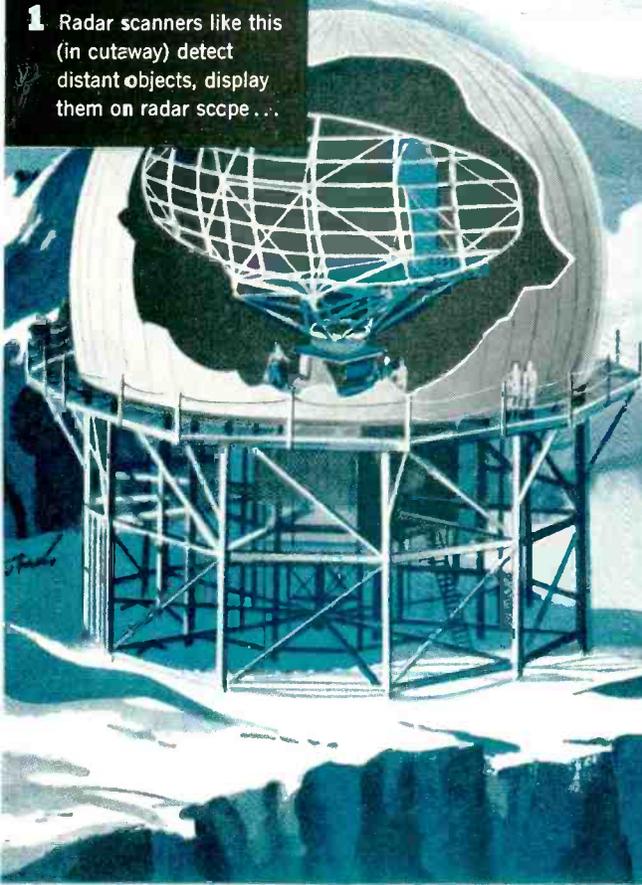
2 In older radars, low-flying planes were lost in "ground clutter," appeared like this on scope...



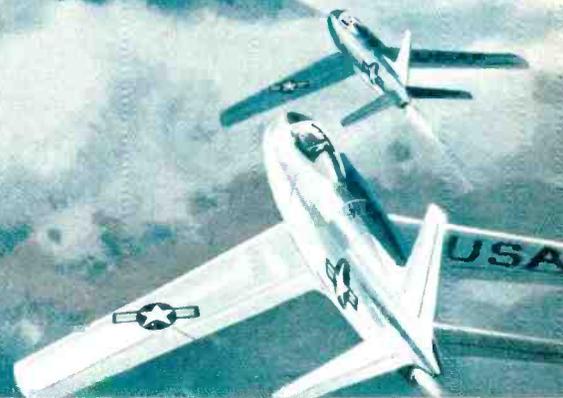
3 New radar has power to eliminate all but moving objects. Low-flying planes appear on scope like this...



1 Radar scanners like this (in cutaway) detect distant objects, display them on radar scope...



4 With earliest possible warning, defenses gain time for effective interception.



NEW POWER SOURCE TIGHTENS RADAR DEFENSES

Million-Watt Klystrons Aid Detection of Distant, Low-Flying Planes

THE STORY BEHIND THE STORY:

What is the significance of the headline above? To borrow from an old baseball expression, "You can't hit 'em if you can't see 'em"—approaching planes that formerly evaded radar detection can now be "seen" at greater distances than ever before.

■ Behind this improved radar vision is a new family of high power tubes known as Megawatt Klystrons. These new tubes not only provide greater ability for beaming radar impulses against small and distant objects, but provide a new

improvement to a technique known as M.T.I. or Moving Target Indication. In radars without M.T.I. everything within the beam of the radar appears on the viewing scope. Images from trees, terrain, buildings, all combine to form "ground clutter" on the scope. M.T.I. eliminates this "ground clutter" by indicating moving objects only. Therefore with Megawatt Klystrons, approaching aircraft can be spotted sooner and defenses can be alerted more quickly.

■ Producing millions of watts of electronic power, these giant tubes make possible illumination of small objects

with radar impulses at greater distances to provide clear, sharp images on the radar scope. Furthermore, the Megawatt Klystron's stable performance and long life assure that these radar sentries are constantly on guard.

■ The Klystron tube made microwave radar possible. Developed by Sperry, it generates, amplifies or multiplies microwaves. Today, Sperry produces Klystrons covering a wide range of powers and frequencies for specific requirements—both military and industrial. To meet demands for these tubes, a new plant has just been opened devoted exclusively to Klystron research and production.

SPERRY GYROSCOPE COMPANY
Great Neck, New York

DIVISION OF SPERRY RAND CORPORATION

INDUSTRIAL POCKETSCOPE

by

Waterman

MODEL S-11-A

DC-COUPLED
WORK-HORSE OF
INDUSTRY

Size:
11" x 5" x 7"
8 3/4 Pounds



ANOTHER EXAMPLE OF *Waterman* PIONEERING...

The INDUSTRIAL POCKETSCOPE, model S-11-A, has become America's most popular DC coupled oscilloscope because of its small size, light weight, and unique flexibility. This compact instrument has identical vertical and horizontal amplifiers which permit the observation of low frequency repetitive phenomena, while simultaneously eliminating undesirable trace bounce. Each amplifier sensitivity is 0.1 Volt rms/inch. The frequency responses are likewise identical, within -2 db from DC to 200 KC. Their total undistorted outputs permit effective trace expansion of twice the screen diameter. The internal sweep generator is continuously variable from 3 cycles to 50 KC and can be synchronized from positive going signals. Return trace blanking is optional. Intensity modulation is accomplished by connecting either directly to the grid of the three-inch cathode ray tube or thru an amplifier having a gain of approximately 10 and a flat response to 500 KC. Direct intensity modulation threshold voltage is approximately 1 volt rms. Additional provisions for direct access to all the deflection plates, the second anode, and the amplifier output terminals extend the usefulness of the S-11-A many fold.

WATERMAN PRODUCTS CO., INC.

PHILADELPHIA 25, PA.

CABLE ADDRESS: POKETSCOPE

WATERMAN PRODUCTS INCLUDE

- S-4-C SAR PULSESCOPE®
- S-5-A LAB PULSESCOPE
- S-6-A BROADBAND PULSESCOPE
- S-11-A INDUSTRIAL POCKETSCOPE®
- S-12-B JANIZED RAKSCOPE®
- S-14-A HIGH GAIN POCKETSCOPE
- S-14-B WIDE BAND POCKETSCOPE
- S-15-A TWIN TUBE POCKETSCOPE
- RAYONIC® Cathode Ray Tubes and Other Associated Equipment

MEMO...
Write for details today!

WATERMAN PRODUCTS

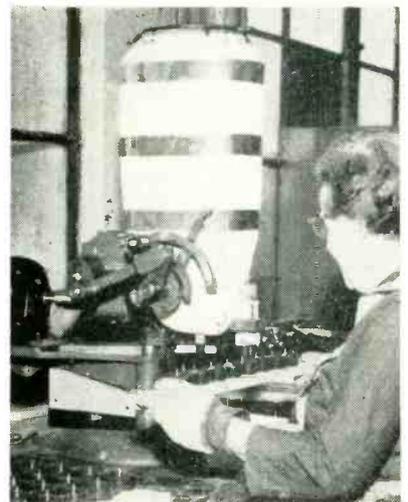
sides of the card.

For embedment, the finished card is plugged in to a metal mold and the resin is poured in from a paper cup. The bottom of the mold has holes for the plug-in terminals; these serve to center the card in the mold, hold it at the correct height above the base of the mold and keep the resin away from the terminals.

The finished unit is trimmed, polished and appropriately imprinted, after which it can be plugged directly into sockets on the chassis of the electronic fuel control unit or other control for which it was designed.

Pump Feeds Cement to Both Sides of Mold

A NEW dual-nozzle metering pump for hot or cold cements, sealing waxes and other viscous materials makes it possible to pour approximately equal quantities simultaneously into opposite sides of a mold or cavity. This technique is desir-

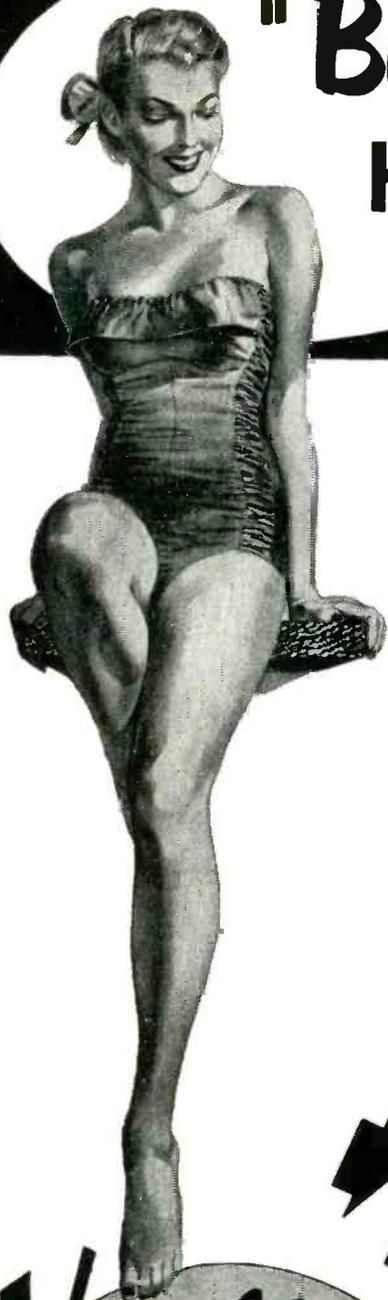


Setup for applying molten sealing wax simultaneously to both sides of lightning arresters for radio and television antennas

able when it is not practical to pour into the center of the cavity, either because there is an obstruction or restricted area in the center, or the cavity is relatively shallow and the material would chill before spreading completely, or overflow the sides if poured in a single mass.

The dual-nozzle pump is being used by JFD to apply molten seal-

"Best Suited" for
HIGH TEMPERATURES



VARGLAS SILICONE CLASS H TUBING and SLEEVING

for applications requiring prolonged heat endurance at temperatures up to 260°C.

Varglas Silicone tubing and sleeving were developed by Varflex for applications involving continuous operating temperatures up to 260°C. Exceptional stability is combined with the following qualities . . .

Flexibility — sharp turns and 90° bends cause no cracking or peeling — no loss of dielectric strength.

Dielectrically-Strong — All grades conform to NEMA and MIL-I-3190 standards.

Moisture-Resistant — including resistance to salt water, mild alkalis and acids.

Flame-Resistant — Standard burning test is 45 seconds to burn 1 inch. Can

be made self-extinguishing on special order.

Cold-Resistant — Excellent resistance to chafing and abrasion, flexible to -35°C.*

*For temperatures down to -65°C, and for applications requiring extraordinary flexibility, we recommend our new Varglas Silicone Rubber sleeving and tubing. Inquiries invited.

Send for FREE SAMPLES

Mail coupon today for free folder containing 25 different test samples of Varflex insulating sleeving, tubing, lead wire and tying cord.



Varflex
CORPORATION

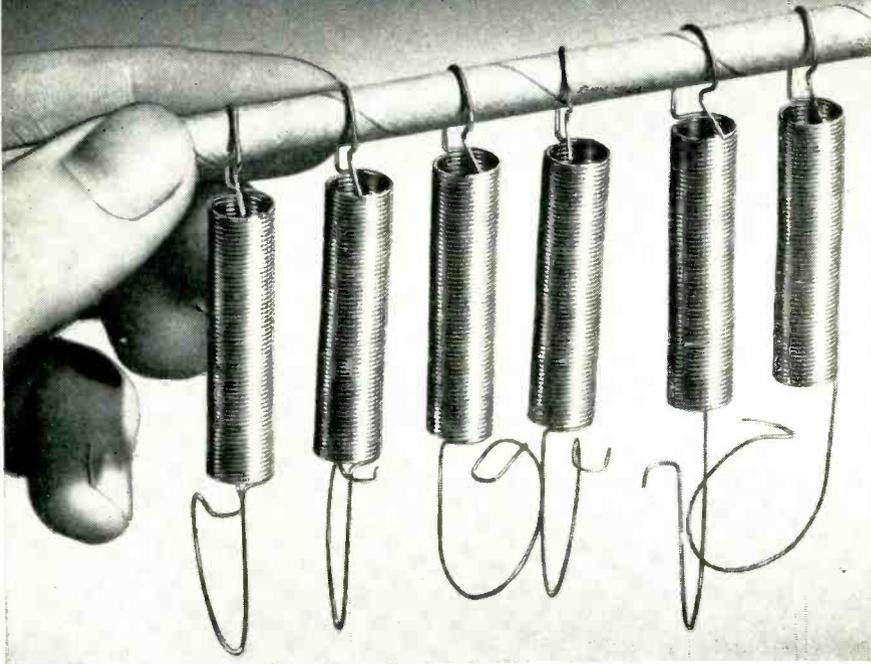
Makers of
Electrical Insulating
Tubing and Sleeving

VARFLEX SALES CO., INC.
308 N. Jay St., Rome, N. Y.
(for Silicone Products only)

Please send me free folder containing samples of your electrical insulating tubing and sleeving.
I am particularly interested in insulation for _____

Name _____
Company _____
Street _____
City _____
Zone _____ State _____

We'll Help You Put More "Automatic" In Your Automation!



● There is an "extra" Lewis Service many spring users don't know about... it might be called: "packing for production" or "arranged for automation." It's simply the way in which Lewis Springs and Wireforms may be shipped to reach the production line ready for quick, time-saving handling and the most efficient assembly operation... by hand or automatic equipment.

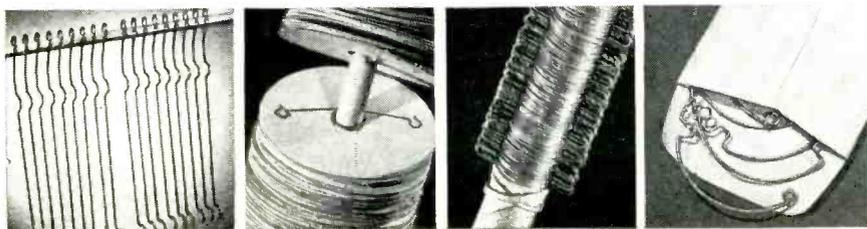
Working with customer's production men, Lewis Engineers devise the packing method best suited to the job: Perhaps threaded on a rod... on special holders... in envelopes... tied or grouped in bundles... and in many other different ways.

If you use springs and wireforms, and have plans to further "automate" production we'd like to help you with our "extras" in Lewis Service. And, of course, top quality springs and wireforms are our business. Send us your problem.

LEWIS SPRING & MANUFACTURING COMPANY
2656 W. NORTH AVE. CHICAGO 47, ILL.

Lewis  **PRECISION SPRINGS**

The Finest Light Springs and Wireforms of Every Type and Material



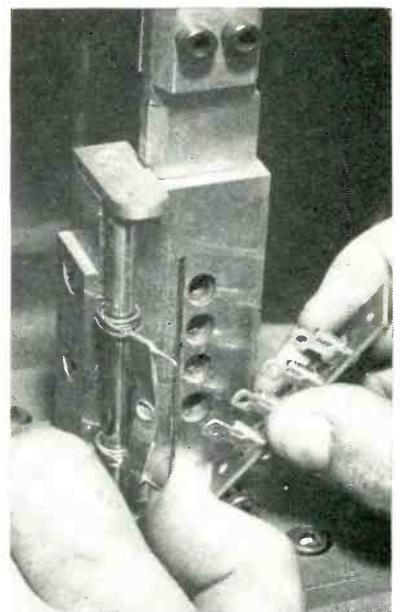
ing wax to lightning arresters. Pouring on both sides of the cavity and central screw in a single operation, instead of the two formerly required, has resulted in a 50-percent saving in labor and a marked reduction in the number of rejects. The operation can now be handled by a nonskilled operator.

The new pump, manufactured by Edward E. Robinson, Inc., Nutley, N. J., has a solenoid control operated by a foot switch, leaving both hands of the operator free for more efficient production. It has thermostatically controlled electrical heating up to 450 F., a no-drip check nozzle and a quantity selector affording instantaneous adjustment to any one of twenty proportional quantity positions. With automatic feeding of parts, up to 6,000 units per hour can be processed.

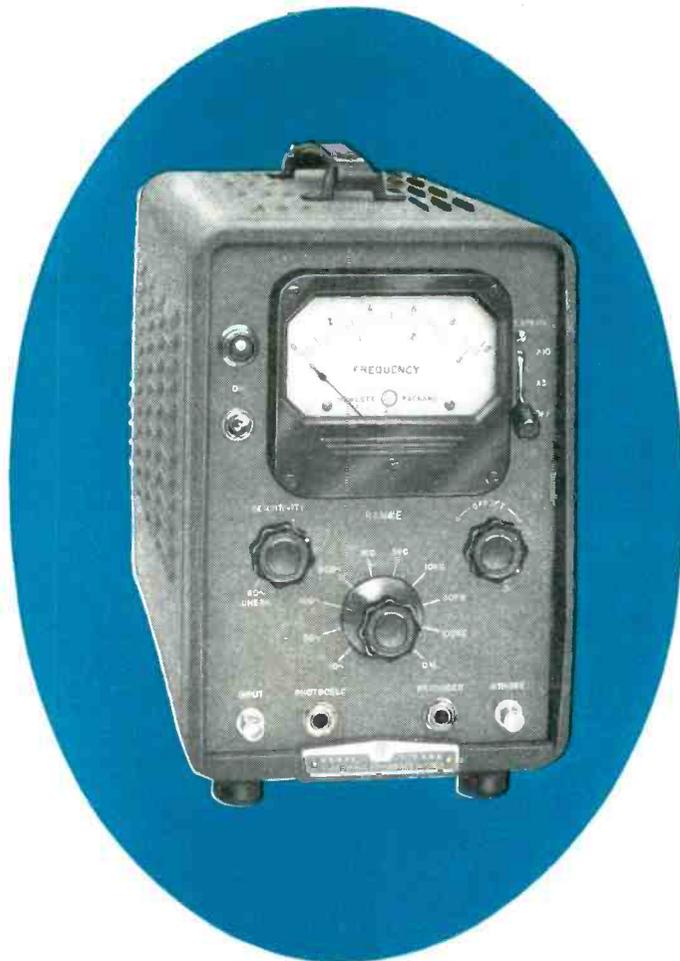
Thread-Mutilating Tool

THE END threads of four screws on a terminal strip are simultaneously mutilated by a simple air cylinder setup in Emerson's Jersey City plant. This prevents the screws from falling out due to vibration during shipment of television receivers on which this strip serves for connecting internal and outdoor antenna leads.

The operation involves pulling back a mousetrap-type spring and



Method of loading terminal strip in holes of die while holding back spring clip with left hand



**New,
convenient,
compact
High accuracy
expanded scale
Ideal for
industrial use**

-hp- 500B FREQUENCY METER—\$285.00

Here's a list of the many industrial and laboratory jobs the new -hp- 500B Frequency Meter can do for you quickly, easily and without elaborate setup:

Count sine waves, square waves and pulses. Indicate average frequency of random events. Measure beat frequency between rf signals. Determine oscillator stability. Measure crystal frequency deviation. Measure temperature, pressure, weight and other physical quantities which can be converted to frequency.

This versatile instrument also serves as a convenient automatic motor speed control, overspeed and underspeed control and makes possible a permanent record of frequency or speed as a function of time. And, it may be used for automatic control of quartz crystal etching.

-hp- 500B covers the range 1 cps to 100 KC and provides direct readings of high accuracy. Readings are not affected by either signal or line voltage variations. An expanded scale permits any 10% or 30% segment to be viewed over the full meter range, making possible highly accurate measurements of differential frequency. A pulse output is provided to sync a stroboscope and continuous recordings of readings may be made on an Esterline-Angus recorder.

Model 500B is extremely compact, light, easy to use and of quality construction throughout. It is also available as Model 500C, calibrated in RPM.

BRIEF SPECIFICATIONS

Frequency Range:	1 cps to 100 KC. 9 ranges.
Input Voltage:	0.2 v sensitivity (sine waves) 1.0 v min. (pulses) 250 v peak max.
Input Impedance:	Approx. 1 megohm shunted by 40 μf .
Accuracy:	Better than $\pm 2\%$ full scale.
Self Check:	Convenient calibration based on line voltage frequency.
Recorder Output:	Panel jack for 1 ma, 1,400 ohm Esterline-Angus Automatic Recorder.
Pulse Output:	To trigger strobe, etc., in sync. with input.
Photocell Input:	Panel jack with bias for 1P41 phototube, 40 μf shunt.
Power:	115/230 v $\pm 10\%$, 50/1,000 cps, 110 watts.
Size:	7 $\frac{3}{8}$ " x 11 $\frac{1}{2}$ " x 12 $\frac{1}{4}$ ". Wt. 17 lbs.
Price:	-hp- 500B or 500C: \$285.00.

Data subject to change without notice. Prices f. o. b. factory.

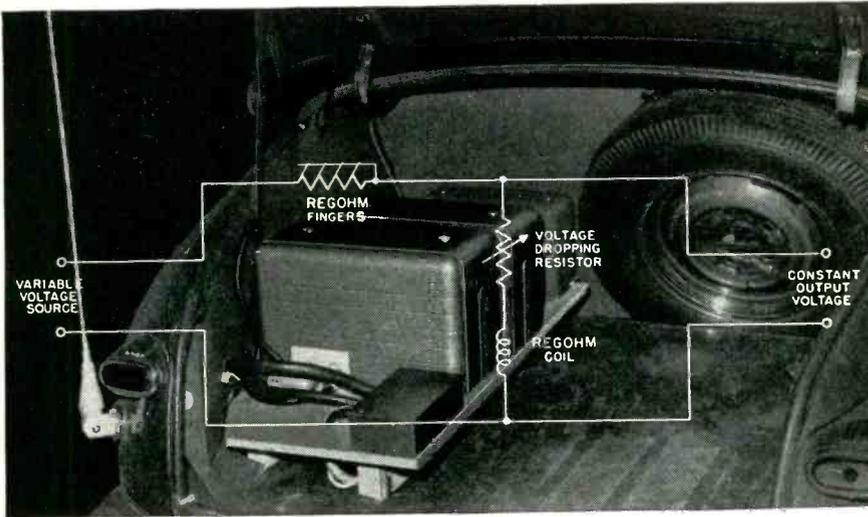


SEE YOUR -hp- REPRESENTATIVE OR WRITE DIRECT FOR DETAILS

HEWLETT-PACKARD COMPANY
3506A PAGE MILL ROAD • PALO ALTO, CALIFORNIA, U.S.A.
CABLE "HEWPACK" • TELEPHONE: DAVENPORT 5-4451

Field representatives in all principal cities

hp ELECTRONIC MEASURING INSTRUMENTS



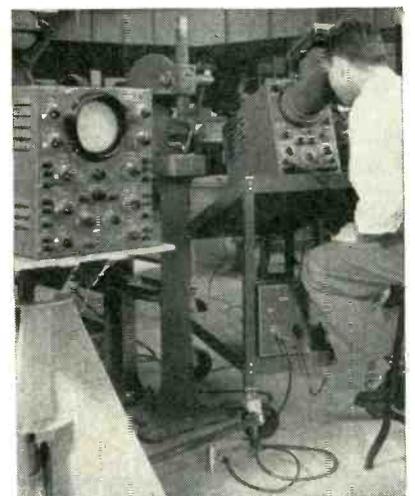
Operating air valve to bring down die-plate that mutilates threads of all four terminal screws at their ends simultaneously

inserting a terminal strip. The terminal screws go into four drilled holes and the terminal lugs go into a single vertical slot. The spring is released to hold the strip in place. The operator then pushes the air valve to operate the cylinder. This brings down a die-plate having four drilled holes, so arranged that the die mashes only the outer two threads of each screw on their upper sides when the die is down.

Drop Test for Instruments

By **SETH T. McCORMICK**
*Technical Products Division
 Allen B. Du Mont Lab., Inc.
 Clifton, New Jersey*

THE DIFFERENTIAL transformer is used to determine the displacement, velocity and acceleration of an in-



Setup for drop-testing finished oscilloscope, on table of hydraulic lift at left. Operator views waveform of impact signal produced by differential transformer in brass cylinder on floor

Extend Vacuum Tube Life *and reduce maintenance* with Regohm DC Filament Voltage Regulation

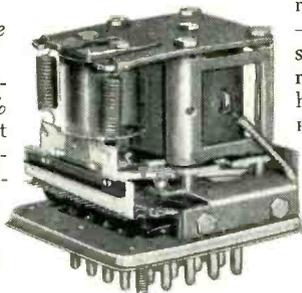
Successful field tests by engineers of one of the leading communications systems led to their using REGOHM to regulate filament voltage and prolong vacuum tube life in mobile telephone systems. You will find it profitable to do the same with your vacuum tube system. Rugged and compact, with long service life, REGOHM's low cost is quickly returned by longer trouble-free tube life and reduced service costs. And REGOHM requires no maintenance.

When filaments are operated above rated voltage, trouble follows. A filament operating at 10% above rated voltage operates on borrowed time. Its life is only one-third as long as it might be with constant voltage. The same life or death statistics apply to other type filaments; with coated filaments, the electron-emitting material may be boiled off and deposited on other tube elements and affect performance.

Variable power-source voltage can be held to a constant by using REGOHM in the type system shown in the schematic. The REGOHM signal coil directly senses filament voltage while finger contacts automatically insert resistance in series with the input line, maintaining a constant voltage.

With Regohm you get these advantages:

Sensitivity: Filament-voltage maintained within a 4% band for all values of input voltage higher than the regulated voltage plus the minimum REGOHM resistor drop. Better regulation at higher voltages possible by using signal amplifying scheme.



Wide Range of Control Resistance:

From zero to infinity within limits determined by the contact ratings. When load currents are less than five amperes, minimum resistance approaches zero, enabling REGOHM to control output voltage at a value only slightly higher than minimum input voltage.

Stability: No anti-hunt network required. Built-in adjustable dashpot insures stability without sacrificing sensitivity or speed of response.

Long Life: At loading of eight watts per step, many thousand hours life can be expected. Infinite life at very low loadings.

Wide Voltage Range: Output voltages from one to 500 volts can be controlled.

Maintenance Free: No maintenance. Replacement simplified by plug-in design. All units interchangeable.

Permanent Adjustment: REGOHM maintains its characteristics after long periods of operation or storage.

Rugged Design: Meets the most rigid commercial and military specifications. Hermetically sealed units available for operation at high altitudes or in corrosive atmospheres. Shock and vibration proof.

An extensive field engineering force is ready to assist you—at no cost—in applying REGOHM to your system. They will calculate required resistor networks, help you choose the proper REGOHM type, engineer special circuiting if needed. Write, wire or phone Electric Regulator Corporation, 100 Pearl Street, Norwalk, Conn. Applications will receive prompt attention.

REGOHM



CONTROL COMPONENT IN: Servo systems • battery chargers • airborne controls • portable and stationary generators • marine radar • inverters • locomotive braking systems • mobile telephones • guided missiles • signal and alarm systems • telephone central station equipment • magnetic clutches • railroad communication systems • magnetic amplifiers.

SHARE IN

GEORGIA'S GOLDEN AGE



ARE YOU IN THE ELECTRONICS FIELD?

Whatever You Make...Whatever You Sell...

... you, too, will find that it's good business to produce in Georgia. Over 7100 manufacturers, including many of America's greatest industrial names, have already staked their claims to share in Georgia's Golden Age. Georgia—scene of America's first gold rush in 1828, today offers many nearby, growing consumer markets to sales-minded industries...



Open For Business Every Day In The Year

Even the weather is on your side in Georgia, where every day is production day. Industry is on the move to Georgia... with an amazing array of natural and physical resources, readily accessible and in abundant supply. Superb transportation—plus a liberal pool of intelligent workers make it easy to produce and move goods *fast!*

Get the facts from Scott Candler, Secretary — Dept. 23



GEORGIA DEPT. OF COMMERCE

SCOTT CANDLER, SECRETARY • 100 STATE CAPITOL • ATLANTA, GEORGIA



when you specify

HAYDON* TIMING MOTORS

TIME — and its accurate measure — are vital factors in today's designs. And whatever your timing requirements, you'll find there's a HAYDON Timing Motor that does the job better . . . opens the way to important improvements and advances in your designs.

Take very slow shaft speeds for example. HAYDON 4400 Series Timing Motors offer speeds from 6 hours to 1 week with totally enclosed gearing and at comparatively low cost. You save the extra bulk and expense of external reduction gears . . . achieve greater compactness, dependability and economy.

When it's time for design improvement it's HAYDON every time. Take advantage of our complete Timing Services. HAYDON'S manufacturing facilities and engineering counsel are at your disposal through the nearby HAYDON Field Engineer.



CLIP AND MAIL THE COUPON FOR HIS NAME — AND FOR AN INFORMATIVE CATALOG — TODAY!

A SUBSIDIARY OF GENERAL TIME CORPORATION



HAYDON Manufacturing Company, Inc.
2433 ELM STREET, TORRINGTON, CONN.

- Send me the name of the nearby HAYDON Field Engineer.
- Send me catalog, "Electric Timing Motors."

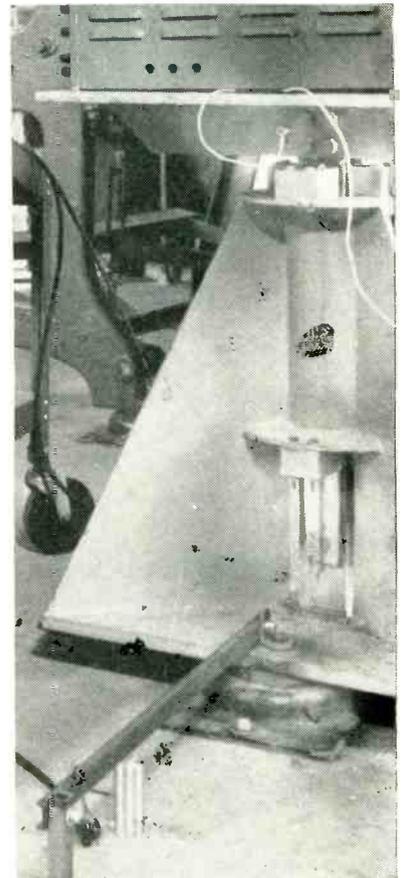
NAME _____
 POSITION _____
 COMPANY _____
 CO. ADDRESS _____
 CITY _____ ZONE _____ STATE _____

* Trade Mark Reg. U.S. Patent Office

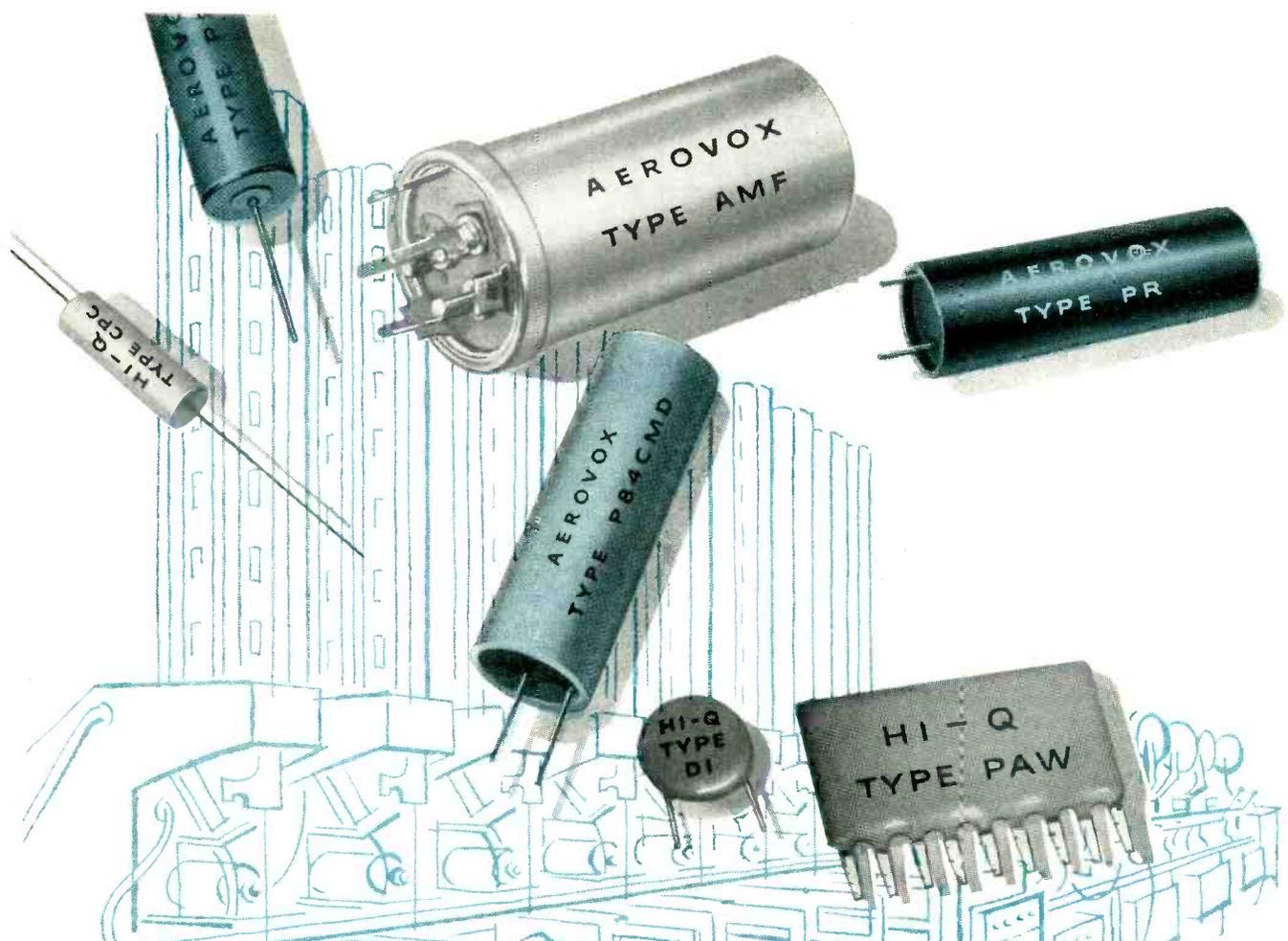
strument on a drop table. The instrument to be drop-tested is fastened on the top of the table and the whole assemblage is lifted hydraulically a short distance and dropped. Impact is controlled by heavy industrial shock mounts under the table.

To bring the displacement of the table within the range of measurement of the differential transformer, a lever arm is fastened to the base of the drop table and pivoted at a point about 3 feet away. The differential-transformer core is attached to the lever a short distance from the pivot point with the differential transformer itself mounted in a heavy piece of brass rod positioned directly underneath.

The output of the differential transformer is applied to a Du Mont type 332 differential-transformer control, where the signal information is removed and in turn applied to the input of a Du Mont type 324 cathode-ray oscillograph where it is photographically recorded by a type



Lever arm is pivoted to floor in foreground with far end bolted to base of shock-mounted table. Differential transformer core, in cylinder, is attached to lever near pivot



AUTOMATION COMPONENTS

All inclusive! That distinguishes the Aerovox automation program from all others. Not limited to any one phase, we are dealing with mechanical, material, electronic, electrical, production and economic aspects for **across-the-board** automation.

Here is an outstanding staff of mechanical experts. A leading machinery company is now incorporated in the Aerovox group. Notable automation developments and pilot plants, including latest printed wiring and module assemblies, are blazing new trails. Aerovox is collaborating with all the mechanized-assembly developers, while our electronic specialists, working side-by-side with mechanical geniuses, are coming up with new components and packaging, function-fitted to mechanized assembly methods.

Such **across-the-board** automation, implemented by outstanding research, engineering, components and production techniques, is available to those interested in **advanced mechanized production**.

Write on your business letterhead for this fact-packed *Automation Manual*. And submit your automation interests, requirements and problems to our *Director of Automation*.



AEROVOX CORPORATION

NEW BEDFORD, MASS.

10 functions in 1



COLORSCOPE VIDEO SIGNAL EVALUATOR

MONOCHROME AND COLOR

In this one multi-function instrument, a complete tool for analysis of every characteristic of the video signal. **COLORSCOPE** is a major advance in TV instrumentation, combining the advantages of multiple functions with a high standard of operating precision. Write for specifications.

Versatile!

10 displays can be switched in sequence on the CRT face: picture monitor . . . pulse cross monitor . . . two lines horizontal time . . . two fields vertical time . . . NTSC vectorscope . . . external vertical signal at horizontal or vertical time . . . external horizontal or vertical amp . . . phase demodulator scope . . . quadrature phase demodulator scope. 14" x 16" x 23" plus power supply, mobile or rack mounted.

TARC
ELECTRONICS

TARC ELECTRONICS INC.

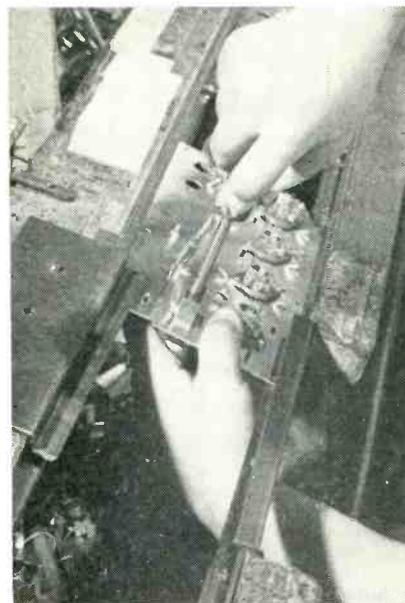
49 URBAN AVENUE • WESTBURY, N. Y.

297 Polaroid-Land oscillographic recording camera.

By successive differentiations of the displacement signal, velocity and acceleration may be obtained. Of interest in the test is the impact in G's on the instrument. We broke several accelerometers in an attempt to use the more direct method of deducing acceleration.

Installing Mounting Clips for I-F Transformers

A SIMPLE rocking tool mounted on a screw-driver shaft is used in Emerson's Jersey City plant to push down the special spring steel clips that are used for mounting an i-f transformer on a metal panel. The operator inserts the transformer in punched holes from underneath, by



Method of using tool to lock spring clips after inserting transformer in metal i-f panel from underneath through opening in frame of Emerson pass-along line



"HOW MEYERCORD
SERVES INDUSTRY"
No. 5 of a Series

MEYERCORD Nameplate DECALS Help You KEEP Your Product SOLD

Meyercord Decals solve the dealer identification and service problem effectively with a time-tested, low cost "factory-dealer" nameplate plan which combines your trademark with the name, address, and phone number of your local authorized dealer. Although ordered by the manufacturer, Meyercord Dealer Decal Nameplates need cost the manufacturer nothing. Specially imprinted Decal Nameplates are sold to and applied by your dealers, who actually save 80% of what similar decals would cost if purchased independently.

We create, design, develop and produce factory-dealer decals in any combination of colors, shape, size, and artwork, in any

quantity. Dealers order small quantities from your company as needed. Meyercord then "personalizes" each dealer order and drop-ships directly to him. Let a Meyercord representative provide details and specific recommendations.

FREE! "Mark-It" Manual of Decal Nameplates

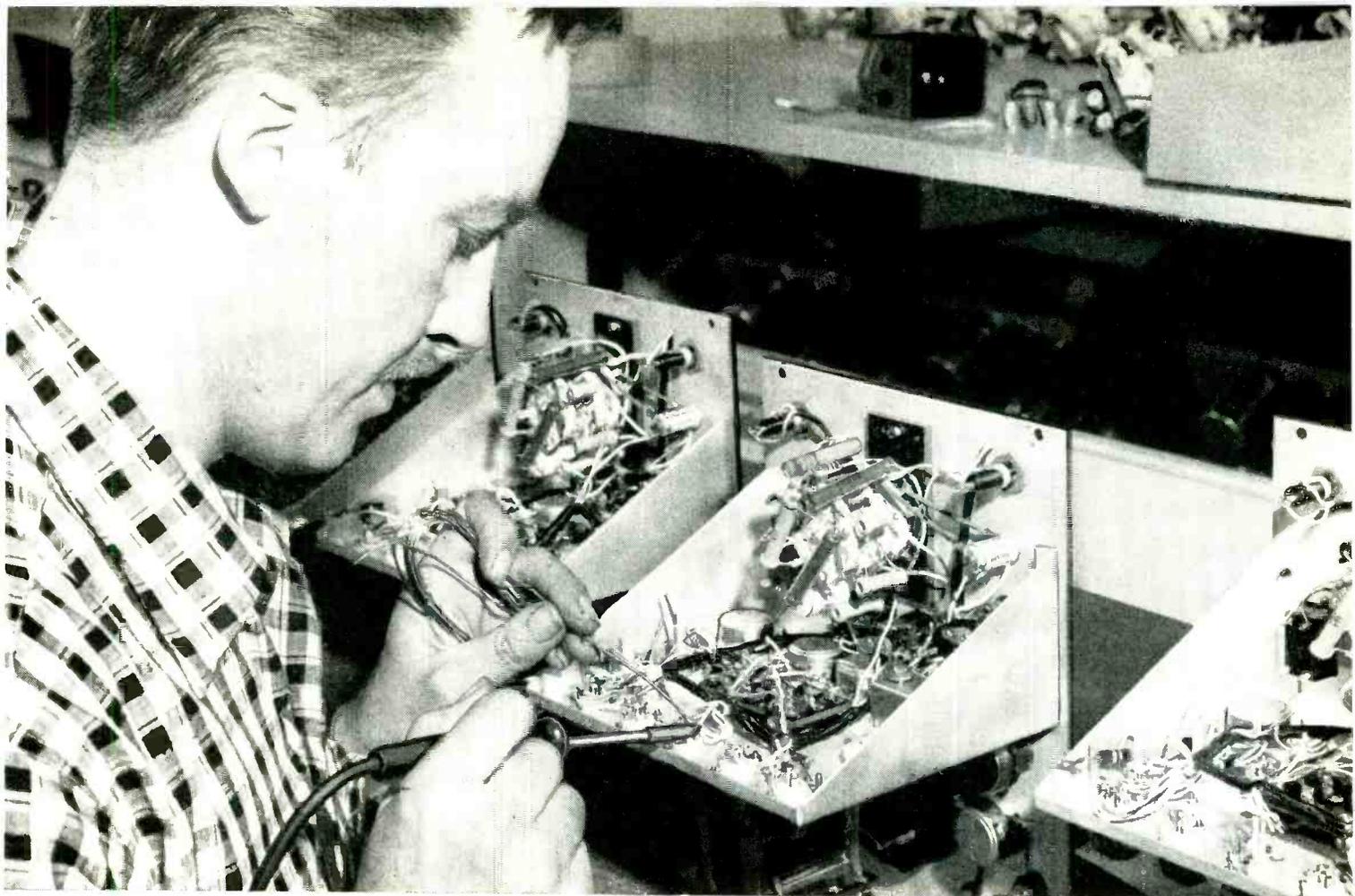
Send today, on your company letterhead, for this valuable full-color guide to every industrial problem in marking, identification, instruction and information. Gives you hundreds of new ideas for the application of decals to your products.

THE MEYERCORD CO.

World's Largest Decalcomania Manufacturers

Dept H-303
5323 WEST LAKE ST.
CHICAGO 44, ILLINOIS

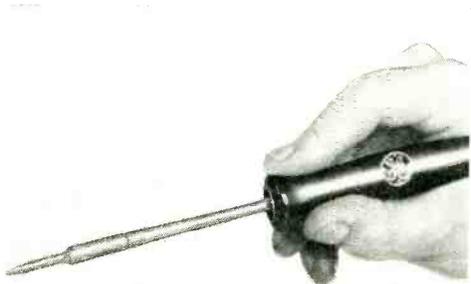
reaching through an opening in the wood support for the metal-rail pass-along rail. At this position, a metal plate on the upper rail and an additional angle-iron strip on the lower rail hold the panel in position so that the operator can push up against it while inserting the transformer. The clip is then halfpushed into position between the transformer terminals on the other side of the chassis, so that one end goes through the chassis



"BEST IRON WE'VE HAD in the plant," says William Fish, a production supervisor of General Radio. This company recently switched to G-E Midget irons for soldering both delicate and

heavy joints in their Type 1862-B Megohmmeters—jobs which formerly required both a heavy and a light iron. In addition, the G-E Midget iron's light weight has helped reduce operator fatigue.

50 G-E Midget irons do work of 100 former irons at General Radio Co., boost production 25%



HANDLES LIKE A PENCIL—Weighing less than a package of cigarettes, the General Electric Midget soldering iron speeds production by reducing operator fatigue.



RAPID HEAT TRANSFER is achieved through a famous Calrod* heater located in the ironclad-copper tip. Result—the G-E Midget iron's heat efficiency is 90%.

*Reg. trademark of the General Electric Company



THREE-IN-ONE IRON with $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{3}{16}$ " tip sizes gives you greater versatility to meet your soldering requirements. Tips can be changed in only 5 seconds.

For more information write for GED-2263, G-E Midget Soldering Iron, Section 724-3, General Electric Co., Schenectady 5, N. Y.

GENERAL  ELECTRIC



After initial adjustments are made, as in photograph, "Mr. Meticulous" automatically performs critical operations in making junction tetrode transistors—tiny experimental devices which may find important uses in the telephone system.

The machine we call "Mr. Meticulous"

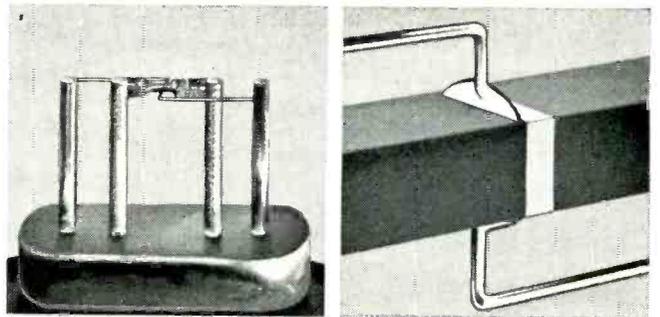
Bell Laboratories scientists, who invented the junction transistor, have now created an automatic device which performs the intricate operations required for the laboratory production of experimental model transistors.

It takes a bar of germanium little thicker than a hair and tests its electrical characteristics. Then, in steps of $1/20,000$ of an inch, it automatically moves a fine wire along the bar in search of an invisible layer of positive germanium to which the wire must be connected. This layer may be as thin as $1/10,000$ of an inch!

When the machine finds the layer, it orders a surge of current which bonds the wire to the bar. Then it welds the wire's other end to a binding post. Afterward, it flips the bar over and does the same job with another wire on the opposite side!

Once only the most skilled technicians could do this

work, and even their practiced hands became fatigued. This development demonstrates again how Bell Telephone Laboratories scientists work in every area of telephony to make service better.



Transistor made by new machine is shown in sketch at left above, magnified 6 times. At right is sketch of area where wires are bonded. The wires are $2/1000$ inch in diameter, with ends crimped to reduce thickness.

BELL TELEPHONE
LABORATORIES

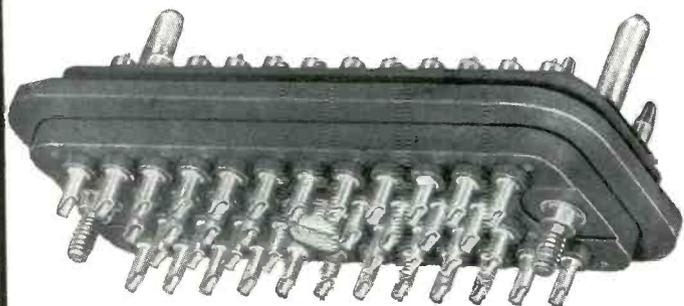
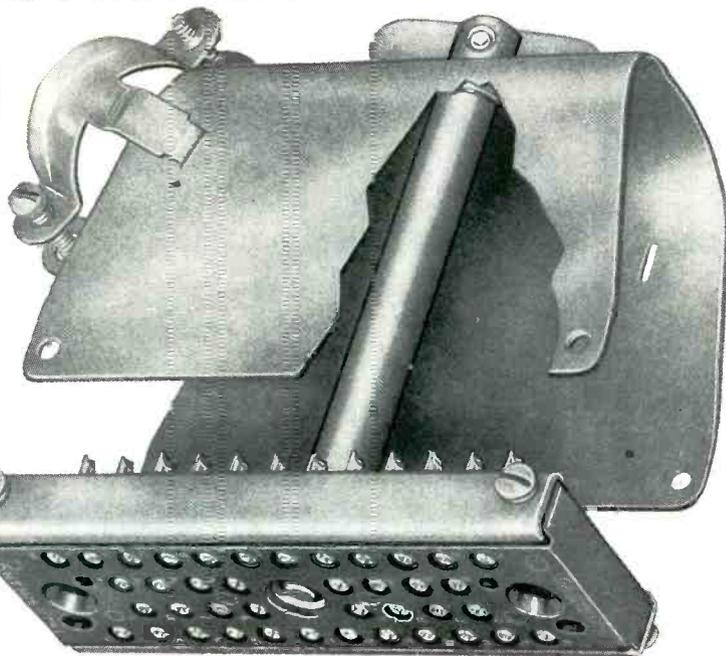


IMPROVING TELEPHONE SERVICE FOR AMERICA PROVIDES CAREERS FOR CREATIVE MEN IN MECHANICAL ENGINEERING

Want more information? Use post card on last page.

new... precision Continental Connectors

Series 'GA'



40 Contacts...
spring loaded for quick release

Quick Release PRESSURIZED CONNECTORS

for guided missile and similar applications

Here's the connector you can specify for pressurized equipment without fear of dangerous air leakage. The Series "GA" plug is molded from Orlon filled Diallyl Phthalate. When subjected to a pressure differential of 30 PSI at 25° C, leakage is less than 1 cubic inch of air per hour. This series is available with hood and cable clamp. Gold plated, nickel silver contacts take #16 AWG wire, and each is spring loaded for easy release. A spring action center screwlock permits quick, easy release or engagement without damage to the unit.

Write for complete technical data without obligation.

Note: Complete Continental Connector Catalog, covering sub-miniature, printed circuit, hermetic seal, pressurized, high voltage and power connectors, is available on request. Send us your name and title on your company letterhead.

Electronic Sales Division
DeJUR-Amsco Corporation,
45-01 Northern Boulevard, Long Island City 1, N. Y.

DeJUR



Method of inserting lacer strip to anchor precision resistors in holder of shipping carton. Each metal tray-load of resistors fills two cartons

lacer. The flaps of the holder are next folded over the resistors and locked in position. This envelope-type package is then slipped into the final cardboard shipping carton.

Resistors can be removed one at a time by pulling back the lacer strip or all can be removed at once by pulling the strip entirely out. This type of packaging is used in the Philadelphia plant of International Resistance Co.

Lead Length Gage

A GAGE that minimizes mistakes in setting up machines for cutting leads of components to desired lengths is used in Emerson's Jersey City plant. It is essentially a square piece of sheet metal having at each of its four corners a projecting rectangle, whose sides correspond in lengths to the various lead lengths commonly used. Thus, the dimensions of the rectangle at one corner are $\frac{5}{8}$ " by $1\frac{1}{2}$ ". Another is $\frac{7}{8}$ " by $\frac{3}{4}$ ", the third is $\frac{1}{2}$ " by $1\frac{1}{4}$ " and the fourth is a 1" square. The dimensions of the sides are clearly stamped in the metal.

With this gage, the operator of a cutting machine can change the setting herself, eliminating the need for calling a mechanic. She can also check the cut leads from time to time as produced by the machine, to make sure that settings have not shifted.

F.M. DEVIATION

Directly Measured



with this time-saving and accurate MARCONI instrument

If you haven't a deviation meter you can use the Bessel Zero or "Disappearing Carrier" method of measurement; this, however, required complex monitoring equipment, an accurately-known modulation frequency, and, finally, mathematical interpretation of results.

With the compact and easy-to-use Marconi Deviation Meter, the modulation frequency need not be known and deviation is directly read on a meter scale.

F.M. DEVIATION METER

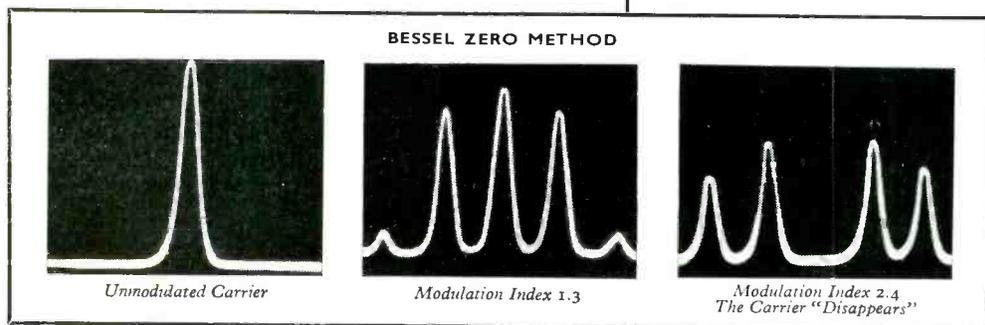
TYPE TF 934/2

Carrier Frequency Range :
2.5 to 200 Mc.

R. F. Input Level :
55 mv to 10 v.

Deviation Measurement Ranges :
5, 25, and 75 kc full-scale.

**Accuracy of Deviation
Measurement :**
±3% from full-scale to half-scale up to
12 kc and ±6% up to 15 kc.



MARCONI INSTRUMENTS

VACUUM TUBE VOLTMETERS • FREQUENCY STANDARDS • OUTPUT METERS • F.M. & A.M. SIGNAL GENERATORS
 DEVIATION METERS • WAVEMETERS • WAVE ANALYSERS • Q METERS • BEAT FREQUENCY OSCILLATORS
 Full data and prices will be mailed immediately on request.

44 NEW STREET • NEW YORK 4

CANADA : CANADIAN MARCONI CO., MARCONI BUILDING, 2442 TRENTON AVENUE, MONTREAL. ENGLAND : Head Office : MARCONI INSTRUMENTS LTD., ST. ALBANS, HERTS.
 Managing Agents in Export : MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2.

TC 40

New Products

Edited by WILLIAM P. O'BRIEN

86 New Products and 63 Manufacturers' Bulletins Are Reviewed
. . . Control, Testing and Measuring Equipment Described and
Illustrated . . . Recent Tubes and Components Are Covered

SELENIUM RECTIFIERS

for printed circuits

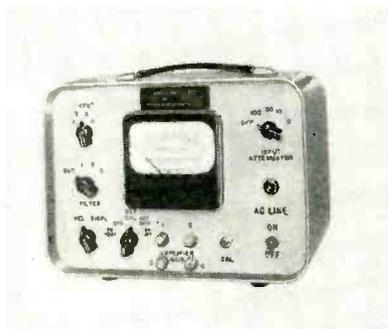
FEDERAL TELEPHONE AND RADIO CO., 100 Kingsland Road, Clifton, N. J., announces a new line of selenium rectifiers for use with printed circuits. Three different types of terminals are available: (1) A square-tipped type for insertion into printed circuit boards up to $\frac{1}{16}$ in. thick. (2) A tapered type designed for maximum ease of insertion by automatic equipment in printed circuit boards up to $\frac{1}{8}$ in. thick. (3) A snap-in type which



holds the rectifier firmly in place even when the circuit board is subjected to vibration or inverted prior to soldering. The printed circuit rectifier series is available in current ratings up to 150 ma for line input voltages up to 175 v a-c. The present series consists of 12 different rectifiers in $\frac{11}{16}$ in., 1 in. and $1\frac{1}{4}$ in. cell sizes, with further expansion planned. These rectifiers can be designed up to 600 ma. Among the advantages are: low assembly and soldering costs, easy insertion, elimination of sockets and adaptability to automation.

VIBRATION METER

both rugged and precise



DUBROW DEVELOPMENT Co., 235 Penn St., Burlington, N. J. Designed for convenience and maximum utility, model 381 vibration meter is a valuable tool for researchers, designers and test engineers in the various fields where mechanical vibration plays an important role. Frequency response is ± 1 percent from 10 to 1,000 cps. Amplitude linearity is ± 1 percent

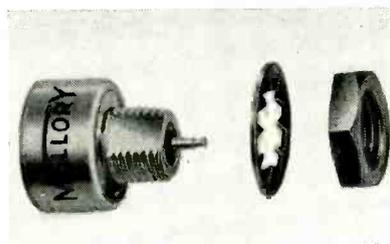
over most of the meter scale. One large indicating meter provides direct readings of both the displacement in mils and the velocity in ips. Three standard input filters provide frequency cutoff at 30, 70 or 110 cps, thus rejecting interfering 1-f vibrations. The filters are plug-in components, and special types can be readily installed by the user. Selection of a particular filter or no filter at all, is accomplished with a switch on the front panel. JAN components are used extensively.

TANTALUM CAPACITOR

with integral mounting

P. R. MALLORY & Co., INC., Indianapolis, Ind. A new refinement of the XT Tantalum capacitor features a method of integral mounting that withstands heavy shock and vibration. Developed for use in guided missiles and other electronic equipment subject to severe acceleration, the capacitor has a threaded neck which fits through a keyed slot in the chassis. A lock washer and hex

nut, supplied with the capacitor, hold the unit securely in place.



Straps or other hardware are not necessary. The capacitor operates at ambient temperatures from -55 C to $+175$ C, and can be supplied for use at 200 C. A wide selection of ratings is available.

PENTODE TUBE

for television receivers

RADIO CORP. OF AMERICA, Harrison, N. J., has added to its line a sharp-



Redesigned

to solve your horizontal deflection problems



—these Sylvania deflection amplifier tubes offer higher plate currents, greater dissipation

Here is a full line of Sylvania Tubes—made to take the tighter conditions of horizontal deflection circuits in streamlined TV chassis designs.

New plate and grid designs achieve minimum zero bias plate to screen grid current ratios of 10 to 1. Plate dissipation has been increased to provide more stable performance throughout tube life. Designed to exhibit low plate knee characteristics, these tubes eliminate “snivet” problems when operated properly within ratings.

Whatever the nature of your TV design problem, Sylvania Tubes are “circuit-designed and circuit-tested” to meet your needs.

Deflection Types for Transformer Circuits

6BQ6GTA	6CD6GA
6CU6	6DQ6

Deflection Types for Series—String circuits

12BQ6GTA	12CU6
25BQ6GTA	25CD6GA
	12DQ6



SYLVANIA®

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

SYLVANIA ELECTRIC PRODUCTS INC.

Dept. 120P, 1740 Broadway, New York 19, N. Y.

Please send complete data on “circuit-designed and circuit-tested” deflection amplifier types.

Check other tube interests.

Other entertainment types

Military types

Special-Purpose types

Control equipment types

Test equipment types

_____ types

Name _____

Address _____

City _____ Zone _____ State _____

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

cutoff pentode designed especially for use in the gain-controlled picture i-f stages of tv receivers utilizing an i-f in the order of 40 mc, and suited also as an r-f amplifier in vhf tv tuners. The 6DE6, a 7-pin minia-

ture type, features a controlled grid No. 1 voltage of -5.5 v for a transconductance of $600 \mu\text{mhos}$ minimum. This cutoff characteristic permits the elimination of the age amplifier in certain tv receiver designs and

minimizes overload distortion and cross modulation effects in the i-f stages. In addition, the 6DE6 has high transconductance combined with low capacitance values which contribute to high gain per stage.

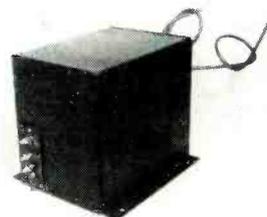
TRANSFORMERS

up to 35kv rms

POWER TRANSFORMER CO., INC., 532 Mulberry St., Newark 5, N. J. Through the use of a special compound with high dielectric characteristics, transformers up to 35 kv rms are built fully encased. Since no liquids are used, no leaks are anticipated. These transformers deliver up to 100 kv d-c at 9 ma in a voltage doubler circuit, or 10 kv d-c at 30

ma in a full-wave bridge, or 15 kv d-c at 20 ma in a half-wave circuit, continuous duty. To insure minimum space for the power supply, the plate and h-v filament transformers are encased in the same can. Plate and filament outputs leads are h-v polyethylene molded, capable of withstanding twice the rated voltage. Applications include

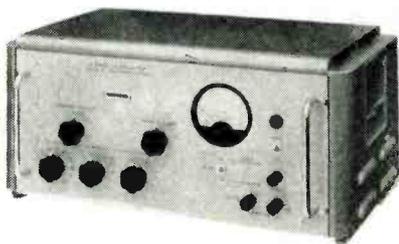
electrical precipitation, cable and h-v testing apparatus and as component of h-v power supplies.



L-F OSCILLATOR

is a 2-phase unit

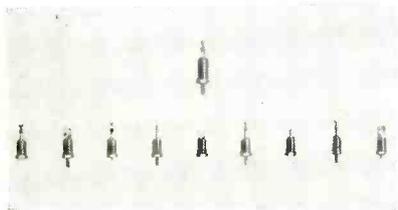
THE SOLARTRON ELECTRONIC GROUP LTD., Thames Ditton, Surrey, England, has available an amplitude stabilized R-C phase-shift oscillator giving a complete range on decade switching of 0.1 cycle to 1.11 kc. With a low d-c and harmonic content, the instrument will prove extremely useful where spot frequencies are repeatedly required to



be set up. Type B0567 oscillator has particular use in the testing of servo systems, also for l-f vibration energization in conjunction with a suitable amplifier. The reference and quadrature outputs are isolated by cathode-follower stages, giving up to 10 v rms with respect to ground from each of the output terminals. Monitoring of output level is kept on a $3\frac{1}{2}$ -in. meter, which can be switched out when the maximum output is required.

TERMINALS

accommodate AMP taper pins



GARDE MFG. Co., 588 Eddy St., Providence 3, R. I., has available miniature and subminiature insulated standoff terminals for h-f applications and miniaturized equipment. They are supplied with taper pin connectors to accommo-

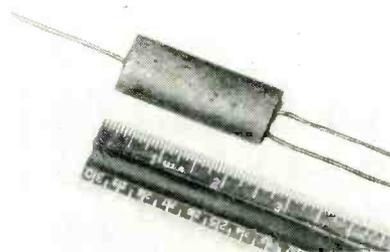
date AMP taper pins for solderless connections. The taper pins are also available on the company's feed-through terminals, headers, connectors, terminal boards and other components. Body materials of the stand-off terminals are designed to meet requirements of MIL-P-14D specifications. Studs are cadmium plated to QQ-P-416 specifications.

POWER SUPPLY

provides bias voltage

MARINE ELECTRIC CORP., 600 Fourth Ave., Brooklyn, N. Y. The RB20 miniature regulated power supply is intended primarily as a source of bias voltage and is completely encapsulated in a cast plastic cylinder

$2\frac{1}{2}$ in. long \times 1 in. in diameter with three wire leads coming out at the ends. Besides the obvious function of applying bias voltage to a high impedance potentiometer, the unit is especially adapted for plate-to-grid coupling in amplifiers. By connecting the input lead to B+, the common lead to the plate of one



ELECTRO TEC SLIP RING ASSEMBLIES

HIGH TEMP PLASTIC!

NEW ETC-7 (POLYESTER RESIN)
USED ON ILLUSTRATED PART FOR
HIGH TEMPERATURE OPERATION

- for high temp applications!

HARD GOLD RINGS!

24 KT. SOLID GOLD RINGS —
ENTIRE RING THICKNESS ELEC-
TRODEPOSITED* UNIFORM
HARDNESS, 90 to 100 BRINELL.

COURTESY LEAR, INC.

— these two features were incorporated in
the assembly illustrated above, having 45
rings, dia. .180", ring width .020", barrier
width .010". Overall length, less leads 1.763".

Electro Tec Corp., in its constant endeavor to keep pace with the most exacting requirements, has developed these new processes and products. They provide flawless performance under conditions far exceeding the capabilities of other types of construction. Where high temperature is involved, the superiority of these assemblies is so marked, that acceptance has been industry-wide. At the same time, an increasing number of users are specifying these assemblies for the ultimate in dependability under normal operating conditions. Inquiries will receive prompt attention; no obligation.

← 72 rings on integral support — no accumulated tolerances — fulfills electrical, minimum weight and space requirements.



Dual purpose assembly combining "V" grooved signal circuits and wide power rings.



Miniature high speed sampling switch — 24 channels.



Combining low friction torque slip rings (.060 dia.) with reference switch segments.

NEW ETC-7 (POLYESTER RESIN) WITHSTANDS TEMPERATURE RANGE FROM -60° to $+500^{\circ}$ F.

PRODUCTS OF PRECISION CRAFTSMANSHIP
BY A NEW AND REVOLUTIONARY PROCESS



**ELECTRO TEC
CORP.**

SOUTH HACKENSACK, NEW JERSEY

*PAT. NO.
2,696,570

MISSILE SYSTEMS

Research and Development

Broad interests and exceptional abilities are required of scientists participating in the technology of guided missiles. Physicists and engineers at Lockheed Missile Systems Division are pursuing advanced work in virtually every scientific field.

■ ■ ■

Below: Missile Systems scientists and engineers discuss future scientific exploration on an advanced systems concept with Vice President and General Manager Elwood R. Quesada. From left to right: Dr. Eric Durand, nuclear physicist, systems research laboratory; Ralph H. Miner (standing), staff division engineer; Dr. Montgomery H. Johnson, director, nuclear research laboratory; Elwood R. Quesada; Dr. Louis N. Ridenour (standing), director, program development; Willis M. Hawkins (standing), chief engineer; Dr. Joseph V. Charyk (standing), director, physics and chemistry research laboratory; Dr. Ernst H. Krause, director, research laboratories.

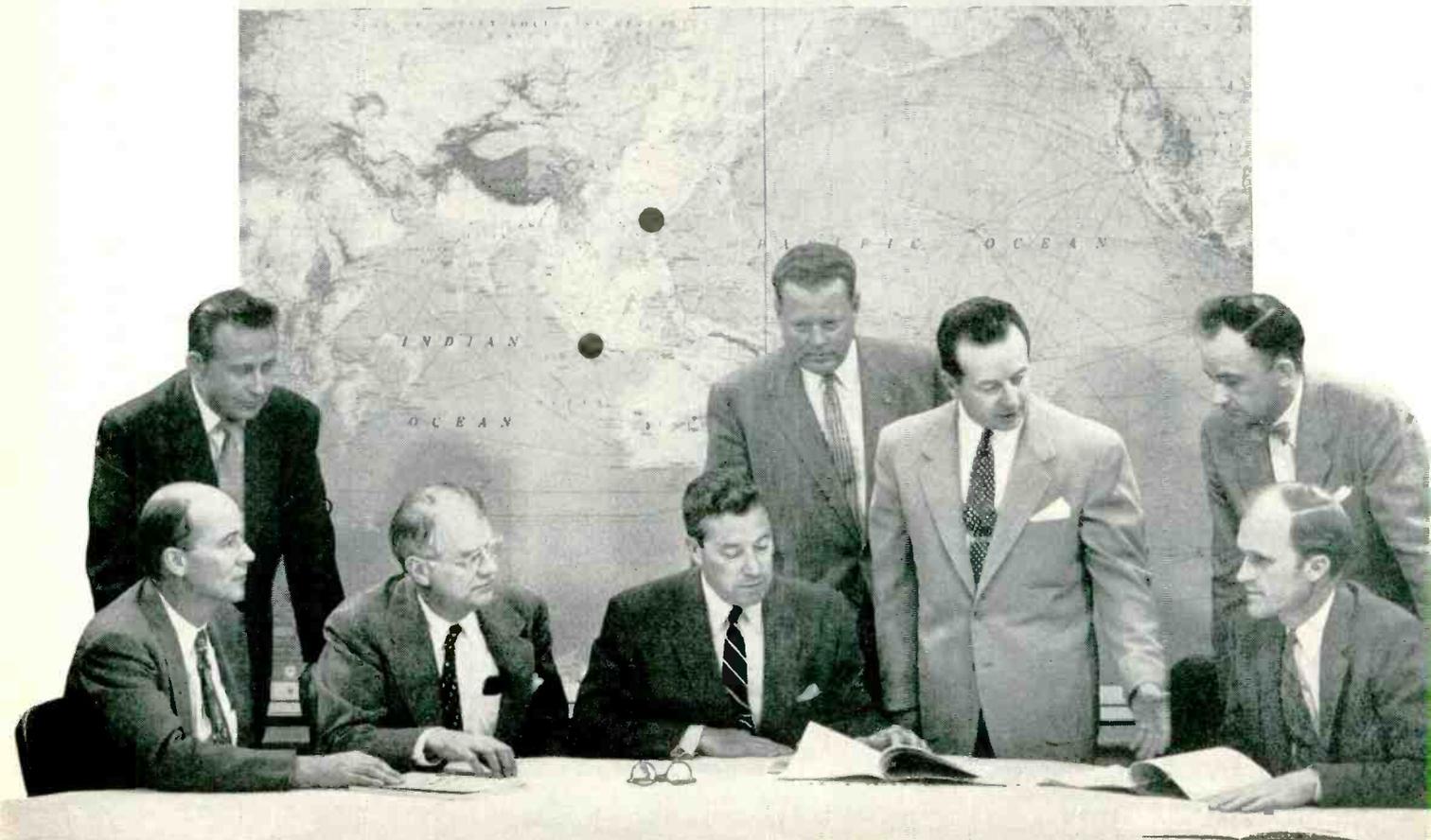
■ ■ ■

Scientific advances are creating new areas of interest for those capable of significant contribution to the technology of guided missiles.

Lockheed **MISSILE SYSTEMS DIVISION**

research and engineering staff

LOCKHEED AIRCRAFT CORPORATION • VAN NUYS, CALIF.



NATIONAL ELECTRONICS CONFERENCE

Chicago, Oct. 3-5

FALL MEETING AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Chicago, Oct. 3-7

C. T. Petrie, A. A. Daush
and senior members of
the technical staff will be
available for consultation
at the Sherman Hotel,
FRanklin 2-2100.

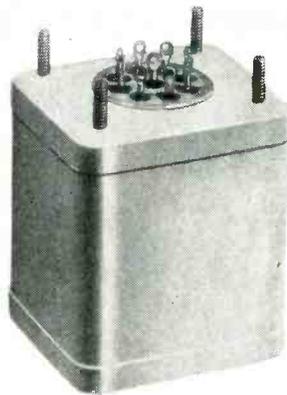
Lockheed

MISSILE SYSTEMS DIVISION

NEW PRODUCTS

(continued)

tube and the output lead to the grid of the following stage, the RB20 will act as a coupling battery. Another unusual feature is its ability to utilize an alternating or direct voltage power source. Designed to be directly wired into electronic circuits, the RB20 features such rugged characteristics as a zero to 200 F temperature range; immunity to humidity, condensation and other environmental conditions; also an input resistance of greater than 6 megohms; and an output voltage of 20 v negative to common at 10 megohm load.



MAGNETIC AMPLIFIERS with 2,000,000 power gain

Hycor Co., Inc., 11423 Vanowen St., North Hollywood, Calif., has available a new standard catalog series of magnetic amplifiers. Type 402, illustrated, is a 2-stage amplifier. Power gain is 2,000,000; input impedance, 200 ohms; load impedance, 3,000 ohms; supply frequency, 400 cps at 115 v; response time, 1 second. All necessary rectifiers are self contained. Complete information and specifications are given in bulletin MA.



R-C and L NETWORK in a plug-in unit

EASTERN PRECISION RESISTOR CORP.,
Richmond Hill 18, N. Y. Complete

Now STYRACON "B" CAPACITORS

In Wide Range
Of Needed Values
For Critical Applications



Now you can select Sprague Styracon "B" capacitors in the most needed voltage, capacitance, and tolerance values for those critical applications in analog and digital computers, precision timing circuits, etc.

Employing a specially processed polystyrene plastic film as the dielectric, these capacitors have extremely high insulation resistance, freedom from dielectric absorption, extremely low power factor (or high Q), close capacitance tolerance, and unusually excellent capacitance stability. Temperature coefficient of capacitance over the rated operating temperature range of -55°C to $+85^{\circ}\text{C}$ is—100 ppm/ $^{\circ}\text{C}$ and practically linear, and is independent of frequency.

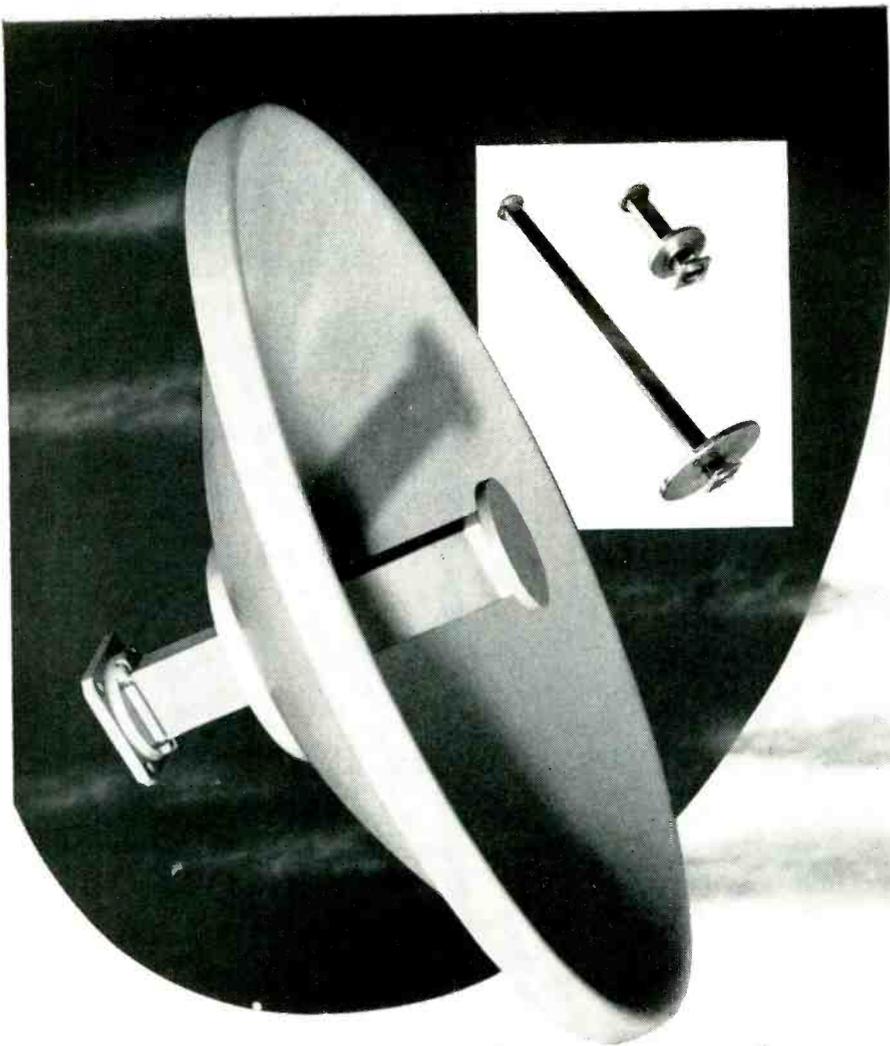
Sprague Styracon "B" capacitors are also available in various mechanical configurations to meet application needs. All are hermetically sealed in metal cases.

Write for Engineering Bulletin 250A, available on letterhead request to the Technical Literature Section, Sprague Electric Company, 35 Marshall Street, North Adams, Mass.

uF	VDC	CATALOG NO.		CASE STYLE
		± 5% TOL.	± 2% TOL.	
.01	200	114P10352S2	—	TUBULAR
.01	600	114P10356S2	—	
0.1	200	114P10452S2	114P10422S2	TUBULAR
	600	114P10456S2	114P10326S2	
0.5	200	111P1J	111P1G	BATH-TUB
0.5	600	111P3J	111P3G	
1.0	200	111P2J	111P2G	
1.0	600	111P4J	111P4G	

World's Largest Capacitor Manufacturer

SPRAGUE[®]



PARABOLIC ANTENNAS *for the K-band*

Designed and developed by Gabriel to meet or surpass civilian and military specifications for K-band operation, these parabolic antennas are produced with dish diameters of one, two, three, and four feet.

Precision reflectors are illuminated by a modified Gabriel wave-guide feed — the same Gabriel design that has received universal recognition in the 7000-mc commercial relay band. The UG-419/U input flange of this feed is suitable for use in pressurized systems. Three- or four-point adjustable mounting is standard.

- **Frequency coverage** — 12,700 to 13,200 mc.
- **VSWR** — less than 1.3:1 through entire range
- **Each antenna can be spot-tuned to a specific frequency, at slight additional cost.**

Large orders for K-band antennas can be filled quickly; the two-foot and three-foot sizes are available for shipment from stock.

For analysis of your antenna or microwave problems, write us or telephone Needham 3-0005 (through Boston).



GABRIEL ELECTRONICS DIVISION

THE GABRIEL COMPANY, Needham Heights 94, Massachusetts

R-C and L networks in a plug-in unit are hermetically sealed to withstand extreme environmental and vibration conditions. Built to customer specification and matched to as close as 0.01 percent these encapsulated packages save valuable chassis space. The illustrated plug-in contains precision wire-wound resistors and polystyrene capacitors aged and matched to within 7 parts per million of each other. The built-in oven maintains a temperature of 75 C.



EXPERIMENTAL KIT for designers' use

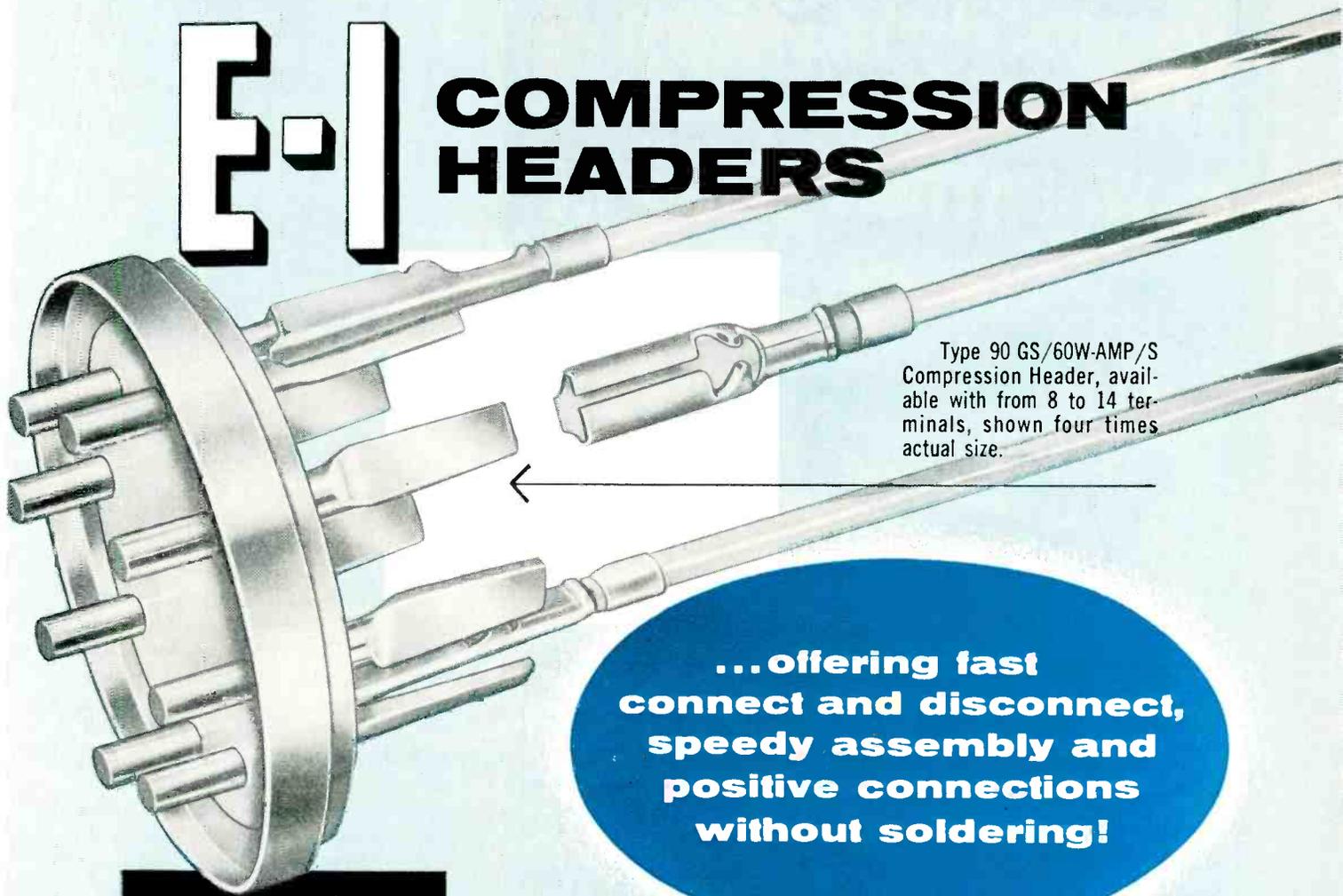
JFD MFG. Co., INC., 6101 16th Ave., Brooklyn 4, N. Y. An engineer's experimental kit, model PK-10 features a selection of 10 of the company's variable trimmer piston capacitors, with pertinent data for each capacitor. The kit was designed for the experimenter and designer in radar, radio, tv, communications, microwave transmission, automation and guided missiles. The capacitors have fused quartz or glass dielectrics and offer such characteristics as: matched temperature coefficients, incremental adjustment of capacitance for highly critical tuning, freedom from microphonics, no tuning backlash and absolute surface resistivity.

S-W DETECTOR small package, low-cost unit

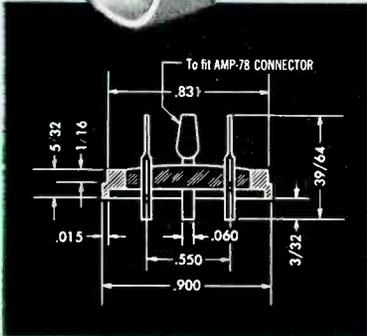
POLYTECHNIC RESEARCH & DEVELOPMENT Co., INC., 202 Tillary St., Brooklyn 1, N. Y. Type 219 standing-wave detector was designed to supersede expensive and bulky slot-

Now! For AMP Taper Pin Connectors

E-I COMPRESSION HEADERS



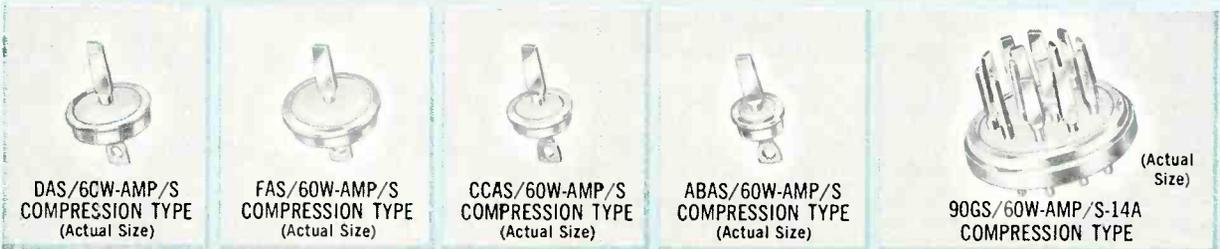
...offering fast connect and disconnect, speedy assembly and positive connections without soldering!



Available

IN COMPRESSION HEADERS AND PRACTICALLY ALL STANDARD E-I SINGLE TERMINAL EYELETS —

E-I offers single and multiple terminal type compression headers and practically every standard E-I single terminal compression eyelet for use with Type 78 AMP connectors*. For recommendations on specific sealed terminal applications, consult an E-I sales engineer, today!



PATENTS PENDING — ALL RIGHTS RESERVED

*Products of Aircraft-Marine Products, Inc. of Harrisburg, Pa.

Division of Ampers Electronic Corporation

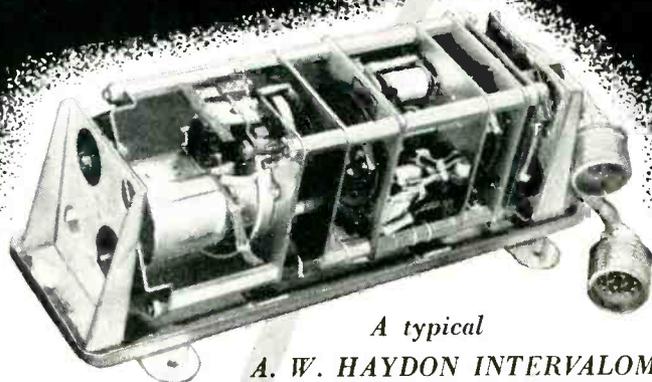


ELECTRICAL INDUSTRIES

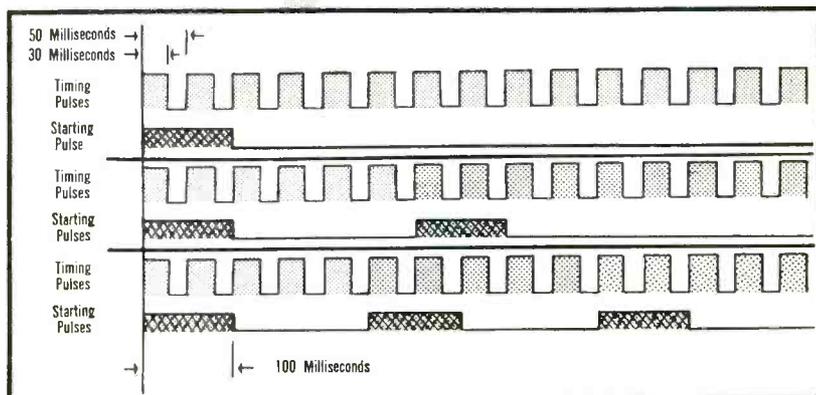
44 SUMMER AVENUE, NEWARK 4, NEW JERSEY

Short Interval Timing Your Problem?

A. W. HAYDON CAN HELP YOU.



A typical
A. W. HAYDON INTERVALOMETER
which supplies precision pulses
as shown on Chart below.



THREE TYPES OF OPERATION

The operator adjusts a selector switch to determine the type of operation.

OPTION #1. When a starting pulse of 100 Milliseconds is applied, this Intervalometer starts up and energizes 15 Pulsing Circuits at 50 Millisecond intervals. Each circuit is on for 30 Milliseconds. At the end of the period, the unit automatically resets to the starting position.

OPTION #2. When a starting Pulse of 100 Milliseconds is applied, this Intervalometer starts up and energizes 6 Pulsing Circuits, then shuts down. When the next starting pulse is applied, the balance of 9 pulsing Circuits are energized. The unit then resets to the starting position.

OPTION #3. When 1st starting Pulse is applied 5 Pulsing Circuits are energized. When 2nd starting Pulse is applied next 5 circuits are energized. When 3rd starting Pulse is applied next 5 circuits are energized.

Write for General CATALOG or Submit Detailed Problem Statement.



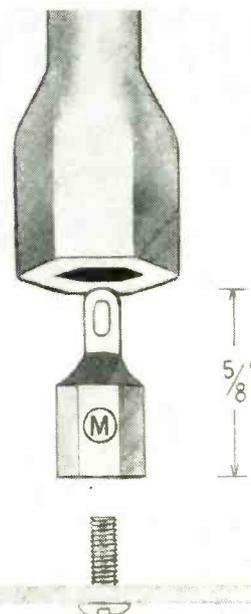
The
A. W. HAYDON Company

235 NORTH ELM STREET, WATERBURY 20, CONNECTICUT

Design and Manufacture of Electro-Mechanical Timing Devices



ted sections in the 100 to 1,000-mc range. It is the small package, low-cost solution for making impedance measurements easily and accurately in this region. By connecting the output to a vswr indicator, such as the PRD type 277, vswr may be read directly on the indicator meter. No special detection equipment is required. The reflection coefficient angle is easily determined merely by rotating the top drum dial to a minimum indication on the meter and reading the angle on the dial directly in electrical degrees. No calculations are required. The probe and crystal detector are self contained. Price of the unit is \$475.



CERAMIC CAPACITOR
is uhf subminiature type

MUCON CORP., 9 St. Francis St.,
Newark 5, N. J. In a new stand-off



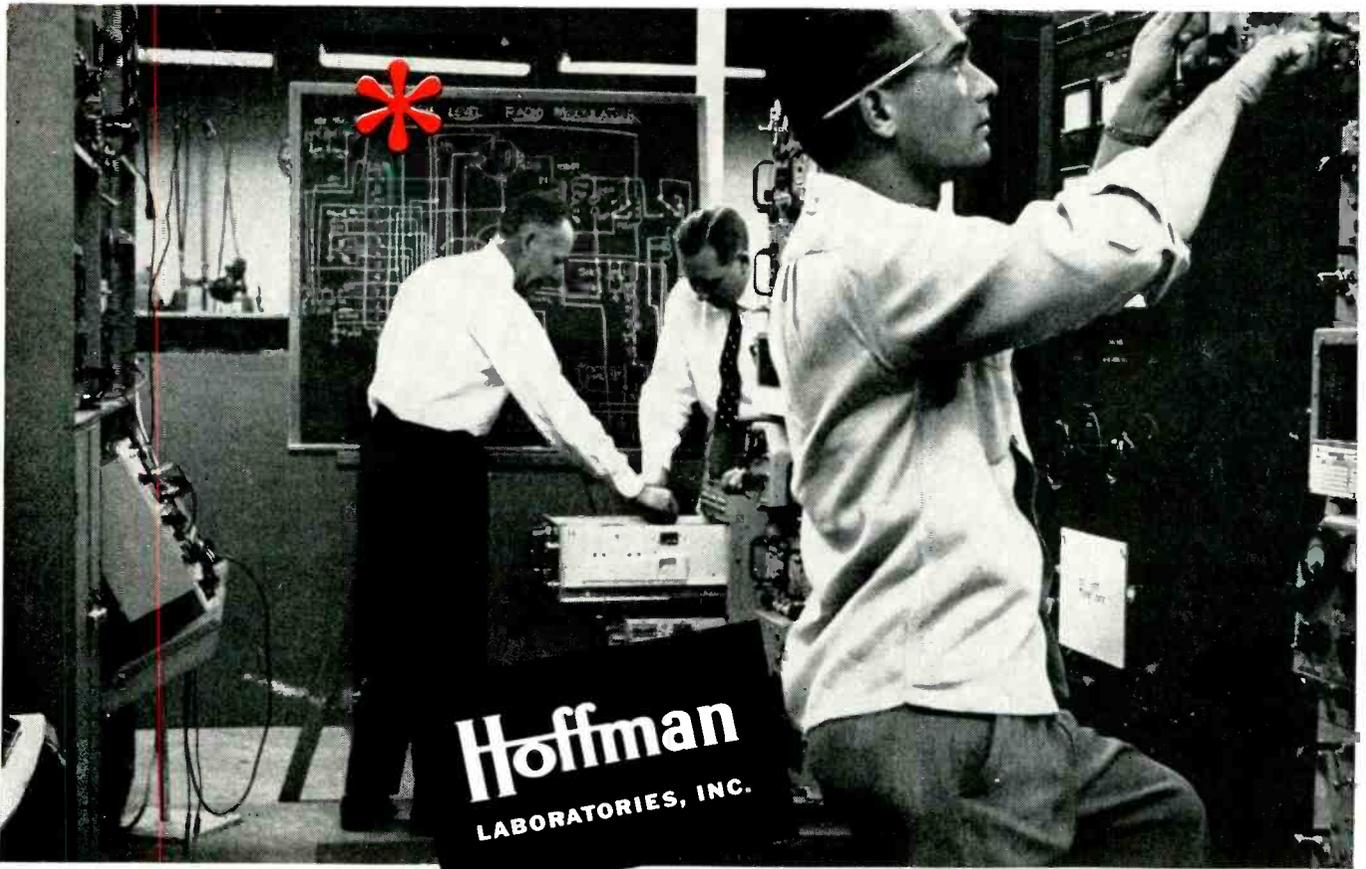
INTEGRATED ELECTRONICS

THE IMAGINATION FOR RESEARCH PLUS THE SKILLS FOR PRODUCTION

Hoffman Laboratories maintains a highly specialized group of engineers whose entire efforts are devoted to the complex problem of developing and producing specialized tactical test equipment for airborne navigation radar, fire control, missile guidance systems, and other advanced electronic gear. To meet the high standards of quality and reliability set by Hoffman Laboratories, this test equipment group is an integral part of the engineering staff.

For the past 13 years Hoffman Laboratories has been successfully solving advanced design and development problems in electronics. During this time Hoffman Laboratories has never undertaken a development program that has not successfully gone into production.

Write the Sales Department for free booklet.



A SUBSIDIARY OF HOFFMAN ELECTRONICS CORPORATION

Radar, Navigational Gear
Missile Guidance & Control Systems
Noise Reduction
Countermeasures (ECM)
Computers
Communications
Transistor Application

Challenging opportunities for outstanding engineers to work in an atmosphere of creative engineering. Write Director of Engineering, Hoffman Laboratories, Inc., 3761 S. Hill St., Los Angeles 7, California.

DEPEND ON

Bendix

ECLIPSE

Red Bank

RELIABLE ELECTRON TUBES



With electronic controls taking over more and more operational functions in military and industrial applications, it is becoming increasingly important that the electron tubes used be dependable under extremely severe conditions. This applies particularly to installations in aircraft where tubes must operate reliably at high altitudes, while subjected to continuous vibration, varying voltages and frequent shock. Because of their advanced design and construction . . . born of never-ceasing research and special production skills . . . Bendix Red Bank Reliable Electron Tubes have the dependability necessary to meet these severe operating conditions. You can depend on our long, specialized experience to give you the right answer . . . for all types of regular as well as special-purpose tube applications. Tubes can be supplied to both commercial and military specifications. Call on us for full details.

Manufacturers of Special-Purpose Electron Tubes, Inverters, Dynamotors, AC-DC Generators, Voltage Regulators and Fractional H.P. DC Motors.

DESIGNATION AND TYPE					TYPICAL OPERATING CONDITIONS		
Type	Proto-type	Bendix No.	Description	Base And Bulb	Heater Voltage	Plate Voltage Per Plate	M.A. Load
5838	6X5	TE-3	Full Wave Rectifier	Octal T-9	12.6	350.	70.
5839	6X5	TE-2	Full Wave Rectifier	Octal T-9	26.5	350.	70.
5852	6X5	TE-5	Full Wave Rectifier	Octal T-9	6.3	350.	70.
5993	6X4	TE-10	Full Wave Rectifier	9-Pin Miniature	6.3	350.	70.
6106	5Y3	TE-22	Full Wave Rectifier	Octal T-9	5.0	350.	100.

Type	Proto-type	Bendix No.	Description	Base And Bulb	Heater Voltage	Plate Voltage	Screen Voltage	Grid Voltage	Gm	Plate Current	Power Output
5992	6V6	TE-8	Beam Power Amplifier	Octal T-9	6.3	250.	250.	12.5	4000	45. MA	3.5 W
*6094	6AQ5 6005	TE-18	Beam Power Amplifier	9-Pin Miniature	6.3	250.	250.	12.5	4500	45. MA	3.5 W
6385	2C51 5670	TE-21	Double Triode	9-Pin Miniature	6.3	150.	—	-2.0	5000	8. MA	—

*Tube Manufactured with Hard (Nonex) Glass for High Temperature Operation (Max. Bulb Temp. 300°C.)

Bendix

ECLIPSE

Red Bank

DIVISION OF

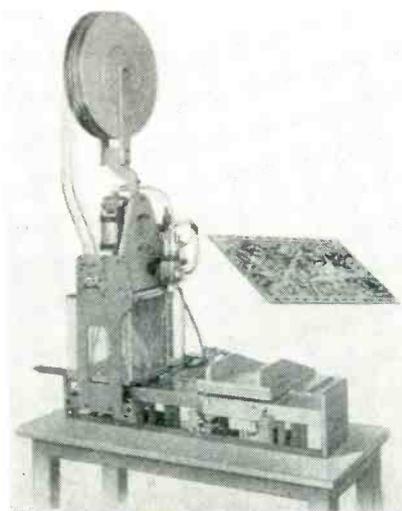


EATONTOWN, N. J.

West Coast Sales and Service:
117 E. Providencia Ave., Burbank, Calif.

Export Sales: Bendix International Division,
205 East 42nd St., New York 17, N. Y.
Canadian Distributor: Aviation Electric Ltd., P.O. Box 6102, Montreal, P. Q.

design, the style S-4 uhf subminiature ceramic capacitor withstands greater shock and stress, and can be more easily installed. It is readily assembled to the chassis with a $\frac{1}{8}$ -in. hex socket wrench which fits the tin-plated $\frac{1}{8}$ -in. hex brass base. The terminal contains an elongated hole to accommodate more than one wire. Overall height is approximately $\frac{1}{2}$ in. with $4-40 \times \frac{1}{8}$ in. deep female mounting hole. A range of values from $3 \mu\text{mf}$ to $3,300 \mu\text{mf}$ can be obtained depending on the type of ceramic material required for the application. Bulletin E-1 gives further information.

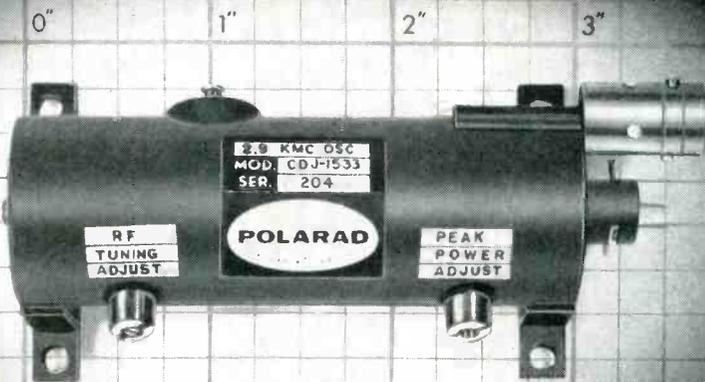


TERMINAL INSERTER for printed circuit boards

MALCO TOOL AND MFG. Co., 4025 W. Lake St., Chicago 24, Ill. An automatic machine makes it possible to insert almost any number of terminals into a printed circuit board in two stages within a 3-second cycle. Insertion is accomplished simultaneously in any symmetrical or nonsymmetrical pattern. Since the terminals or pins are self retaining, they will not vibrate loose during additional assembly or other operations prior to permanent soldering. Operation is completely automatic. Terminals or pins in chain form are fed from two reels simultaneously through the die into the printed circuit board feeding mechanism. The machine can be engineered to meet any particular application or production requirement, in accordance with specifications as requested. Bulletin 551,

SUB-MINIATURE S-BAND CAVITIES

2750-3000 mc



Sub-miniature is the word. The new Polarad S-Band cavities are only 3" long and 1" in diameter, yet outperform many larger cavities. They are particularly suited for beacon transmitters, missiles, radar, etc., where miniaturization is a key factor in the choice of components. These cavities withstand vibration, 500 g shock test, 100 g longitudinal acceleration, and are temperature compensated over the range of 0°C to 70°C. They are available for grid-pulsed, plate-pulsed, or CW operation. They may be code modulated by conventional drive circuits using hard tube or gaseous tube types.

All S-Band cavities are factory tuned to the desired frequencies, and can be varied by means of a simple special tool which permits simultaneous frequency and locking adjustment.

FEATURES:

- Extremely small size, 1" x 3"
- Ruggedized pencil triode
- 300 V DC supply is required for grid pulsing
- Temperature compensated
- Meets all MIL specifications
- Fixed low impedance output coupling into 50 OHM BNC connector

CONSULT US ON YOUR APPLICATIONS

FIELD MAINTENANCE SERVICE THROUGHOUT THE (CONTINENTAL)

SPECIFICATIONS:

MODEL	Modulation	Power Output	PRF
CGP-1	Grid Pulsed	2 watts peak	0-4,000 PPS
CPP-1	Plate Pulsed	100 watts peak	0-1500 PPS
CCW-1	CW	50 MW	—

Tuning Range..... 2750 — 3000 mc
 Pulse Width..... 0.75 ± 0.1 μSec.
 Rise Time..... 0.1 μSec.
 Frequency Stability..... 0.02 mc/°C.



ELECTRONICS CORPORATION

43-20 34th STREET • LONG ISLAND CITY 1, N. Y.

REPRESENTATIVES • Albuquerque • Atlanta • Baltimore • Boston • Chicago • Cleveland • Fort Worth • Kansas City • Los Angeles • New York
 Philadelphia • San Francisco • Seattle • St. Paul • Syracuse • Washington, D. C. • Canada, Arnprior—Export: Rocke International Corporation

NOW SHEET METAL R-F ENCLOSURES



at the lowest
price ever

Offering all the advantages of sheet metal construction, Ace's new *galvanized* sheet metal enclosure is easily erected—ideal for use indoors or out—readily weather-proofed for any climate—safely transported assembled or disassembled—ideally suited for mobile units—constructed to take a real beating in the toughest kind of service.

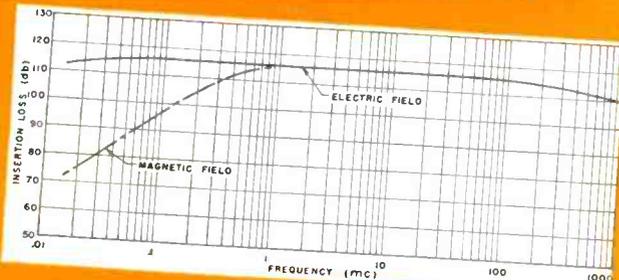
Furthermore, you get top attenuation across the entire fre-

quency range, typical of all Ace shielded enclosures. See curve below.

This new low priced enclosure uses the famous patented Lindsay Structure, with solid 24 gauge galvanized steel panels fastened to rigid steel channels forming leak-proof seams. Service entrances can be provided to meet every need, from power and water to forced air ventilation or air conditioning systems.

Get complete information now on this new solution for your r-f interference problems. Write for new catalog which contains performance and construction data on every type of ACE Shielded Enclosure.

Plotted by an independent electronic interference measurement laboratory.



ACE ENGINEERING & MACHINE CO., INC.

3644 North Lawrence Street • Philadelphia 40, Pennsylvania

now available, gives further information.

NETWORK provides pulse formations

ESC CORP., 534 Bergen Blvd., Palisades Park, N. J. Model No. 21-19 network provides pulse formations from 0.25 μ sec to 2.0 μ sec in width by three miniature toggle switches. Circuit is arranged to provide a residual pulse width of 0.25 μ sec at all times. Other features of the compact delay network include an impedance of 200 ohms ± 10 percent with a 35-percent maximum attenuation for 2.0 μ sec delay of the reflected pulse. Each delay network is potted in epoxy resin and enclosed in an hermetically sealed case. The entire assembly is further enclosed in a dust-proof case and is finished in accordance with MIL-T-945A salt spray and humidity conditions. Glass compression type terminals are provided for all connections.

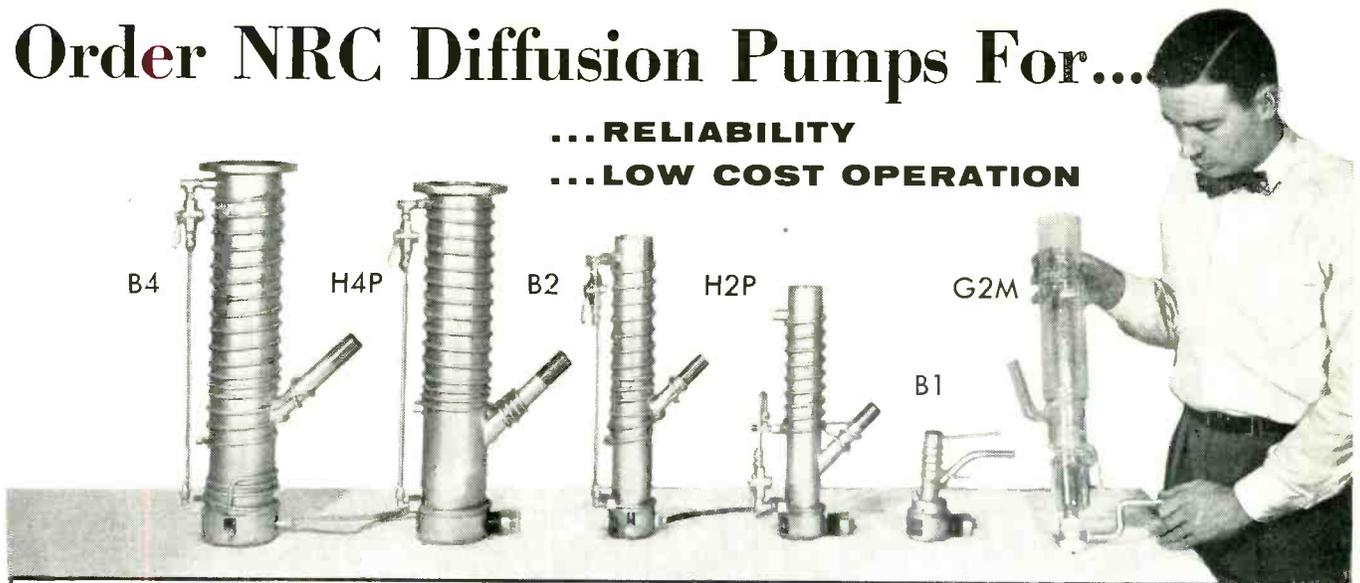


GENERATOR produces square waves

THE SOLARTRON ELECTRONIC GROUP LTD., Thames Ditton, Surrey, England. Model GO.511 generator produces square waves at 1 mc, 100 kc, 10 kc and 50 cps; the rise time of the 1-mc signal being between 30 and 40 μ sec, and the fall time less than 25 μ sec. At the other output frequencies the rise and fall time is in the same ratio (1:40) to the signal frequency. The 10-kc and 100-kc square waves have rise times which are ideally suitable for the adjustment of feedback amplifiers. The generator provides a constant output of 10 v across 75 ohms load, and at 50 cycles only, a continuously

Order NRC Diffusion Pumps For...

...RELIABILITY
...LOW COST OPERATION



OPERATING SPECIFICATIONS

Model	Liters/Sec.	Cu. Ft./Min.	Max. Oper. Pressure mm Hg	Blank-off (1)	Fore-Pressure	Recommended Fore Pump Capacity	Recommended Fore Pump Model	Pumping Fluid Narcoil #	Fluid Capacity c.c.	Water Requirements g.p.m.	Power Requirements Watts	Price (2)
DIFFUSION PUMPS												
H-2-P	70	147	.01	1.5×10^{-6}	.18	3 c.f.m.	NRC 4S or 4D	40	85	.2-.3	200	\$ 125.
H-4-P	300	637	.01	1.0×10^{-6}	.25	7 c.f.m.	NRC 6S or 6D	40	250	.5-1.0	500	235.
H-4-SP	300	637	.01	1.5×10^{-6}	.25	7 c.f.m.	NRC 6S or 6D	40	250	.5-1.0	500	200.
H-6-P	730	1550	.01	1.5×10^{-6}	.20	30 c.f.m.	NRC 30S or 30M	40	400	1-2	950	370.
H-10-P	1700	3600	.01	1×10^{-6}	.10	50 c.f.m.	NRC 100S or 100M or 30M	40	1000	2-4	2300	675.
H-16-P	5000	10600	.01	1.8×10^{-6}	0.3	100 c.f.m.	NRC 100S or 100D	40	800	2-4	3000	1200.
BOOSTER PUMPS												
B-1	8.5	18	.10	4×10^{-4}	.20	1 c.f.m.	NRC 2S or 2D	10	25	.1-.15	85	57.
B-2	72	153	.30	1.5×10^{-4}	1.0	8 c.f.m.	NRC 15S	10	175	.5-1.0	450	175.
B-4	220	465	.30	1.5×10^{-4}	1.45	12 c.f.m.	NRC 15S	10	375	.4-.6	1350	325.
B-6	520	1100	.30	2.5×10^{-4}	.90	100 c.f.m.	NRC 100S	10	11360 (3 gal)	2-4	6000	930.
H-10-P	2000	4240	.30	1.5×10^{-4}	.28	50 c.f.m.	NRC 100S or 30S	10	1000	2-4	2300	675.
GLASS PUMPS												
G-2-M	28	59	.10	8×10^{-7} (3)	.50	3 c.f.m.	NRC 4S or 4D	Hg	100	1-2	300	204.(4)

(1) Ion gauge measurements (total pressure)
(2) Incl. std. flanges except B-1

(3) With liquid nitrogen cold trap
(4) Incl. initial charge of mercury

Check the high throughput, high forepressure tolerance, low blank-off and other performance specifications in the table above, and then consider: *You can rely on NRC PERFORMANCE-PROVED pumps to meet these specifications day after day because:*

... Performance is unaffected by normal variations in line voltage and cooling water characteristics.

... Heavy aluminum self-centering jets are hard to damage — jet spacing is not critical.

... Pumps are designed to operate with rugged

pump oils which resist breakdown and oxidization.

... Jets are virtually self-cleaning — no small apertures to get clogged.

... "Cast-in" heaters give exceptional life — are readily accessible for cleaning.

... Stainless-steel bodies stay clean — do not rust.

... Backstreaming is minimized.

... NRC glass mercury vapor pumps are assembled on a production basis to assure reproducible performance, interchangeability of components, easy disassembly for cleaning.



CUT DIFFUSION PUMPING COSTS with NARCOIL 40
NEW Reduced Cost
\$38⁵⁰ Per Gal.

Unequaled in its combination of stability and low blank-off.



NARESCO EQUIPMENT CORPORATION

Subsidiary of NATIONAL RESEARCH CORPORATION
Dept. 49, Charlemant St., Newton Highlands 61, Mass.
Please send me NRC Diffusion Pump Bulletin

Name _____ Title _____

Company _____

Address _____

City _____ State _____

SALES OFFICES: Boston, Chicago, Cleveland, Houston, Los Angeles, New York, Palo Alto, Philadelphia; in Canada: Toronto, Amprior



**FULL
SIZE**
3" x 3" x 4"

Unsurpassed
IN PERFORMANCE
Unequaled
IN COMPACTNESS

CHARACTERISTICS

2 degrees of freedom
... 360° in roll, ± 82° in pitch
Repeatability to established vertical
... 15 Minutes max. of ½ cone angle
Free drift rate
... 0.5" Minute
Erection Time
... 3 minutes at start
Erection Rate
... 3" minute-Normal 80°/minute-Fast
Synchro Output (each axis)
... 11.8 volts, 400 cycles

Only Kearfott can offer a *Miniature Vertical gyro* with big gyro *Performance*. Completely self contained, this gyro requires *No External Erection Amplifiers*. A gravity sensitive electrolytic device, within the gyro, directly associated with the torquer motors, provides the necessary vertical reference.

Hermetically Sealed, filled with a dry, inert gas. Satisfies the requirements of MIL-F-5272 as regards shock test (Procedure II) humidity, salt spray, fungus resistance, rain, sand, dust, immersion and explosion proof.

This gyro duplicates the performance of the Kearfott T2108 series in $\frac{1}{3}$ the volume and weight.

KEARFOTT COMPONENTS INCLUDE:

Gyros, Servo Motors, Synchros, Servo and Magnetic Amplifiers, Tachometer Generators, Hermetic Rotary Seals, Aircraft Navigational Systems, and other high accuracy mechanical, electrical and electronic components.

Engineers: Many opportunities in the above fields are open. Please write for details today.

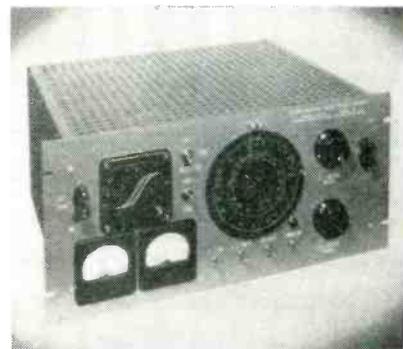
A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION



KEARFOTT COMPANY, INC., LITTLE FALLS, N. J.

Sales and Engineering Offices: 1378 Main Avenue, Clifton, N. J.
Midwest Office: 188 W. Randolph Street, Chicago, Ill. South Central Office: 6115 Denton Drive, Dallas, Texas
West Coast Office: 253 N. Vinado Avenue, Pasadena, Calif.

variable output from 0 to 18 v across an impedance of not less than 2,000 ohms. The output pulses may be reduced in amplitude by the external use of a Solartron 75-ohm, 60-db attenuator, or may be differentiated in the normal manner by connecting a resistance-capacitance network across the 75-ohm output terminals.



WIDE-RANGE BRIDGE for production line and lab

WATERS MFG., INC., 4 Gordon St., Waltham 54, Mass. A new wide-range incremental-inductance bridge will measure from 0 to 5, and 5 to 180 henrys at any frequency from 60 to 1,000 cps. Completely versatile in its use to measure small choke coils, toroids, relay coils, audio filter coils and similar applications, it permits independent variation of a-c voltage from 0 to 135 rms, and d-c from 1 to 500 ma. The test inductor resistance may be up to 750 ohms at 500 ma. Ruggedly built, it provides for fast accurate measurements on production lines, and its 3-percent accuracy makes it also suitable for lab use.



TUBULAR CAPACITOR for -55 C to +100 C operation

CORNELL-DUBILIER ELECTRIC CORP., South Plainfield, N. J. The Tiger Cub type MGT paper dielectric

For High Q and Excellent Capacitance Stability



PLASTICON CAPACITORS

are
made
with

NATVAR Styroflex®



CP Plasticon Type P Capacitors are available with metal can containers in 22 capacities ranging from 0.1 mfd at 1000 vdc to 25 mfd at 100 vdc; and with tubular "Glass-mike" containers in 22 capacities from .001 mfd at 1000 vdc to 1.0 mfd at 100 vdc.

Capacitors designed and manufactured by Condenser Products Co., Division of New Haven Clock & Watch Co. are extensively used in calculators, computers, integrating circuits, electronic controls, sawtooth oscillators, and other equipment where stability and low dielectric loss are important.

Natvar Styroflex film is used as the dielectric because it has all of the outstanding properties of polystyrene, plus complete flexibility due to bi-axial orientation during the manufacturing process.

If you need an insulating material with the desirable characteristics of polystyrene—plus flexibility, it will pay you to investigate Natvar Styroflex. Ask for new data sheet ST-1, just off the press.

NATVAR CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

TELEPHONE
RAHWAY 7-8800

CABLE ADDRESS
NATVAR: RAHWAY, N. J.

201 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY



Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Aboglas®
- Vinyl coated—varnished—lacquered tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

Ask for Catalog No. 23

HIGH VOLTAGE RESISTORS — UP TO 125,000 VOLTS !



RESISTANCE VALUES TO 1 MILLION MEGOHMS !

Widely renowned for stability and reliable performance, RPC's High Voltage resistors are successfully used as VT voltmeter multipliers; high resistance voltage dividers; bleeders in high voltage power circuits; corona resistors and standards of high resistance value. They are eminently suitable for use in television transmitters and receivers, cathode ray tube circuits, X-ray equipment, Van de Graff generators, electro-meter tube circuits, pulse circuits, dust precipitators, photo cell applications and high voltage circuit equipment. Leading laboratories, manufacturers and many government agencies specify RPC High Voltage Resistors.

TYPE B. From 1 to 6½ inches long; diameter ⅜ to ⅝ inches. Voltages to 40 KV. High stability carbon coating on strong non-hygroscopic steatite rod. Very long effective resistor length in small space is due to application of coating as a helix on rod's surface. Thus, resistance coating of relatively low specific resistance produces stable resistors of high resistance value. Ends of resistors permanently connected with silver contact coating.

Type B resistors are readily mounted on panel or stand-off insulators. Can be assembled as tapped resistors and matched pairs. Temperature and voltage coefficients are low.

TYPE D. Provide voltage rating up to 125 KV and load capacity up to 90 Watts. From 6½ to 18½ inches in length. Made on steatite tubes and can be supplied with silver contact bands, band type terminals or lug ferrules.

In both types, B and D, standard resistors tolerance is ±15%. Tolerances of ±10%, ±5%, or ±3% can be supplied. A tolerance of ±2% can be supplied in matched pair resistors.

Write for additional details and catalog.

Hermetically sealed and encapsulated resistors available. For special assemblies, special types and sizes consult our Engineering Department.

RESISTANCE PRODUCTS CO.

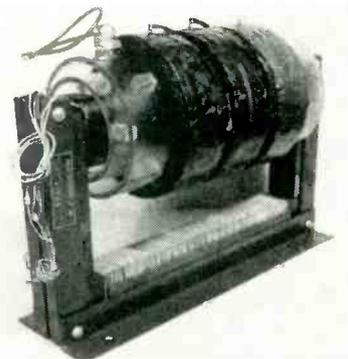
914 South 13th Street Harrisburg, Penna.

Makers of Resistors—High Megohm, High Voltage, High Frequency, Precision Wire Wound.

tubular capacitor is designed to operate effectively at temperatures from -55 C to +100 C. An external wax dip provides added moisture protection that will withstand 250 hours of continuous exposure in 90-percent relative humidity at 40 C. The capacitors are available in capacitances from 0.001 μf to 1.0 μf in 6 voltage ranges from 100 to 1,600 v d-c working. Low resistance lead wires are soldered to extended foils and held firmly in place by Polykane, the high temperature, nonmelting end fill.

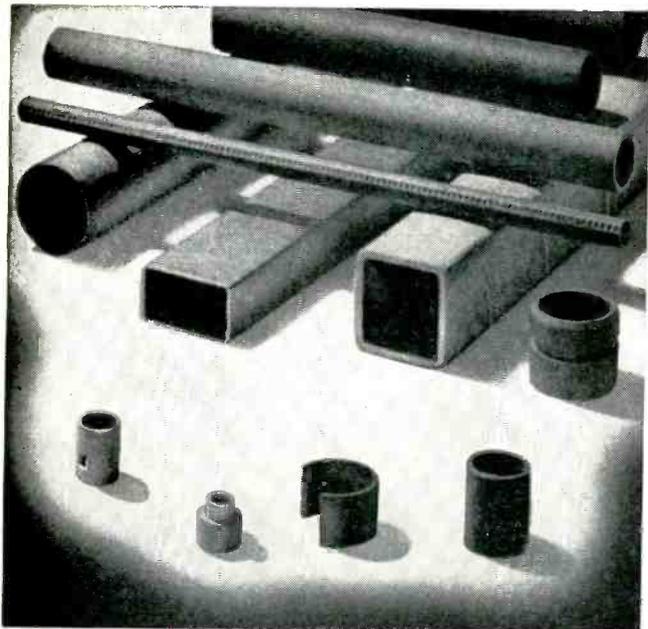
N-P TESTER for semiconductors

BAIRD ASSOCIATES, INC., 33 University Road, Cambridge 38, Mass., has introduced a new test instrument for determining *n* or *p* type conductivity. Model JR1 is designed around a convenient thermoelectric probe constructed with spectrographically pure graphite electrodes to minimize sample contamination. Electrode heating is accomplished with a 110-v a-c heater, readily controlled by accessible switches on the front panel of the tester. In operation, the sample under test is brought into contact with the electrode probes. Direction of deflection of a compactly built, easily readable pointer-type galvanometer reveals conductivity type of the sample.



H-V TRANSFORMER using polystyrene

POWER TRANSFORMER CO., INC., 532 Mulberry St., Newark 5, N. J. Transformers up to 320 kv rms have been built to deliver close to 1,000,000 v d-c, using a voltage doubler circuit, up to 300 kv d-c in a full-



C-D-F SPIRAL TUBING offers many advantages to the cost-conscious design engineer and purchasing agent. It is low-cost, moisture-resistant, high-strength, and easy to fabricate. It has sufficiently low dielectric loss properties and good dielectric strength for many applications.



New **C-D-F** Plastic Spiral Tubing reduces unit costs, improves products

Using C-D-F's new Spiral Tubing is a way of saving money in buying electronic insulation . . . without lowering the electrical and mechanical characteristics of the part required. This special tubing is a high-strength plastic made from paper or vulcanized fibre that is spirally wound. It is available in two basic forms in various grades: (1) as plain untreated tubing. (2) as impregnated tubing containing various types of thermosetting insulating varnishes.

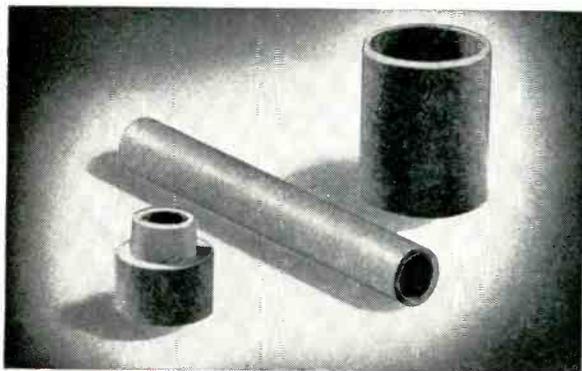
BUY ONLY THE PROPERTIES YOU NEED

Spiral Tubing can be used to replace rolled or molded laminated phenolic tubing in many cases. As the degree of moisture resistance and mechanical strength is established during the manufacturing process, you specify . . . and buy . . . only those properties required for the application. C-D-F also offers complete designing, machining and assembly. You can get finished components, or random length tubing, with fast deliveries. Write for Technical Folder ST-53 and samples, after checking our catalog in Sweet's Design File. Call the C-D-F sales engineer listed there—he can save you time and money immediately with C-D-F Spiral Tubing!

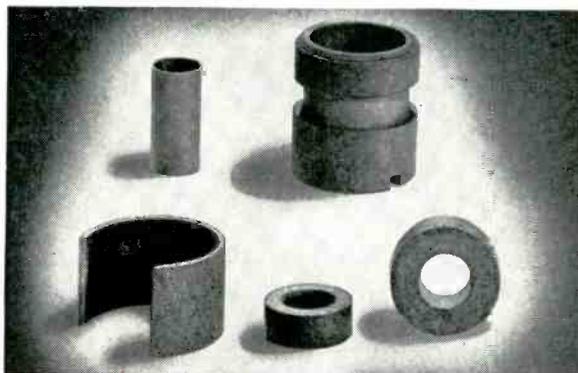
Continental-Diamond Fibre

CONTINENTAL-DIAMOND FIBRE DIVISION OF THE BUDD COMPANY, INC.

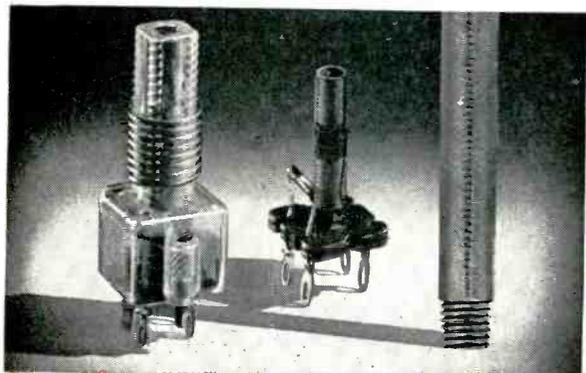
NEWARK 16, DELAWARE



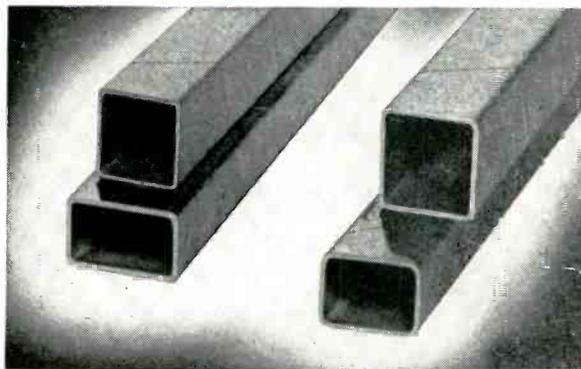
A VERY HARD TUBE is supplied in C-D-F Grade 6A. The parts shown have maximum mechanical strength, lowest water absorption rate under immersion conditions and most stable dielectric loss properties. Fine for bushings and cores.



THIN-WALL SPIRAL TUBING has good concentricity and is tough. Note thin wall construction, cleanness of machining, variety of shapes. C-D-F Spiral Tubing is easily machined, formed, punched. Made in many grades for special applications.



NEW CONSTANT TORQUE TUBING, for permeability tuning with iron cores, features exact internal threading with three point suspension of the core to prevent binding . . . no external embossing to lower dielectric strength. Write for samples.



HARD OR SOFT, square or rectangular coil-form tubing is made for solenoid and transformer applications. Sides are straight with minimum gap in paper winding. Supplied in soft, varnished kraft, or hard, rigid tubing.



RATE OF CLIMB WITHOUT DELAY

THE TRANS-SONICS® VERTICAL SPEED TRANSDUCER provides 0 to ± 5 volts output linearly proportional to vertical speed over its range of $\pm 25,000$ ft./min. rate of climb or dive.

The instrument has a delay of only 0.2 sec. at sea level and less than 2 sec. at 50,000 ft.

There are no moving parts or linkages in the Vertical Speed Transducer. It is designed for rugged service aboard aircraft and missiles.

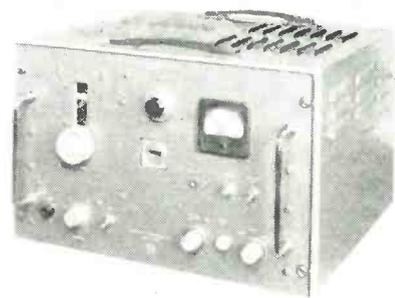
Remote dial indicators for pilot's display are available.

Request technical data on the Trans-Sonics Vertical Speed Transducer.

For Transducers see Trans-Sonics

TRANS-SONICS, INC.
5 FOREST STREET, BEDFORD, MASS.

wave bridge, resistive load or up to 400 kv d-c capacitive load. Input can be 115 v to 230 v or any input voltage at any frequencies from 25 to 3,200 cps, depending upon individual design, which allows for leakage inductances and distributed capacitance factors as function of input frequency. Illustrated is a 55 kv rms transformer capable of delivering 150 kv d-c at 0.1 ampere in a voltage doubler or 50 kv d-c at 0.3 ampere continuous duty.



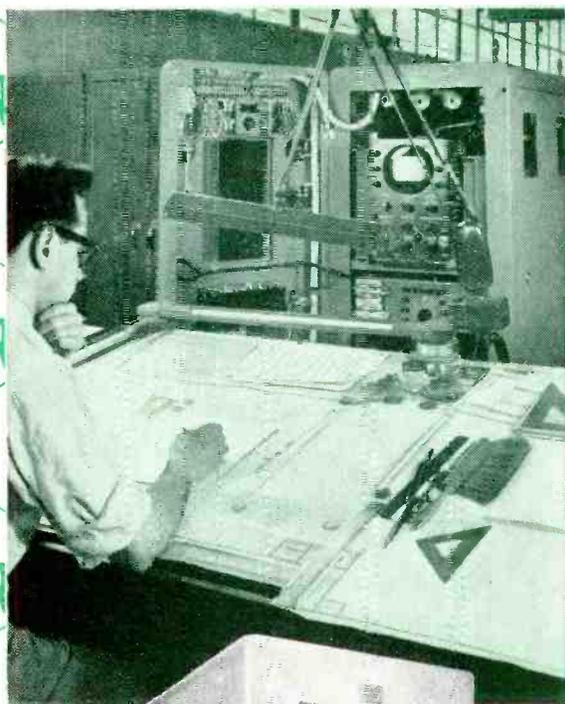
MICROWAVE OSCILLATOR is ultrastable

LABORATORY FOR ELECTRONICS, INC., 75 Pitts St., Boston 14, Mass. Featuring an automatic stabilization indicator, a new model in the line of stabilized microwave oscillators has just been announced. Model 814 is a frequency generator in the X-band region which makes use of a discriminator and feedback loop to secure short term stabilization in the order of 5 parts per hundred million. It also features simplified tuning which makes it possible for inexperienced personnel to use the instrument in routine testing. The tuning dial is calibrated to read directly in frequency. The tuning range of the oscillator is from 8,500 mc to 10,000 mc.

METALLURGICAL WIRES for semiconductors

SECON METALS CORP., 7 Intervale St., White Plains, N. Y., has introduced several new metallurgical wire products specifically researched and developed for application in the fields of semiconductors, transistors, diodes and crystals. The products include gold and aluminum

Custom Electronic Components



MODULATORS for MAGNETRONS and KLYSTRONS

When industry and experimental laboratories need special instruments, designed and built to the highest standards of precision performance and at lowest cost, they turn to FXR for proved dependability. A good example of close integration between FXR engineering design and production, typified in the illustration, shows an electromechanical engineer working on a design change to accommodate a customer's special requirements. Got a design problem? Try FXR first!



14
MEGAWATT
UNIT
Type Z821A



ONE
MEGAWATT
UNIT
Type Z820A



625
KILOWATT
UNIT
Type Z824A

BASIC DESIGNS NOW AVAILABLE

High Power Modulator Type No.	Power (peak megawatts)	Voltage (peak kilovolts)	Current (peak plate-amperes)	Impedance (output-ohms)	Duty Cycle (maximum)	Pulse Shape (μ sec/pps)	Input 60 CPS (Φ /volts)	Size (HxWxD, ft.)	Weight (lbs.)	Tubes Operated
Z820A	1.0	33	33	1,000	.001	0.5/2000 2.5/400	1/190-250	6x2x3	1400	4J50, QK-349 RK-6249
Z821A	14.0	90	160	560	.001	2.0/200-500	3/440-550	7x4x7	6800	QK-338
Z822A	0.2	20	10	3,330	.018	10/1200-1800	3/440	6x3x4	3330	SAL 39 (GL-6625)
Z823A	0.042	12.7	3.3	3,330	.064	coded/300	3/440	6x4x4	3200	SAL 39
Z824A	0.625	25	25	1,000	.001 at 0.5/2000	1.0/1000 2.0/250 5.0/100	1/190-250	6x2x3	2500	QK-349 at reduced power
Z825A	1.6	40	40	1,000	.001 at 0.5/2000	1.0/1000 2.5/400	1/190-250	6x2x3	2500	WE-5780

Modulator Loads and Exhaust Ovens are also available.



FIRST BY FAR



Electronics & X-Ray Division

F-R MACHINE WORKS, Inc.

26-12 BOROUGH PLACE, WOODSIDE 77, N. Y. • ASTORIA 8-2800

Data subject to change without notice based on application.

Recent word in certain of our dignitaceous* monthly periodicals gives nick-of-timely surcease to those indefatigable oracles of Eras, New Eras and Vast New Eras; viz., largest machinery manufacturers have joined giants of electronics and given birth to a New Vast-New-Era: ; *The Automatic Production of Electronic Equipment.*

Although as yet no printed material on specific applications is available to the lay public, no time should be lost in devising a suitably architiptic name for this Science which results from the wedding (shotgun — ?) of Electronics and Automation.

Thus, the Sigma CONTEST, in which the modesty of the prizes is far exceeded by the wealth of satisfaction which will accrue to the winner from the knowledge of the importance of his contribution.

B I G S I G M A C O N T E S T

R U L E S

1. Entry must include name for Electronics combined with Automation, and brief statement explaining reasons for choice.
Hints: Electromation? Elematics? Electautos? Mechelecs?
2. Judges agree to reach a final biased decision. Answers to inquiries concerning individual entries cannot be guaranteed. All entries do become the property of Sigma Instruments, Inc.
3. All entries must reach Boston by October 1, 1955.
4. Sigma Instruments, Inc., disclaims any liability resulting from patent infringement, copyright violation or intra-industry squabbles.
5. If you have a state law prohibiting this contest we suggest that you move.

PRIZES ★ PRIZES ★ PRIZES

Grand Prize One Sigma Type 72 Relay complete with Data Sheet (Excellent mantelpiece ornament).

2nd Prize One Fisher-Pierce Photoelectronic Nitelighter (Start your collection of people-built antiques).

3rd, 4th and 5th Prizes One Sigma Type 26F Relay with 1 year subscription to POPULAR ELECTRONICS.

Honorable Mention Certificate of Merit, suitable for framing, signed by C. P. Fisher.

Booby Prize Picture of our founder.

*patent pending

SIGMA

SIGMA INSTRUMENTS, INC.

CONTEST HEADQUARTERS

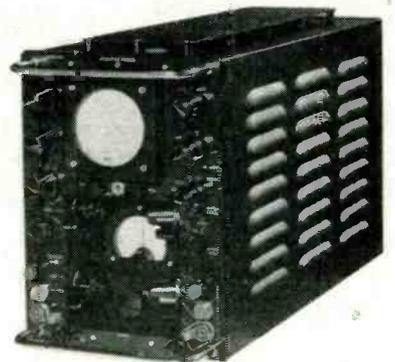
931b Statler Building, Boston 16, Massachusetts

wires, whisker wires in base metals as well as hard platinum alloys, and lead wires of a great variety such as tinned copper wire or ribbon.



PLUG-IN AMPLIFIER is chopper-stabilized

ELECTRO DEVELOPMENT ASSOCIATES, INC., 6403 Cary Drive, Austin, Texas. Model OS3 operational amplifier is a chopper stabilized, miniaturized, plug-in type. Dimensions are $5\frac{1}{4}$ in. \times $5\frac{3}{8}$ in. \times $1\frac{1}{8}$ in.; weight, 15 oz; gain, 4.5×10^7 open loop. Power requirements are 6.5 ma at +300 v d-c; 4.5 ma at -300 v d-c; 0.94 ampere at 6.3 v, 60 cycles. Input impedance is over 100 megohms. Output is -50 v d-c to +50 v d-c, -1 ma to +1 ma into a 50k load.



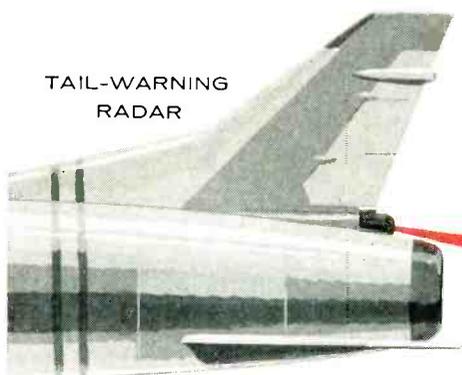
OSCILLOSCOPES in two new models

THE SOLARTRON ELECTRONIC GROUP LTD., Thames Ditton, Surrey, England. Models CD.518 and CD.568 oscilloscope give high brilliance of trace and are fitted with rubber masks to facilitate viewing. The CD.518 has an internal time marker generator providing marker pips at 1- μ sec or 10- μ sec intervals

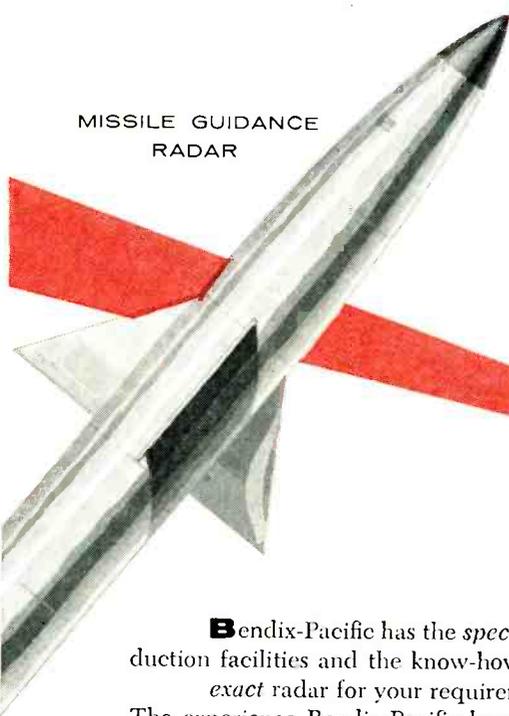


NAVIGATIONAL RADAR

MAPPING RADAR



TAIL-WARNING
RADAR



MISSILE GUIDANCE
RADAR



TERRAIN CLEARANCE
RADAR

**specialized
radar...
made
by
specialists**

BENDIX PACIFIC AIRBORNE RADAR

Bendix-Pacific has the *specialized* engineering talents, the production facilities and the know-how to develop and build the *exact* radar for your requirements.

The experience Bendix-Pacific has already acquired in developing many advanced types of radar equipment and systems offers you a *plus value* that can mean excellence in design and efficiency in manufacture for *your* systems projects.

Let us place a qualified radar systems engineer at your service. He will be glad to visit you at your convenience.

If you are a highly qualified radar engineer, Bendix-Pacific offers you an excellent future. Write for details.



EAST COAST OFFICE: 475 5th AVE., N.Y. 17 • **DAYTON, OHIO**—1207 AMERICAN BLDG., DAYTON 2, OHIO • **WASHINGTON, D.C.**—SUITE 803, 1701 "K" ST., N.W.
CANADIAN DISTRIBUTORS: AVIATION ELECTRIC, LTD., MONTREAL 9 • **EXPORT DIVISION:** BENDIX INTERNATIONAL, 205 E. 42nd ST., NEW YORK 17

NOW

adjustable

POLYSTYRENE CAPACITORS

with Accuracy

in the order



of 0.1% or better

and Long Time

Stability in

the order

of 0.03%



Check these outstanding features:

- I. R. @ 25° C - 10^{12} OHMS
- Dielectric Absorption - .015%
- Dissipation Factor - .0002
- Temp. Coeff. (-20° to 140° F.) 100 P.P.M. per °C

Excellent for Computer Integration, Test Equipment or Secondary Standards.

Join these other leading firms in specifying Southern Electronics' precision polystyrene capacitors for your most exacting requirements: Reeves Instrument Corp., Electronic Associates, Inc., Convair, Berkeley Scientific, M.I.T., Calif. Inst. of Tech., and many others.

Write for complete catalog -

Available from 0.1 M.F.D. to 8 M.F.D.

SOUTHERN ELECTRONICS



Corporation

239 West Orange Grove Ave., Burbank, Calif.

and also a 1-mc sine wave calibration facility. This marker signal may be adjusted readily with respect to the main input trace in order to accurately measure time intervals and time base velocities. The CD.568 gives 1 mc, 100 kc and 10-kc sine-wave outputs. A loose-leaf perforated catalog sheet gives complete specifications.



PULSE FORMING NETWORK

meets military specs

E. S. C. CORP., 534 Bergen Blvd., Palisades Park, N. J. The No. 11-54 pulse forming network forms two 0.6- μ sec pulses at 12-ohm impedance and 500-v d-c working. The entire unit measures only 1 $\frac{3}{8}$ in. \times 1 $\frac{1}{4}$ in. \times 1 $\frac{1}{8}$ in.



LAB INSTRUMENT

analyzes resistance

THE KULJIAN CORP., 1200 N. Broad St., Philadelphia 21, Pa. Model KED-15 resistance analyzer is capable of accurately measuring the voltage coefficient of resistors over a variety of ranges from 1,000 ohms to 1,111 megohms to within 0.1 percent. It was designed to check such characteristics as d-c resistance, temperature coefficient, and voltage coefficient of resistors according to

TAYLOR

Laminated Plastics
Vulcanized Fibre

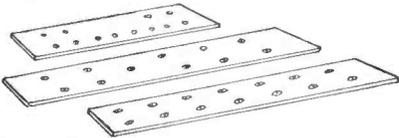
Shop Talk

TAYLOR FIBRE CO.

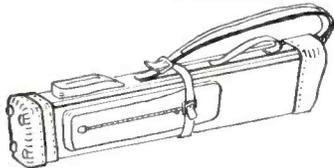
Plants in Norristown, Pa. and La Verne, Calif.

PHENOL—MELAMINE—SILICONE—EPOXY LAMINATES • COMBINATION LAMINATES • VULCANIZED FIBRE • POLYESTER GLASS ROD

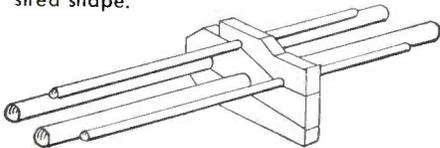
Tips for designers



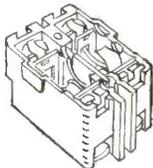
Terminal strips for aircraft electronic equipment Grade GEC epoxy laminate, and of Grade 353 and Grade C phenol laminate . . . each chosen for properties to match the individual application.



Bottom of golf bag is made of Taylor Vulcanized Fibre . . . a tough, abrasion resistant material readily formed to the desired shape.



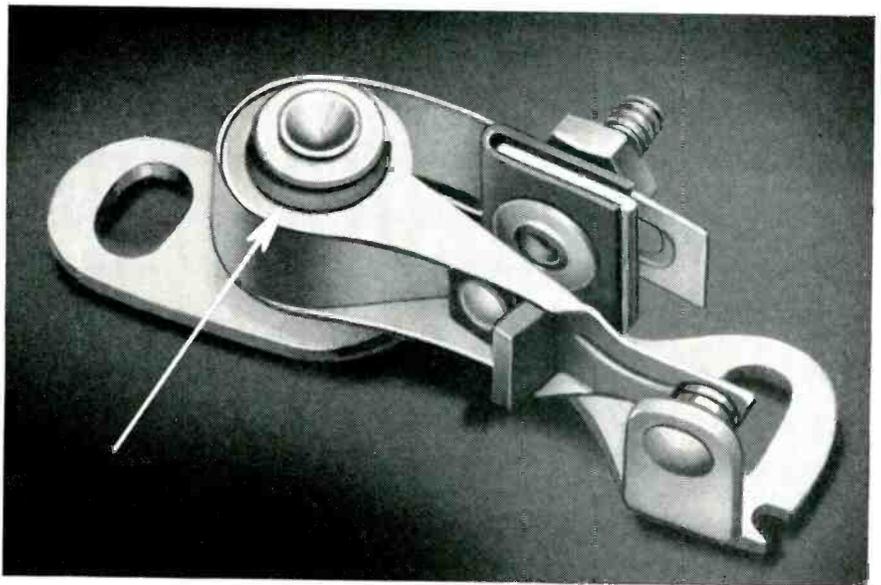
Fuel line clamp for a fighter airplane's "pipeline" system is machined from Taylor fabric base laminate which has high mechanical strength and resists extreme temperature and humidity.



Liners for circuit breakers are made of Taylor Vulcanized Fibre, whose arc-resistant properties protect the breaker's molded base from the damaging effects of arcing at the breaker points.

Taylor Fabricating FACILITIES

Your production problems can often be simplified . . . schedules safeguarded . . . inventory headaches cured . . . and overall costs reduced by having Taylor fabricate finished parts of vulcanized fibre and laminates to your specifications. Efficient, modern facilities are ready to serve you. Write to Taylor about your specific requirements.



Distributor breaker assembly uses Taylor XX laminated tubing for the contact arm bushing. This paper base laminate maintains high dielectric strength under humid conditions, has good dimensional stability and machines readily.

Design for performance and economy— with Taylor Phenol Laminates

You can be sure of getting performance to fit your product at a price to fit your budget, when you design with Taylor phenol laminates. More than thirty different grades offer you a broad combination of electrical, physical and machining properties that cover a wide range of product applications.

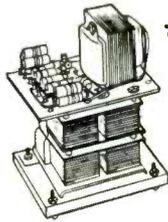
Included in this selection of materials are paper and fabric base grades. Notable among these is a family of hot punch laminates—the new "300" series. Especially developed for the increasingly stringent demands of modern electronics, this series marks a new high in ease of fabrication and economy . . . plus exceptional stability under all climatic conditions.

You'll find that Taylor laminates

can lead to real economies in production, through their excellent punching, staking and machining qualities. They come in forms that permit efficient production of varied shapes . . . sheets 49" by 49", tubes and rods. And they're a real bargain in performance, often giving you properties found only in premium-priced materials.

Equally important, you're always sure of quality. Taylor formulates its own resins . . . manufactures its own special grades of paper . . . all under the strictest laboratory control.

Write today for a copy of the general catalog on these and other Taylor materials. And ask a Taylor specialist to see you for a consultation on your specific materials selection problem.

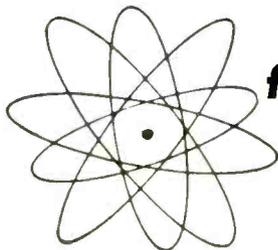


Thompson's
Magnetic
Amplifier

How to "borrow"

... ideas
... facilities
... experience

Thompson's
Airborne Rotary
Selector Switch



from Thompson

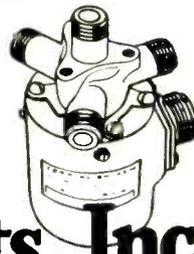
FOR help in untangling knotty electronics problems, many manufacturers have learned to "count on Thompson".

Ideas? To Thompson electronics engineers, no research, development or production problem is "unsolvable". Given the opportunity, they'll come up with sound ideas to solve *your* electronics problems. "Borrow" those ideas!

Facilities? Complete development and testing laboratories . . . plus the most modern production equipment . . . are available to Thompson's electronics engineering staff. "Borrow" these facilities!

Experience? Thompson has had 53 years of successful problem-solving for the automotive, aircraft and general industries of America. The highly developed skills and combined experience of the entire Thompson organization are available to you for all your electronics problems. "Borrow" this experience!

One of the
many
Thompson
Coaxial
Switches



CORONA DETECTOR
is safety type

SUNSHINE SCIENTIFIC INSTRUMENT, 1810 Grant Ave., Philadelphia 15, Pa. The detector illustrated determines the presence of corona in h-v rotating apparatus. The unit consists of a probe mounted on the end of an insulating pole, a control unit and cables. It is connected to a standard oscilloscope for a visual corona reading. The equipment is inexpensive, portable, safe and easy to use, and can prevent damage, shutdown and material spoilage. Catalog No. 17 describes the instrument in detail.



POTENTIOMETERS
are high-resolution type

DEJUR-AMSCO CORP., 45-01 Northern Blvd., Long Island City 1, N. Y. Series K-200 high resolution poten-

Electronics Division

Thompson Products, Inc.

2196 CLARKWOOD RD., CLEVELAND 3, OHIO

Quality, Accuracy & Dependability

THESE FREED TELEMETERING COMPONENTS

TELEMETERING BAND PASS FILTERS

Covers the frequency band from 400 cps to 70 kc. 3 DB Band width $\pm 9\frac{3}{4}\%$ of center frequency. Features octal "plug in" header. Size $2\frac{1}{8}'' \times 3\frac{1}{2}'' \times 4\frac{1}{2}''$.

FREED #	CENTER FREQUENCY	3 DB BAND WIDTH
FBP-34	400 cps	$\pm 9\frac{3}{4}\%$ CF
FBP-35	560 cps	$\pm 9\frac{3}{4}\%$ CF
FBP-36	730 cps	$\pm 9\frac{3}{4}\%$ CF
FBP-37	960 cps	$\pm 9\frac{3}{4}\%$ CF
FBP-38	1300 cps	$\pm 9\frac{3}{4}\%$ CF
FBP-39	1700 cps	$\pm 9\frac{3}{4}\%$ CF
FBP-40	2300 cps	$\pm 9\frac{3}{4}\%$ CF
FBP-41	3000 cps	$\pm 9\frac{3}{4}\%$ CF
FBP-42	3900 cps	$\pm 9\frac{3}{4}\%$ CF
FBP-43	5400 cps	$\pm 9\frac{3}{4}\%$ CF
FBP-44	7350 cps	$\pm 9\frac{3}{4}\%$ CF
FBP-45	10500 cps	$\pm 9\frac{3}{4}\%$ CF
FBP-46	12300 cps	$\pm 9\frac{3}{4}\%$ CF
FBP-47	14500 cps	$\pm 19\frac{1}{2}\%$ CF
FBP-48	22 KC	$\pm 9\frac{3}{4}\%$ CF
FBP-49	22 KC	$\pm 19\frac{1}{2}\%$ CF
FBP-50	30 KC	$\pm 9\frac{3}{4}\%$ CF
FBP-51	30 KC	$\pm 19\frac{1}{2}\%$ CF
FBP-52	40 KC	$\pm 9\frac{3}{4}\%$ CF
FBP-53	40 KC	$\pm 19\frac{1}{2}\%$ CF
FBP-54	52.5 KC	$\pm 9\frac{3}{4}\%$ CF
FBP-55	52.5 KC	$\pm 19\frac{1}{2}\%$ CF
FBP-56	70 KC	$\pm 9\frac{3}{4}\%$ CF
FBP-57	70 KC	$\pm 19\frac{1}{2}\%$ CF

CHARACTERISTIC IMPEDANCE 2500 OHMS

Band pass filters FBP-10 through FBP-33 feature the same attenuation characteristics as the above listing and are supplied with solder lug terminals.

SLUG TUNED DISCRIMINATORS

Covers the frequency band of 3 kc to 70 kc. Frequency deviation $\pm 8\frac{1}{2}\%$ of center frequency. $\frac{1}{2}\%$ linearity. Features slug tuned adjustment. Size $1\frac{1}{8}'' \times 2\frac{1}{4}'' \times 4\frac{1}{2}''$.

FREED #	DST	Fo	FREQUENCY DEVIATION	LINEARITY	DC OUTPUT
17	3	KC	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%	32.5V
18	3.9	KC	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%	32.5V
19	5.4	KC	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%	32.5V
20	7.35	KC	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%	32.5V
21	10.5	KC	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%	32.5V
22	12.3	KC	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%	32.5V
23	14.5	KC	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%	32.5V
24	22	KC	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%	32.5V
25	30	KC	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%	32.5V
26	40	KC	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%	26V
27	52.5	KC	$\pm 7\frac{1}{2}\%$ Fo	WITHIN 1%	26V
28	70	KC	$\pm 15\%$ Fo	WITHIN 1%	26V
29	22	KC	$\pm 15\%$ Fo	WITHIN 1%	26V
30	30	KC	$\pm 15\%$ Fo	WITHIN 1%	26V
31	40	KC	$\pm 15\%$ Fo	WITHIN 1%	26V
32	52.5	KC	$\pm 15\%$ Fo	WITHIN 1%	26V
33	70	KC	$\pm 15\%$ Fo	WITHIN 1%	26V

FREED #	CENTER FREQUENCY	LINEARITY	DC OUTPUT
10	400 cps	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%
11	560 cps	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%
12	730 cps	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%
13	960 cps	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%
14	1300 cps	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%
15	1700 cps	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%
16	2300 cps	$\pm 8\frac{1}{2}\%$ Fo	WITHIN .5%

DISCRIMINATOR INPUT LOW PASS FILTERS

Covers the frequency band of 400 cps to 70 kc. Less than .05 DB attenuation at $\pm 9\frac{3}{4}\%$ of center frequency. 30 and 50 DB attenuation at the third and fifth harmonic of the pass band frequencies. Size $1\frac{1}{2}'' \times 1\frac{1}{2}'' \times 4\frac{1}{2}''$.



CHARACTERISTIC IMPEDANCE 30,000 OHMS

LPI --	Fo
10	400 CPS
11	560 CPS
12	730 CPS
13	960 CPS
14	1300 CPS
15	1700 CPS
16	2300 CPS
17	3000 CPS
18	3900 CPS
19	5400 CPS
20	7350 CPS
21	10.5 KC
22	12.3 KC
23	14.5 KC

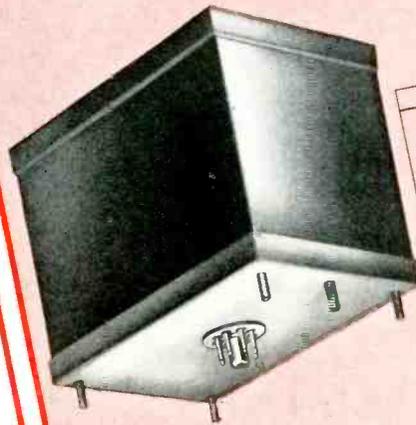
CHARACTERISTIC IMPEDANCE 5100 OHMS

LPI --	Fo
24	22 KC
25	30 KC
26	40 KC
27	52.5 KC
28	70 KC

DISCRIMINATOR OUTPUT LOW PASS FILTERS

Covers the frequency range from 6 cycles to 10,000 cycles. Features octal "plug in" header. Size $4'' \times 6'' \times 4\frac{1}{2}''$.

CHARACTERISTIC IMPEDANCE 330 OHMS
ATTENUATION: LESS THAN .2DB UP TO 5 TIMES Fo
LESS THAN .7DB FROM 5 Fo TO 1. Fo
MORE THAN 20DB AT 2 TIMES Fo
MORE THAN 30 DB FROM 3 TIMES Fo TO 100 KC



LPO --	Fo
10	6 CPS
11	8 CPS
12	11 CPS
13	14 CPS
14	20 CPS
15	25 CPS
16	35 CPS
17	45 CPS
18	60 CPS
19	81 CPS
20	110 CPS
21	160 CPS
22	220 CPS
23	330 CPS
24	450 CPS
25	600 CPS
26	660 CPS
27	790 CPS
28	900 CPS
29	1050 CPS
30	1200 CPS
31	1600 CPS
32	2100 CPS
33	7200 CPS
34	10000 CPS
35	

IN STOCK FOR IMMEDIATE DELIVERY

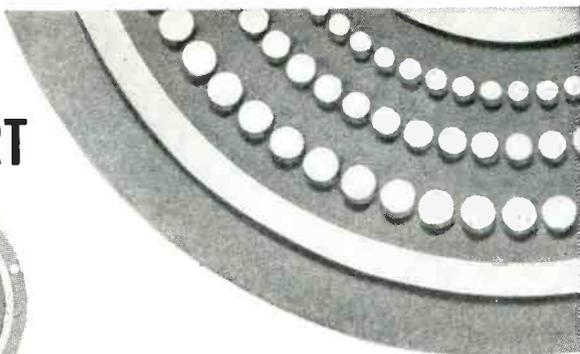
Send for further information and catalog

FREED TRANSFORMER CO., INC.

1722 Weirfield Street

Brooklyn (Ridgewood) 27, New York

FIRST REPORT



MYCALEX®

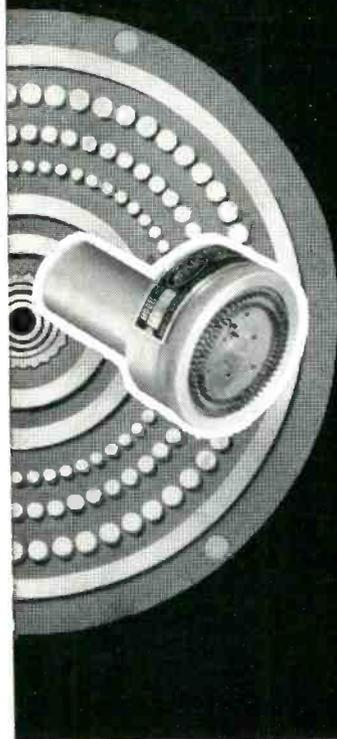
TELEMETERING TESTS

1660 hours

of high quality switching at **600 rpm**

March 29, 1955:

After 1660 hours of operation, the new Mycalex Model TM-55 Series Commutator Switch continues to function with a perfect and unchanging signal. This initial continuous test run was halted only to permit a simple brush cleaning — and the life test resumed. Test goal — 10,000 hours!



170 hours

of uniform operation at **1,800 rpm**

A second test — running concurrently — and using the new Mycalex Model TM-55 Series brush construction provided a clean signal for 170 hours at 1,800 rpm! Once again, operation was halted only to permit brush cleaning — and the test resumed.

Mycalex 410 provides:

- absolute dimensional and age stability
- imperviousness to moisture
- precision dimensional tolerance control
- temperature endurance to 650°F.

Write today:

Mycalex Electronics Corporation
Dept. 114
P. O. Box 311
Clifton, N. J.

MYCALEX ELECTRONICS CORPORATION



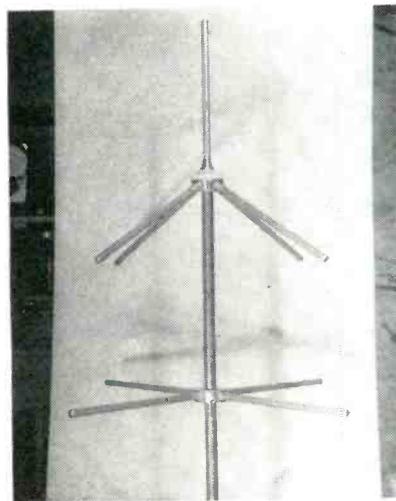
Under exclusive license
of the Mycalex Corporation
of America

Executive Offices
30 Rockefeller Plaza
New York 20, N. Y.

NEW PRODUCTS

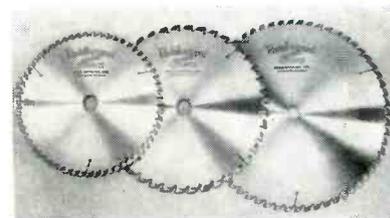
(continued)

tiometers are especially designed for low-torque, high-function-angle applications. These 2-in., ball-bearing potentiometers are completely enclosed and can be used as single or multiple ganged units. Any practical number of potentiometer sections can be ganged on a single shaft by one-piece stainless-steel clamp rings. This arrangement permits precise phasing of each unit without disassembly and independently of other units.



LOW-BAND ANTENNA for communications uses

HERB KRECKMAN, 124 Greenwood Drive, Massapequa, N. Y. A new Kreco antenna announced recently is the low-band (25 to 50 mc) duoground-plane styled after the tried and proven high-band version. This antenna model GP-830, is ruggedly constructed and easily mounted — and fed with RG-8/U coaxial cable.

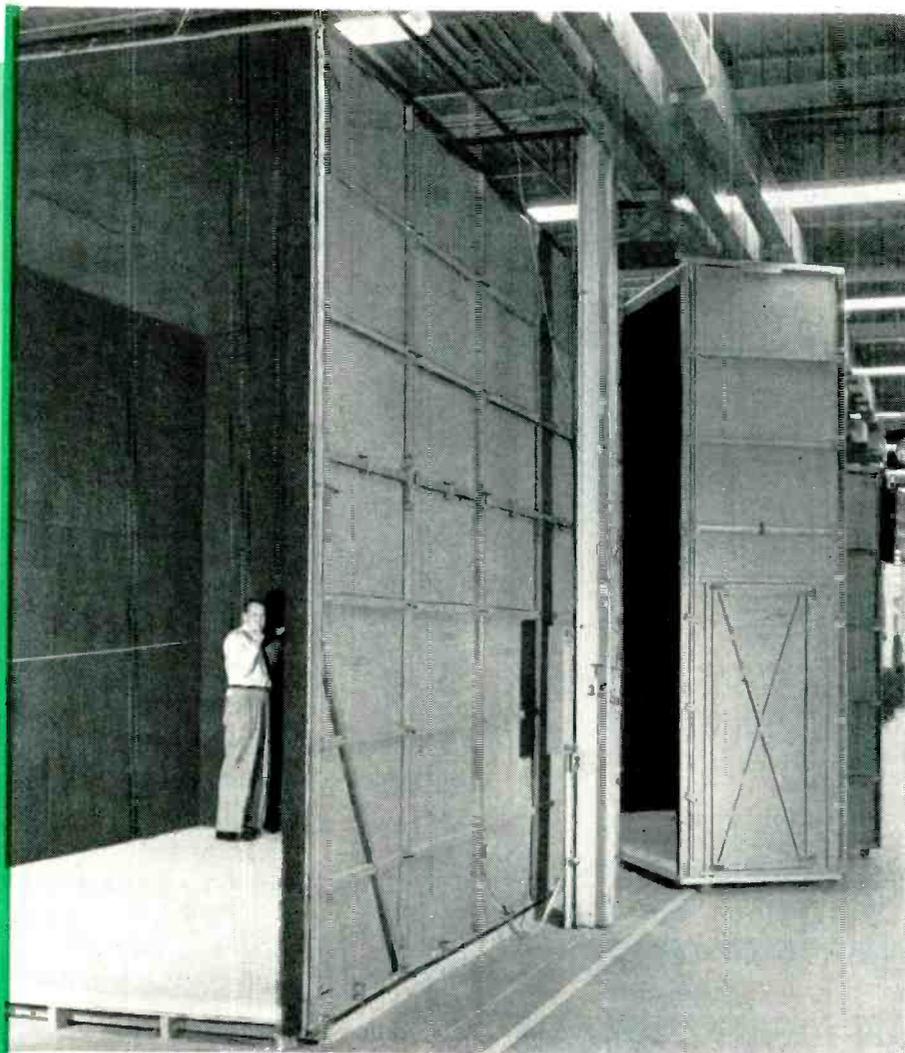


SAW BLADES are Radialloy-tipped

RADIAL CUTTER MFG. CORP., 831 Bond St., Elizabeth 4, N. J. Extensive field testing in the field of printed circuitry phenolics has enabled the manufacturer to develop a saw that takes naturally to tough

**to simulate
free space
for
microwave
antenna
testing**

**Westinghouse
uses the
new**



McMillan

"free space" room

At Westinghouse Electric Corporation's Air Arm Division in Baltimore, the problem was to produce a large room which would simulate free space conditions for microwave testing to be done in conjunction with environmental testing. The McMillan "free space" unit illustrated above was especially designed in association with Westinghouse to fit this particular need.

McMillan supplied a "modular unit" consisting of the individual structural-steel channels, or ribs, together with the microwave absorber panels. It was a simple job for Westinghouse workmen to form the construction and mount the panels.

In this installation, McMillan Hair Mat, type H-4 was used on the wall and ceiling panels for its light weight, while the floor panels utilized McMillan Plastic Foam Block, type B which can be walked on without affecting its electrical performance. All absorbing materials were backed with copper shielding to prevent R.F. disturbance from outside. Panels were approximately 4' x 8'. The complete front section (right hand section of illustration above) which includes the door, was mounted on roller casters to allow large equipment to be moved in and out.

McMillan can produce any size room on this "modular" principle, with whatever type microwave absorber may be required — for either indoor or outdoor use. Send for catalog.



INDUSTRIAL CORPORATION

26 BROWNVILLE AVENUE

IPSWICH, MASSACHUSETTS

marion
 advancement
 in instrument
 design

**SOLDERING
 PROBLEMS
 ?**

PORTABLE
 BENCH-TYPE
 INDUCTION
 SOLDERING
 UNIT CUTS
 ASSEMBLY
 COSTS...

Simplifies,
 improves and
 speeds up
 component production.
 Provides local heat to
 otherwise inaccessible spots.
 Safe and simple. Max. power input 775
 watts, 100 watts standby; 115 volts,
 60 cycles. Measures 15 3/4" x 21 1/2" x 15",
 weighs 150 lbs. Price \$414.00, foot
 treadle extra. Complete data on request.



Model PM1



marion electrical instrument co.
 Grenier Field, Manchester, N. H., U. S. A.
 Manufacturers of Ruggedized and "Regular"
 Panel Instruments and Related Products.
 copyright 1955 M.E.I. Co.

marion meters

**VIBRATING
 REEDS**

100 TO 400 CPS

Hi-Q

RESONANT RELAYS
 OSCILLATORS
 FILTERS



Q = 50
 Q = 100
 Q = 200
 Q = 400

Plug-In

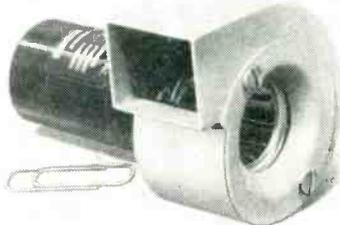
RUGGEDIZED
 MINIATURIZED
 HERMETICALLY SEALED
 ZERO TEMPERATURE COEFFICIENT
 FOR INFORMATION WRITE TO

Winkler Laboratories
 5225 N. 20th St. • Phoenix, Arizona

NEW PRODUCTS

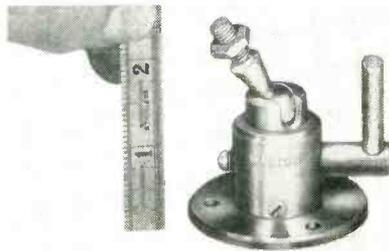
(continued)

cutting materials. The Radialloy-tipped saw blades are ideally suited for application in the electronics industry since they provide fine chip-free cuts, close tolerance operation, smooth edges and production and maintenance economy. They are available in 6, 7, 8, 10, 12, 14, 16 and 18-in. diameters with 30, 40, 60, 72 and 80 teeth. An illustrated brochure is available.



**CENTRIFUGAL BLOWER
 cools airborne equipment**

EASTERN AIR DEVICES, INC., 397 Central Ave., Dover, N. H. A new, compact, high velocity, subminiature centrifugal blower for cooling airborne electronic equipment has been announced. The unit is only 2 1/2 in. long and weighs less than 6 oz. Designed and tested for high altitude and high ambient operation, it meets all applicable MIL specifications. The new blower, available in either rotation and in single or double-ended models features a metal blower housing for compactness and maximum air delivery. The housing can be rotated to any required position. These blowers deliver air at comparatively high velocity which is of great importance to efficient cooling of small objects.



**WORK POSITIONER
 is small and lightweight**

WILLTON TOOL MFG. Co., 9525 Irving Park Road, Schiller Park, Ill. Manufacturers of electronic

ZOPHAR
 ---WAXES
 ---COMPOUNDS

Zophar Waxes, resins and compounds to impregnate, dip, seal, embed, or pot electronic and electrical equipment or components of all types; radio, television, etc. Cold flows from 100°F. to 285°F. Special waxes non-cracking at 76°F. plain or fungicidal. Let us help you with your engineering problems.

For immediate service contact:
 L. E. Mayer, Sales Manager
 A. Saunders, Technical Director
 H. Saunders, Chemical Laboratory
 Phone SOuth 8-0907

ZOPHAR MILLS, INC.
 112-130 26th Street,
 Brooklyn 32, N. Y.

109 YEARS

Over 85% of the torque wrenches used in industry are

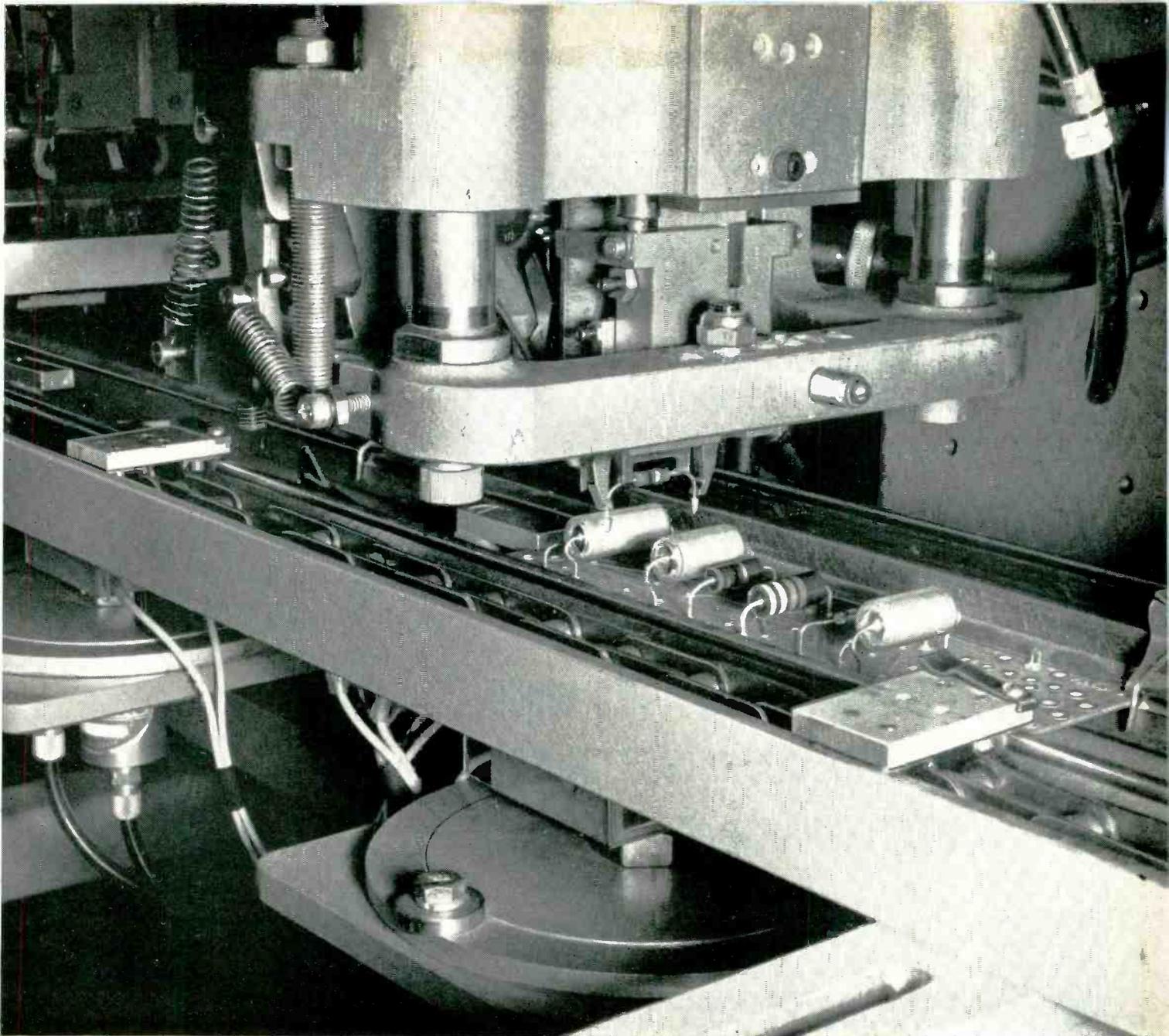
STURTEVANT
 TORQUE WRENCHES
 Read by Sight, Sound or Feel.

- Permanently Accurate
- Practically Indestructible
- Faster—Easier to use
- Automatic Release
- All Capacities

in inch grams...inch ounces...inch pounds...foot pounds. (All sizes from 0-6000 ft. lbs.)

Every manufacturer, design and production man should have this valuable data. Sent upon request.

PA **STURTEVANT CO**
 ADDISON [QUALITY] ILLINOIS



THIS IS AUTOFAB, an automatic machine that assembles 9,600 electronic circuits in a single working day. Designed, built and offered for sale by General Mills, *Autofab* assembles

printed circuits (complete with practically all radio and TV components) at lower cost than ever before. Components can be attached at any angle and at any position on the base plate.

AUTOMATION? Consult a pioneer in the field

Autofab is an outgrowth of General Mills' 28 years of experience in the design and production of automatic processing and packaging equipment. Our staff is thoroughly experienced in the theory and practice of automation; our complete facilities and a diversified staff of 2,000 enable us to carry entire projects from the research stage to final production in quantity.

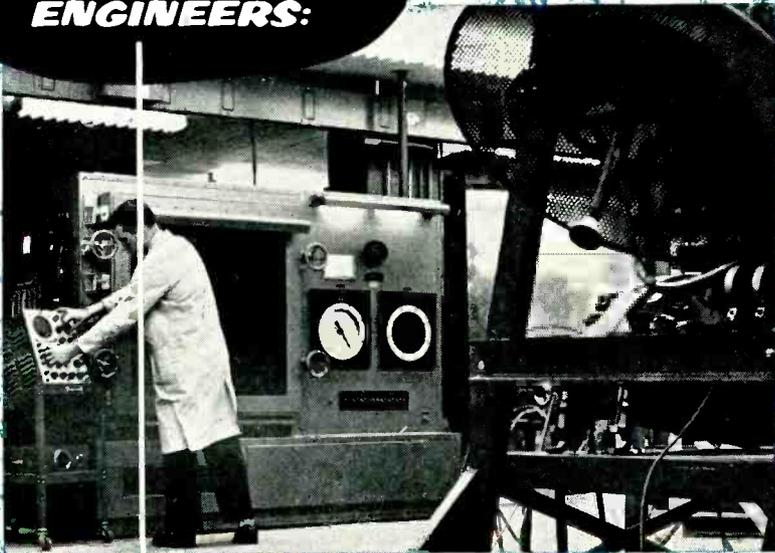
Autofab is a GMI trademark.

WHAT'S YOUR PROBLEM? General Mills can help you with research, design, development, production engineering and precision manufacturing in connection with • automation • bombing, navigation and missile control systems • industrial instrumentation and control • specialized precision instrumentation • electro-mechanical computers • remotely-controlled manipulators • fine-particle technology • meteorological and high-altitude research.

JUST OFF THE PRESS is a new booklet describing the services available to you at the Mechanical Division. An 8-page brochure with details of the *Autofab* machine is also available. For either or both, address Dept. EL-4, Mechanical Division of General Mills, 1620 Central Avenue, Minneapolis 13, Minn.

Job opportunities available for creative engineers. Work closely with outstanding men on interesting projects.

MECHANICAL DIVISION OF General Mills, Inc.

ELECTRONIC ENGINEERS:

READ WHAT HAPPENED WHEN WE PUT OURSELVES IN THE WESTINGHOUSE TEST CHAMBER

Both the Electronics and the Air Arm Divisions of the Westinghouse Electric Corporation are expanding. We need experienced electronic engineers for advanced design and development work . . . so we put ourselves in the "environmental test chamber" to see just what we have to offer the people we need.

We found that we have a professional atmosphere that is ideal for the engineer. We offer advanced study at company expense and merit promotions that assure a good future.

Our income and benefit advantages scored high on this test, too. Finally, there were many "extras," like the Westinghouse Patent Award Program, that make investigation of the current openings worthwhile for all electronic engineers.

APPLY NOW-

Openings exist in the fields of—

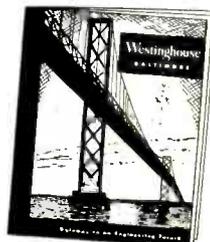
COMMUNICATIONS (Microwave)	BOMBER DEFENSE
FIRE CONTROL	MISSILE GUIDANCE
RADAR	FIELD ENGINEERING
COMPUTERS	TECHNICAL WRITING
INDUSTRIAL INDUCTION HEATING	TEST EQUIPMENT

Send resume outlining education and experience to:

Technical Director
Dept. 241
Westinghouse Electric Corporation
2519 Wilkens Avenue
Baltimore 3, Md.

TO APPLY-

**ILLUSTRATED BROCHURE
WILL BE SENT TO
ALL APPLICANTS.**

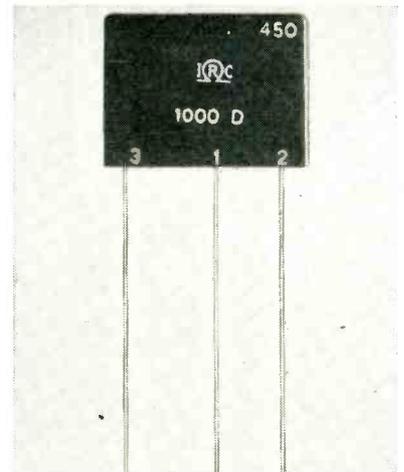


PRINTED CIRCUIT enclosed by molding process

INTERNATIONAL RESISTANCE Co., 401 N. Broad St., Philadelphia 8, Pa. Type MCR printed electronic circuit is completely enclosed by a molding process which transforms the entire assembly into a strong, compact unit and features improved moisture resistance and less change on load life. The units offer lower voltage coefficients, greater shelf-life stability and stable, improved temperature coefficients. They are available with round copper wire terminals and tab leads.

GROMMETS are nonabrasive type

SHAMBAN ENGINEERING Co., 11617 W. Jefferson Blvd., Culver City, Calif. The S11154 one-piece grommets are fabricated of KELON-T (Teflon). Designed for use in aircraft and electronic applications to guide cables and conduits through





Truflex

Continuous Coils Cut Production Costs

TRUFLEX[®] Thermostat Metal Coils Over $\frac{1}{3}$ Mile Long in One Piece Simplify Fabrication and Reduce Costs in Thermal Element Manufacture

The problem . . . to obtain thermostat metal strip in a series of types having sufficiently uniform dimensional control and temperature response to be fabricated into finished parts on automatic machines.

The solution . . . Step 1; the consistent quality of each type of TRUFLEX tested quickly demonstrated that mass production by machine was fully practical for all types.

Step 2; General Plate Division then supplied the required types in long coils 3 feet in diameter with center hole to fit the customer's automatic machine arbors. Each coil is a continuous piece 1800 feet long, by 0.040" thick and 0.250" wide.

These coils save the customer many dollars by minimizing idle machine time and eliminating costly waste of material in fabrication.

If your products require temperature

control . . . indication or compensation, the accurate performance and uniform high quality of TRUFLEX Thermostat Metals will save you money too.

Here's why! General Plate Division uses advanced production methods, combining the best equipment available with years of manufacturing "know how", to insure positive consistence in thermal and mechanical performance of TRUFLEX Thermostat Metals.

General Plate Division will fabricate parts from TRUFLEX to meet the specific mechanical and electrical performance demands of your particular applications. Or, if you prefer to make your own parts, General Plate Division will supply TRUFLEX Thermostat Metal in strip to meet your specifications.

Write today for your copy of the new TRUFLEX Thermostat Metal Catalog. Engineering assistance available without obligation.



**GENERAL PLATE ELECTRICAL
CONTACT KIT
FOR LABORATORY
AND DEVELOPMENT USE**

Kit K11 contains a wide assortment of silver rivet contacts; Kit K12 has representative standard button contacts. Also included are metal strips for fabrication of contact parts. These kits are available at nominal cost.

**METALS & CONTROLS CORPORATION
GENERAL PLATE DIVISION
39 FOREST STREET, ATTLEBORO, MASS.**

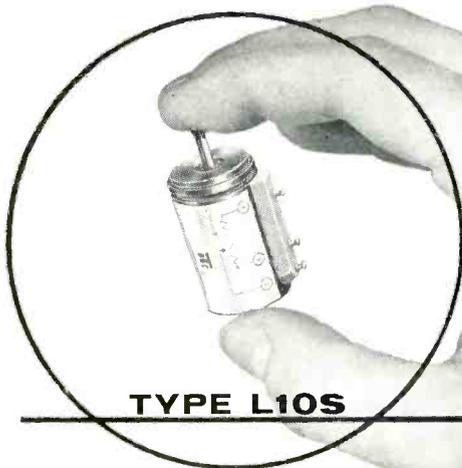
*You can profit by using
General Plate Composite Metals!*

NOW

MINIATURIZATION

plus

PERFORMANCE



TYPE L10S

in
precision
multiturn
potentiometers

TIC, a leader in precision potentiometers, again sets the standard. New L10S provides miniaturization for compact assemblies . . . without sacrificing performance.

Designed to meet stringent military specifications — tested to MIL-E-5272A. Manufactured to extremely close mechanical tolerances — precision pilot . . . centerless ground shaft . . . precision ball bearings. Made for high electrical accuracy. Type L10S provides rugged construction . . . light weight . . . low torque . . . inherent stability . . . and high resolution.

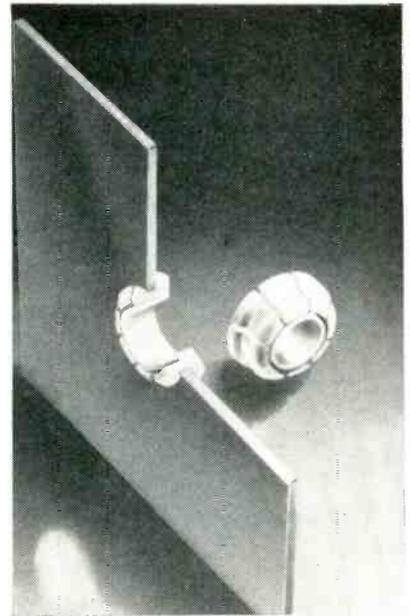
Wide temperature and resistance ranges of miniature L10S provide greater versatility. Extend its application in servo systems . . . computers . . . control . . . telemetering . . . and measurement systems. Check the L10S features. Then write for free brochure.

NEW

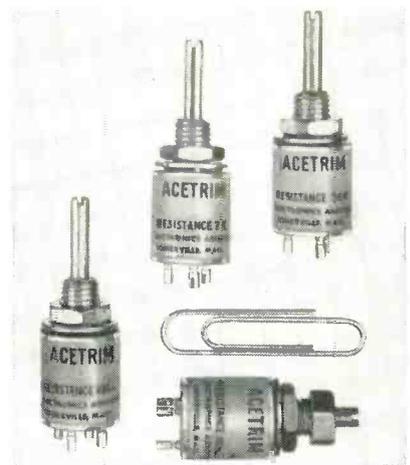
ULTRA-LINEAR
RUGGED
HIGH TEMPERATURE

CHECK THESE
FEATURES

LINEARITY:
±0.05% standard; ±0.025%, special.
TEMPERATURE RANGE:
-55°C. to +130°C.
RESISTANCE RANGE:
1000 ohms to 100,000 ohms.
WEIGHT:
1 ounce.
TORQUE:
Starting .75 in. oz., Running .60 in. oz.



bulkheads, they resist chemical action and heat. Natural slipperiness of KELON-T and smooth rounded edges minimize abrasion and extend service life of cables and conduits. They can be installed easily in blind or hard-to-reach locations from one side of a bulkhead. Useful temperatures range from -110 F to +300 F. Grommets are available in a full range of diameters and will accommodate sheet thicknesses from 0.025 in. to 0.125 in.



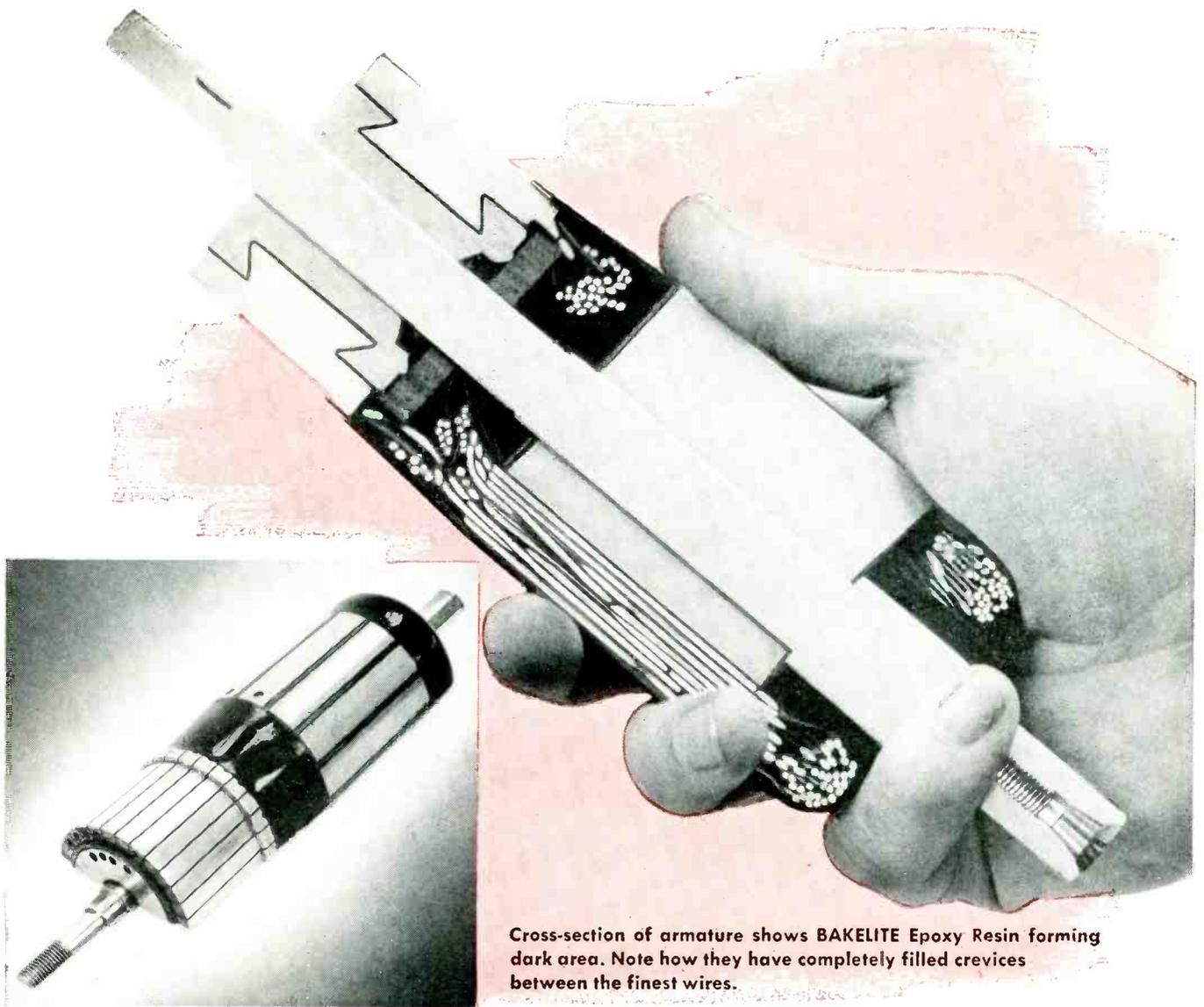
TRIMMERS
are ½ in. diameter

ACE ELECTRONIC ASSOCIATES, 125 Rogers Ave., Somerville 44, Mass., announces Acetrim, a new line of subminiature wire-wound precision potentiometer trimmers. They feature a diameter of ½ in., resistance range from 10 ohms to 50,000 ohms, ambient temperature range from

TECHNOLOGY INSTRUMENT CORP.

533 Main St., Acton, Mass., Colonial 3-7711

West Coast Mail Address: P.O. Box 3941, North Hollywood, Calif., POplar 5-8620



Cross-section of armature shows BAKELITE Epoxy Resin forming dark area. Note how they have completely filled crevices between the finest wires.

Encapsulation with **BAKELITE** Epoxy Resin Ended Rejects and Returns!

With BAKELITE Brand Epoxy Resin replacing conventional materials for insulating this 2 H.P. D.C. motor armature, the manufacturer reports rejects and returns reduced to zero! It is a vital part of a compressor used in special military aircraft and operates at 3,000 psi. and 2 cfm.

The use of BAKELITE Epoxy Resin provided greater permanence of form, higher impact strength, improved chemical and moisture resistance, and lower maintenance cost.

Despite 8000 RPM and temperatures up to 400 deg. F., the manufac-

turer states that not a single insulation failure has been reported since encapsulation of this armature in BAKELITE Epoxy Resin.

Several types of BAKELITE Epoxy Resins are available for potting and encapsulating techniques. Specially formulated BAKELITE Epoxy hardeners provide a variety of viscosities and curing speeds to meet a wide variety of applications. You can pick the combination with the best set of properties for your specific product. For detailed information and list of suppliers, write Dept. KJ-50.

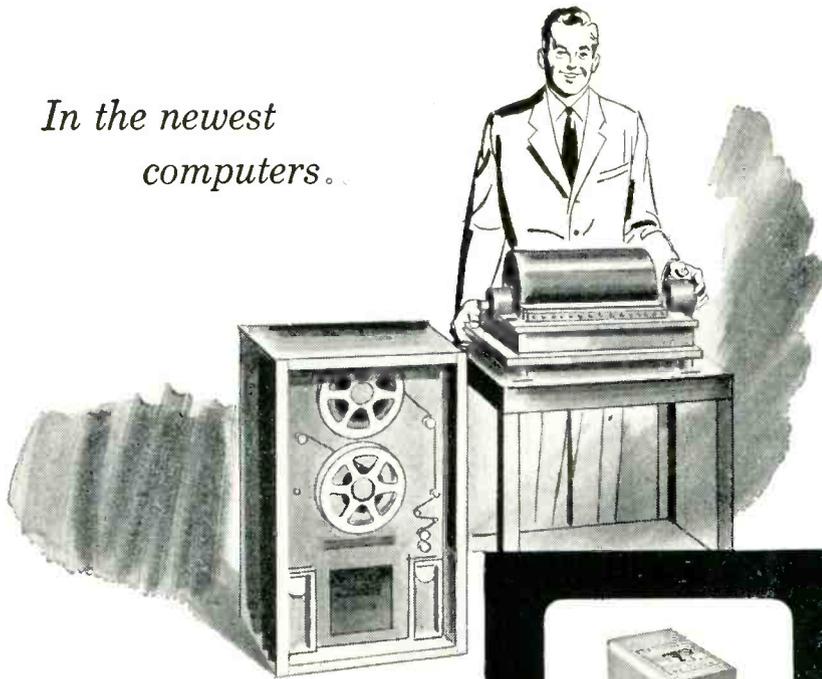


Armature encapsulated by
McCulloch Motors Corp.,
 Los Angeles 45, Cal.

BAKELITE COMPANY, A Division of Union Carbide and Carbon Corporation UCC 30 East 42nd Street, New York 17, N. Y.

The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC

*In the newest
computers.*



BRUSH MAGNETIC HEADS

*help provide system
flexibility—accuracy—high
storage density*

IN DRUM MEMORY SYSTEMS...

Several basic Brush multichannel and single channel heads (and their modifications) permit flexibility in Magnetic Drum design. Low loss materials provide greater magnetic head efficiency.

IN TAPE MEMORY SYSTEMS...

Precision construction of Brush multichannel heads with close tolerances on gap and track alignment permits greater pulse packing and closer track spacing. Equipment can be designed with increased storage capacity and faster access with Brush heads.

For specifications on standard products or designs to your requirements, write Brush Electronics Company, Dept. K-9A, 3405 Perkins Avenue, Cleveland 14, Ohio.

BRUSH ELECTRONICS COMPANY

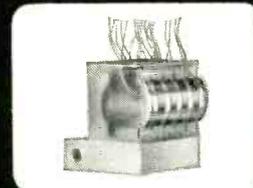
*Division of
Clevite Corporation*



BK-1300 series—up to 25 interlaced channels per inch.



BK-1500 series—ultimate in precision-made multichannel heads.



BK-1605 series—simple mounting and adjustment, ideal for drum computers.



BK-1501 series—compact, wafer-thin, permit individual adjustment.



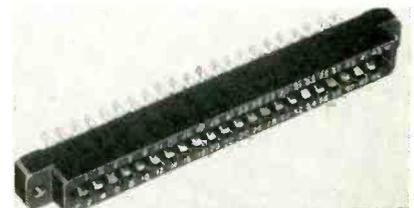
BK-900, BK-1000, BK-1200 series—variety of types for single channel applications.

—55 to 125 C, a new type shaft lock and weight of only $\frac{1}{4}$ oz. The case and threaded mounting bushing is precision machined, one-piece anodized aluminum for maximum heat dissipation. The shaft is centerless ground stainless steel with a threaded bushing; available with nonrotating lock or stops if required.



VSWR INDICATOR with 100-cps bandwidth

THE SOLARTRON ELECTRONIC GROUP LTD., Thames Ditton, Surrey, England. Model CA.512 vswr indicator is a compact sensitive amplifying detector unit for use in microwave instrumentation. An indication is given of standing wave direct value, or in terms of ratio or reflection coefficient. The instrument is used in conjunction with a probe detector element which is moved in a slotted-line section of the waveguide under test. Indication is given on a clearly scaled 6-in. meter and there is coarse and fine adjustment of overall sensitivity provided. Due to use of a selective amplifier in the instrument there is an extremely low noise level on the detected signal, this enabling the maximum gain to be used without loss of accuracy in readings.



CONNECTORS for printed circuits

CANNON ELECTRIC Co., 3207 Humboldt St., Los Angeles 31, Calif., has available five new connectors for

MISSILE TEST EQUIPMENT For over ten years Farnsworth has participated in the design, development, and production of guidance and control systems and special test equipment for such missile programs as Terrier, Talos, Sparrow, and others. Numerous "firsts" in this field have been accomplished as a result of contributions in the form of missile receivers, control systems, power supplies and complete system analyses.

IATRON A charge-controlled cathode ray "memory" tube permits operator-controllable image persistence from one millisecond up to several minutes duration. Unusually brilliant picture presentation at a brightness level of up to 10,000 footlamberts for projection purposes.

IMAGE CONVERTER TUBES Used in any application where it is necessary or desirable to "see in the dark." Convert an infrared image into a visible image. Applications: medical and biological research, hot-body observation, temperature distribution, crime detection, security, and photography.

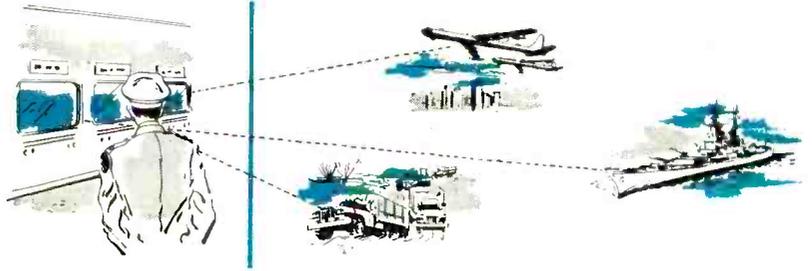
INFRARED VIEWER This unique, compact, easy to handle viewer is a valuable tool for crime detection, research and industrial application. Observation of objects or scenes in the dark is easily accomplished when they are illuminated by infrared radiation.

PHOTOMULTIPLIER TUBES Responsive in the near infrared spectrum featuring sensitivities as high as 50 amperes per lumen of incident radiation. Applications include photometric measurements for industrial and scientific uses.

IMAGE DISSECTOR A highly versatile TV camera tube particularly well adapted for use as a slide or facsimile scanner. This tube can be constructed in a variety of types to meet special requirements.

RADAR RANGE CALIBRATOR, AN/UPM-11A A precision instrument incorporating both "Radar" and "Beacon" functions. The equipment operates as a radar transponder in that pulsed r-f energy fed into the equipment results in a series of return echo pulses being fed back from the equipment to the radar under calibration. This simulates radar targets at accurately determined ranges.

PORTABLE CABLE TESTER Designed for testing all radio frequency cables that will accommodate, or can be adapted to, type "HN", "N", or "BNC" connectors. It will supply a d-c voltage up to 12,000 volts provided the current drain is negligible, and current surges of at least 3,000 amperes peak into a load of 0.05 ohm at room temperature.



MORE THAN 30 YEARS experience in electronic television bring you Farnsworth's model 600A standard Industrial Television system. Military and industrial uses of this great new medium are rapidly becoming common-place but only Farnsworth can offer you this experience plus the skills accumulated over years of successful design and

Farnsworth DIVISION OF IT&T

vision . . . beyond the range of sight . . .

production of complex military electronic equipment. In the air, on the sea, in the factory, in your business—there is a place for industrial television in your future. Why not use the best?

ELECTRONICS THE KEY TO AMAZING TOMORROWS
RESEARCH
RADAR
ELECTRON TUBES
MISSILE



Applied Physics, Circuit Research, Solid State Physics, Low Temperature Physics.



Transmitters and Receivers, Computers, Microwave Components, Pulse-Coding and Circuitry.

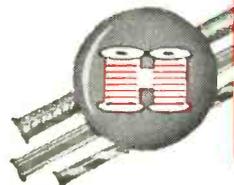
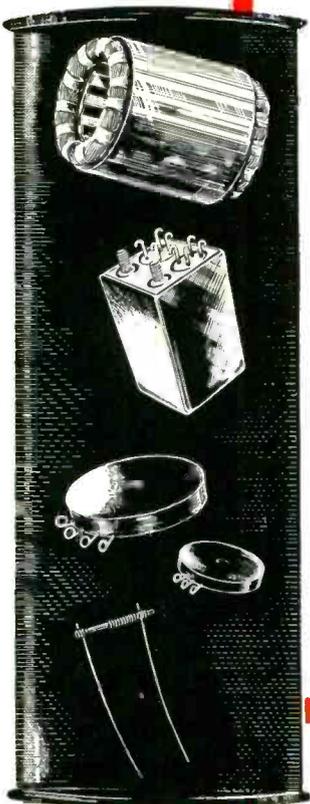
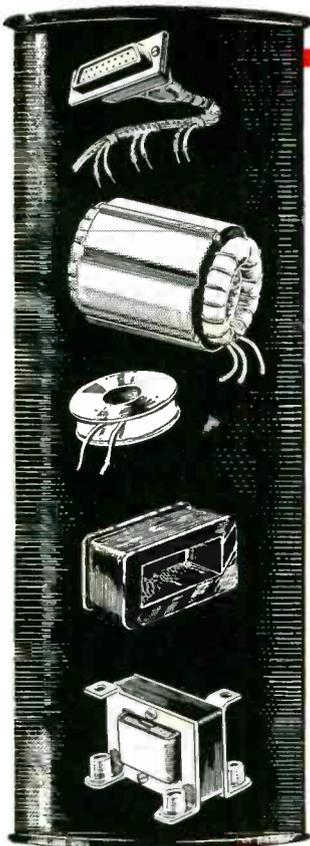


Photomultipliers, Storage Tubes, Image Tubes, Infrared Tubes.



Guidance and Control Systems, Test Equipment.

FARNSWORTH ELECTRONICS COMPANY • FORT WAYNE, INDIANA
a division of International Telephone and Telegraph Corporation



THE ONE



SOURCE FOR

HOOK-UP

AND

MAGNET WIRES

for class **H** service

Hitemp Wires, Inc. specializes in the production and development of Teflon* insulated wires for high temperature application and miniaturization (class H service). All Teflon hook-up wire meets MIL-W-16878A (E & EE). Teflon magnet wire, manufactured to standard wire gauges, is available in single, heavy, triple and quadruple insulation thicknesses.

Being specialists in high temperature insulated wire, we can manufacture wire and cable to your specific requirements. Among these are 50, 70 and 93 ohm coaxial cables.

Throughout manufacture, Hitemp quality engineered wires are subjected to the most rigid tests and inspections to insure the closest tolerances before prompt shipment.

Let your nearest Hitemp sales engineer help you with your high temperature wire problems today!

NATIONAL REPRESENTATIVES

- | | | |
|---|--|---|
| CANADA, ALA., GA., LA., MISS., PA., VA., W. VA.
Aironic Accessory Co.
161 Orinoco Drive
Brightwaters, N. Y. | MD. & DEL.
Sol W. Goodman
32 W. Biddle St.
Baltimore, Md. | TEXAS
General Power Equipment
4515 Prentice Street
Dallas, Texas |
| NEW YORK & NEW JERSEY
Par Distributors
240 Old Country Rd.
Hicksville, N. Y. | ILL. & WIS.
Wesley L. Wilson
2750 West North Ave.
Chicago, Ill. | MICHIGAN
James B. Morrow
85 Louise Ave.
Highland Park, Mich. |
| CONNECTICUT
Richard Whitehead, Jr.
Guilford, Conn. | WASH. D.C.—GOVT.
John W. Houston, Jr.
748 Washington Bldg.
Washington 5, D. C. | N. C., S. C. & TENN.
Glenn & Larson
123 Brevard Court
Charlotte, N. C. |
| FLORIDA
Larry Johnson
117 N. W. 103rd St.
Miami, Florida | UPPER NEW YORK STATE
Philip L. Kirsh
223 Windemere Road
Rochester, N. Y. | ARIZ. & N. MEX.
Russell Engineering
2140 Westwood Blvd.
Los Angeles 25, Cal. |
| INDIANA
Richard C. Warner
Box 338
South Whitley, Ind. | ARK., IOWA, KAN., MD., NEB.
White Supply Co.
4343 Duncan Ave.
St. Louis, Mo. | MAINE, N. H., MASS., VT., R. I.
Ward F. Humphrey
13 East Plain St.
Conchituate, Mass. |
| CALIF. & WASH.
Standard Wire & Cable
3440 Overland Ave.,
Los Angeles, Calif.
210 Post St., Rm. 915,
San Francisco, Cal. | KENTUCKY & OHIO
Gallagher Company
15 Ritchie Avenue
Cincinnati, Ohio | EXPORT
Ballthraill Trading Co.
1509 Race St.
Phila. 2, Pa. |

HITEMP WIRES, INC.

26 WINDSOR AVE., MINEOLA, NEW YORK

*Leading Specialists in High Temperature Insulations**

*Du Pont's Trade Name for POLYTETRAFLUOROETHYLENE

- "TEMPRITE", TEFLON MAGNET WIRE
- "TEMPRITE-X", SPECIAL TEFLON MAGNET WIRE
- "TEMPRENE NON-RIGID", FLEXIBLE TEFLON TUBING
- "TEMPREX TUBING", TEFLON EXTRUDED TUBING
- "TEMPRENE", TEFLON HOOK-UP WIRE
- "TEMPREX", TEFLON EXTRUDED HOOK-UP WIRE
- "TEMPCLAD", TEFLON INSULATED LEAD WIRE
- "RETEP", TEFLON SATURATED GLASS BRAID LEAD WIRE
- "NEBROC", TEFLON GLASS FIBRE CORD, TAPE AND THREAD
- "TEMTUBE", TEFLON GLASS FIBRE SLEEVING
- "THERMALON", SILICONE MAGNET WIRE

printed circuits. Ranging from 10, 18, 22, 28 to 44 contacts, these fittings are made of Dupont Zytel molded insulation, with gold plated phosphor-bronze or beryllium-copper contacts. Flashovers are 2,000 v and 2,500 v 60 cps a-c (rms), with a current rating of 5 amperes. Polarization is accomplished by deleting one or more contacts, and inserting a blanking stud in the vacant cavity. Four connector types have single contact rows, one double contact rows. Rivet-and-eyelet type terminals are available.



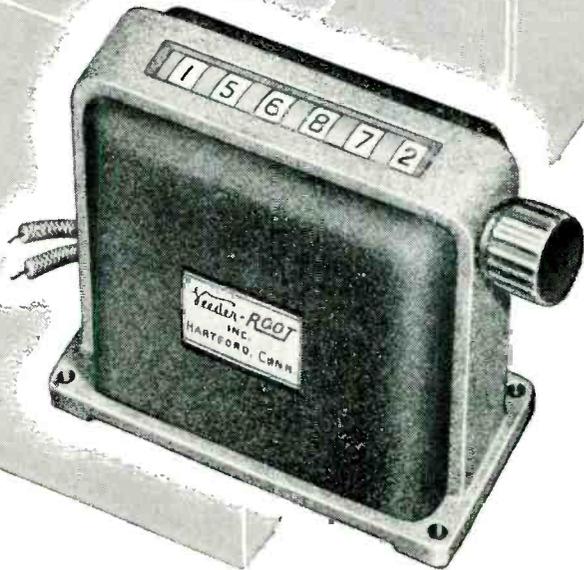
URNS RATIO BRIDGE for lab or production line

SPECIFIC PRODUCTS, 14515 Dickens St., Sherman Oaks, Calif. Model MC-127 turns ratio bridge is now available. An R-C type audio generator and amplifier are used to feed a bridge which has two unknown transformer windings in two legs. The ratio division resistors are in the third leg and balancing decade resistor is in the fourth leg. Output of the bridge is fed to a selective amplifier and to the vtvm which operates the meter. A phasing switch reverses connections to transformer under test which speeds testing operations when used for inspection or production testing. Read-out is direct from decades in turns ratio. A high-low ratio switch changes decimal point on panel. A high-sensitivity switch provides accurate adjustment. Bridge ratio arms are accurate to ± 0.1 percent. Normal operation indicates a single turn in a thousand.

SAPPHIRE BALLS for insulation purposes

INDUSTRIAL TECTONICS, INC., Ann Arbor, Mich., has available a series

Here's the Complete "Package" for Counting Electrically...



*Added Evidence
that —*

Everyone Can Count on **VEEDER-ROOT**

This Veeder-Root Reset Magnetic Counter (AC or DC) is actuated through electromagnets. And it may be connected in series with any device having a contact arrangement . . . like the specially designed Veeder-Root Electrical Contactor at the left, which insures positive operation of the counter, either in oscillation or connected directly to a revolving shaft . . . with the counter placed at

any distance from the machine or process on which the count is required.

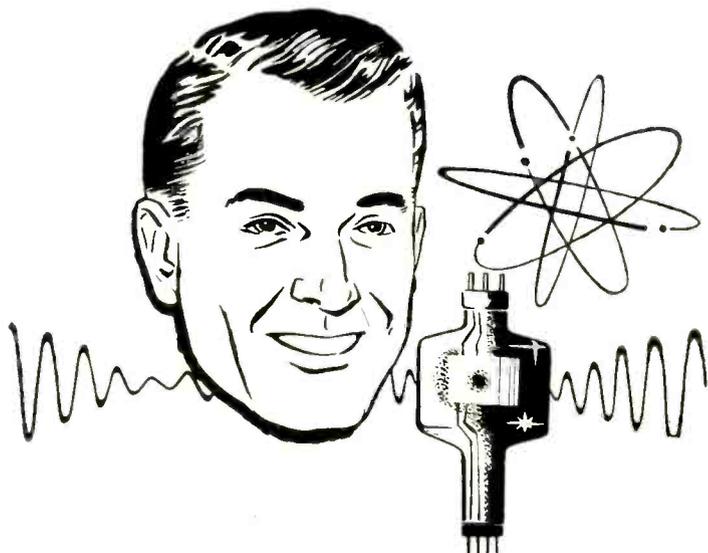
This is another one of the hundreds of Veeder-Root Standard and Special Counting and Computing Devices developed for every conceivable counting duty, in every field from atomics to electronics.

What do you need to count? Just write:

VEEDER-ROOT INCORPORATED
HARTFORD 2, CONNECTICUT



Chicago 6, Ill. • New York 19, N. Y. • Greenville, S. C.
Montreal 2, Canada • Dundee, Scotland
Offices and Agents in Principal Cities
"The Name that Counts"



BELL AIRCRAFT CORPORATION

has

Immediate Openings

for

ELECTRONICS ENGINEERS

Electronics at Bell Aircraft includes the broad field of radio communication, wide-band amplifiers, pulse circuitry, computers, coders, decoders, subminiature components, special electronic indicators, remote-control systems, telemetry and instrumentation systems.

● **RESEARCH and DEVELOPMENT ENGINEERS**

Electronic guidance, control, checkout and instrumentation systems for guided missiles and remotely controlled aircraft. Systems engineering.

● **MICROWAVE ENGINEER**

Research and development work on antennas and complex components.

● **ELECTRONIC STANDARDS ENGINEER**

Evaluation of electronic component parts for guided missiles.

● **TRANSFORMER ENGINEER**

Design of special transformers and reactors.

Send complete resume to: Manager, Engineering Personnel

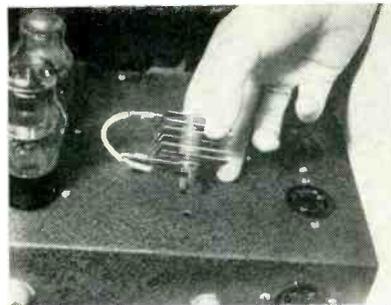


POST OFFICE BOX 1

BUFFALO 5, N. Y.



of precision synthetic sapphire balls ranging in size from $\frac{1}{16}$ in. to $\frac{3}{8}$ in. diameter. Specific gravity is 3.98; melting point, 2,030 C; water absorption, zero; and compressive strength, 300,000 psi. These sapphire balls may be used in bearings to insulate the inner race from the outer race; in relays, where a rolling contact utilizes the hardness and insulating properties of the material; and in variable capacitors to insulate the rotor from the stator.



SNAP-IN RECTIFIER
speeds assembly time

RADIO RECEPTOR CO., 240 Wythe Ave., Brooklyn, N. Y., has announced a new snap-in type rectifier featuring a clip arrangement which does not require tools for assembly, speeds assembly time and completely eliminates broken studs. Known as a Qui-klip, it does not require special sockets for mounting, only needing two round holes to be snapped into place. In addition, solderless connectors are available for making electrical contact to the rectifier.

INDUCTORS
for r-f transmission uses

ILLUMITRONIC ENGINEERING, 680 E. Taylor, Sunnyvale, Calif. Two new design features incorporated into the construction of Air Dux inductors give them greater adaptability in meeting the engineering demands

There's always INSTRUMENT News from

SEE . . . These and many other
Advanced Midwestern Instruments

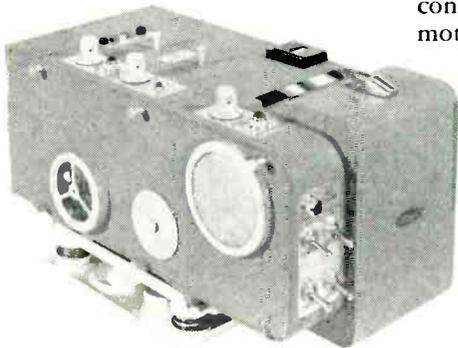
I.S.A. and Product Engineering Shows
BOOTH 341-342 BOOTH 140

MIDWESTERN I N S T R U M E N T S



MI 590 OSCILLOGRAPH — SPECIALLY DESIGNED FOR REMOTE CONTROL

Every feature necessary for successful use as a flight-test instrument. This new design incorporates all the rugged dependability of previous models *plus* new features which provide possibilities for controlling the oscillograph from a remote location.

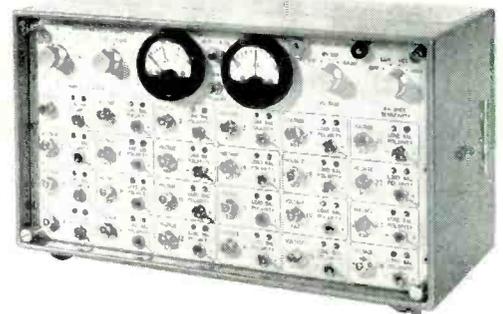
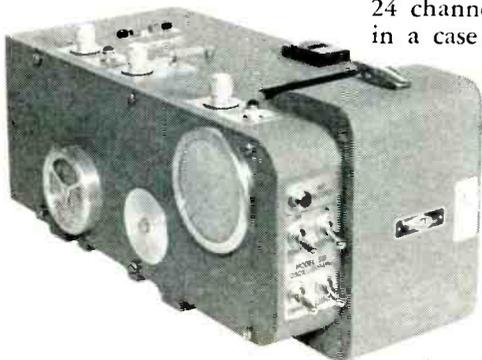


MI 580 OSCILLOGRAPH — DEPENDABLE FOR FLIGHT-TEST . . . FIELD . . . OR LABORATORY

This model provides 14 channels of separate data, observable on full-width viewing screen while in operation, and recorded at selected speeds ranging from $\frac{1}{2}$ to $44\frac{1}{4}$ inches per second. Designed for flight-testing, field or laboratory applications.

MI 435 BRIDGE BALANCE UNIT VERY SMALL . . . VERY VERSATILE

The use of miniature precision components and rugged, aluminum alloy case combine to produce a general purpose instrument for laboratory or flight-test use. The smallest possible size, with versatility of operation and application; 24 channels, plus automatic calibration, in a case 6" x 11" x 5-11/16".



MI 581 OSCILLOGRAPH — EXTREMELY VERSATILE FOR USE UNDER MOST RUGGED CONDITIONS

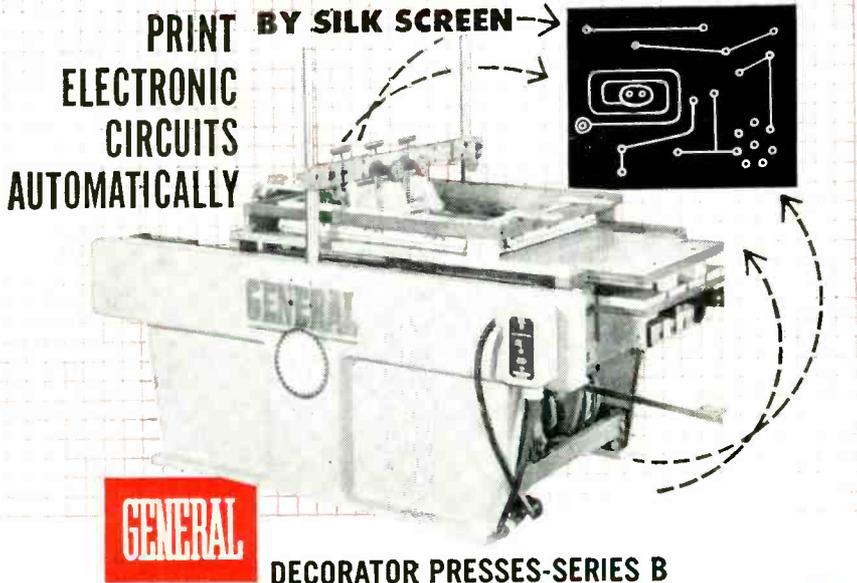
Similar to the 580 in basic design, this model includes many extra features with only a minimum increase in size. It also contains a No-Record Indicator, Burn-Out Indicators, Automatic Record Numbering, Captive Fasteners, and Automatic Record-Length Control.

Write for Complete Information

MIDWESTERN INSTRUMENTS

P. O. BOX 7186 PHONE Riverside 7-1331
TULSA, OKLAHOMA





PRINT BY SILK SCREEN
ELECTRONIC CIRCUITS
AUTOMATICALLY



DECORATOR PRESSES-SERIES B

■ The Silk Screen method is being widely accepted for preparing copper laminated plastic panels prior to etching printed circuits. General Decorator Presses put printed circuits on an automatic, high production basis. Bowed panels are held flat by vacuum. Line contact impression and accurate register give clean, sharp reproduction of fine lines. Controlled inking lays down a thick, uniform layer of resist.

Model No.	B1224	B1824	B1836
Sheet Size	13x25"	19x25"	19x37"
Speeds Up To	1500 per hr.	1500 per hr.	1500 per hr.

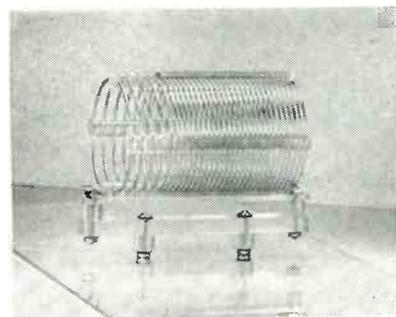
ThermoJet
 DRYER

Utilizes a new system for high speed drying of inks, resists and coatings by greatly accelerated evaporation of solvents.



GENERAL

Write for complete information
RESEARCH AND SUPPLY COMPANY
 572 S. Division Avenue
 Grand Rapids 3, Michigan



of r-f transmission equipment. Air Dux coils may be made with a change in the pitch of the winding for higher Q's, also indenting of alternate turns may be utilized for greater ease of tapping. The coils are manufactured in various diameters from fractions of an inch to several feet. They can be wound in any pitch, with any wire size and finish, and with several available mounting methods, to meet the varied needs of the manufacturer.

RECEIVER TUBES
 straight-sided button-stem

GENERAL ELECTRIC Co., Schenectady 5, N. Y. Straight-sided button-stem versions of two receiving type tubes have been added to the company's line. The 5R4-GYA retains the same electrical characteristics as the 5R4-GY. However, in the T-12 size bulb, the new tube is half an inch smaller in diameter than the ST-16 glass type bulb. The new 6L6-GB is about 1/4 in. shorter and 1/4 in. smaller in diameter than the 6L6-GA and considerably smaller than the 6L6-G. Here also electrical characteristics remain the same.

Never before one like this!



In this new broadband linear, Central Electronics, Inc., unveils several major advances. And for the meter proper C.E. chooses Burlington. Why Burlington? First, because they combine quality with a reasonable price. Second, because they offer an illuminated instrument that can be re-lamped from the front. Wherever and however you use electrical instruments, you'll probably find *your* best answer in Burlington stock or custom-made instruments.



Write for Catalog N1

BURLINGTON INSTRUMENT CO.
 127 N. Third St. Burlington, Iowa

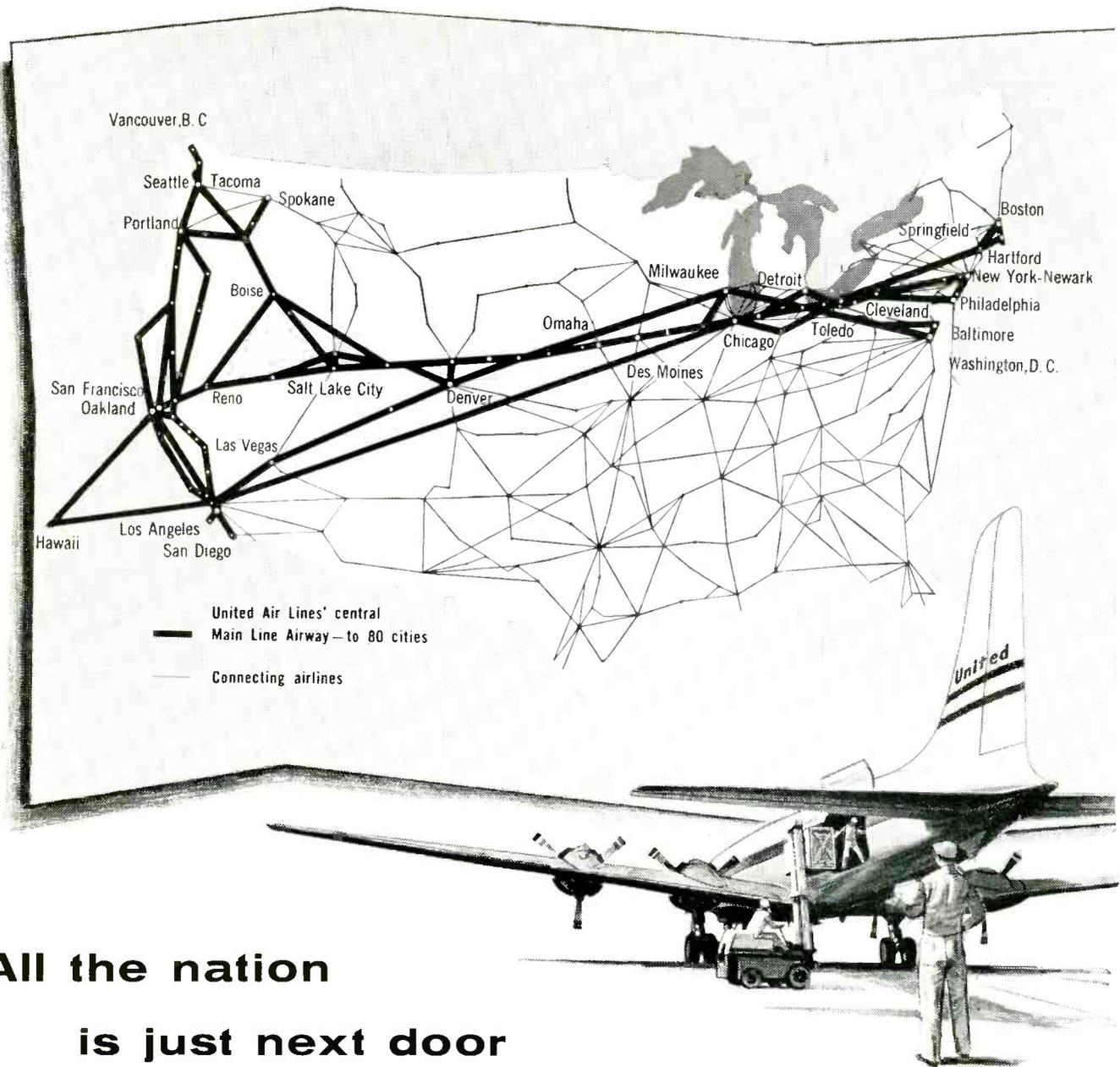


CUSTOM BUILT TO SPECIFICATION



SIGNAL GENERATOR
 is crystal controlled

DECADE INSTRUMENT Co., Box 153, Caldwell, N. J., has announced the Decalator model 100, a new crystal controlled signal generator from



**All the nation
is just next door
when you ship by United Air Freight**

United's Main Line Airway follows the bustling business belt across the nation. No matter where you ship you are only a few hours away, sometimes merely minutes, from cities along this strategic route.

United can furnish fast connections, too, at any of these cities with other air carriers, truck lines and rail transportation to reach all sections of the country. And United offers Reserved Space Air Freight on all

flights—not only over its own routes but world-wide through connecting airline agreement.

Speed, service unmatched by any other air carrier, convenience—these are among the money-saving benefits you get when you ship by United. And remember, too, the great cargo power United offers. There are more than 254 Mainliner® flights daily, with air cargo on every one.



Learn the advantages of United Air Lines' Air Freight Service—call the nearest United representative or write for free booklet, "Industry's Flying Partner." Cargo Sales Dept. V9, United Air Lines, 5959 S. Cicero Avenue, Chicago.

"so Narda terminations
can't be burned out, eh?"



Of course, we mean *microwave* power. That's our statement: within their designed frequencies, we don't know anyone who has enough microwave power available to affect our line of terminations.

People have tried, too! One correspondent tells us that he overloaded our Model 320 by 100%, putting 1000 watts average power into this termination which we rate at 500.

Made of aluminum with fins for effective heat dissipation, these high power terminations cover the entire waveguide band with an average VSWR of only 1.05. Standard cover flanges are provided. Narda terminations may be pressurized for increased peak ratings.

Write for our catalog describing the complete line of Narda microwave and uhf test equipment. We also like to apply our skills and considerable experience to unusual problems in microwave and uhf. Give us a call if you have a problem.

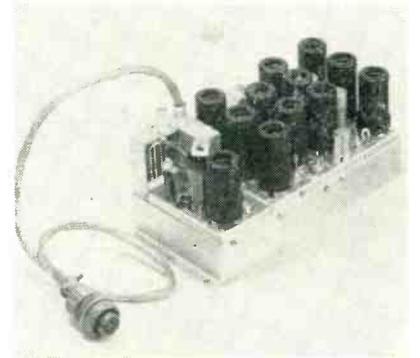


the **narda** corporation

160 HERRICKS RD., MINEOLA, N. Y. • PIONEER 6-4650

COMPLETE INSTRUMENTATION FOR MICROWAVE AND UHF

10 kc to 1.5 mc. Features include decade switching for rapid selection of desired frequency and perfect re-settability, multiscale meter and attenuator for wide-range output voltage, extremely high accuracy, dependability and ease of operation. Specifications include: steps, 1 kc in 3 decades; interpolation, calibrated 0 to 1 kc; accuracy, 100 cps; short term stability, ± 25 cps; harmonic content, 3 percent maximum; output, 3 v rms; attenuator, 3 v, 1 v, 0.3 v, 0.1 v, 0.03 v, 0.01 v full scale; meter, calibrated 0 to 1 and 0 to 3 v. Price is \$995.



DATA TRANSMITTER for telemetering systems

WEST COAST ELECTRONICS CO., 5873 W. Jefferson, Los Angeles, Calif. Model XT-1 telemetering transmitter is designed for higher powered data transmission in guided missile and aircraft telemetering systems. It accepts modulating signals between 900 and 100,000 cycles. It provides 8-w power output; 215 to 235-mc frequency range; direct crystal control with a precision better than 0.03 percent; 50-ohm output impedance; 150-kc deviation, frequency modulation; frequency response flat within ± 1 db; less than 1 percent harmonic distortion; 50,000 ohms video input impedance. A bulletin giving further specifications, a typical application block diagram, and outline and mounting dimensions is available.

TRANSFORMER KIT aids pulse circuit design

SPRAGUE ELECTRIC Co., 35 Marshall St., North Adams, Mass. Pulse transformer kit, catalog No. 100Z1,



Collins PRECISION VFO— Ready-to-Install ACCURACY and STABILITY

Accuracy and stability — the two most important features in Oscillator performance — can now easily be incorporated into your high-performance design, cutting engineering time to a minimum. Whether your project is a transmitter, receiver, test equipment, frequency standard or others, Collins offers a ready-to-install Variable Frequency Oscillator known for its linear calibration and stable output.

- Outstanding Stability
 - Average 24-hour stability under fixed-station conditions .003% or better.
 - Single-knob tuning with backlash of less than one cycle in 20 kc through use of mechanical loading and precision ballbearing construction.
 - Frequency modulation less than 100 cps under 5 G's acceleration at 60 cycles.
- Compact, ready-to-operate design.
- Linearity of calibration better than 1 kc throughout tuning range with multiple-turn tuning.
- Sealed against atmospheric changes.
- Available in fundamental ranges from 300 kc to 4 mc. Individual models achieve up to 2 to 1 tuning ratio.
- Uses standard power supply voltages.
- Each unit 100% tested under lab conditions to rigid specifications.
- Ease of installation.

Frequency Ranges Available

70E-1	1.0-1.5 mc
70E-10	600-800 kc
70E-12	1.955-2.955 mc
70E-15	2.0-3.0 mc
70E-20	1.65-2.05 mc
70E-21	300-400 kc
70E-25	2.0-4.0 mc
70H-2	2.455-3.455 mc
70H-3	1.5-3.0 mc

For requirements other than the above ranges or for detailed specifications write to the Collins office nearest you

COLLINS RADIO COMPANY

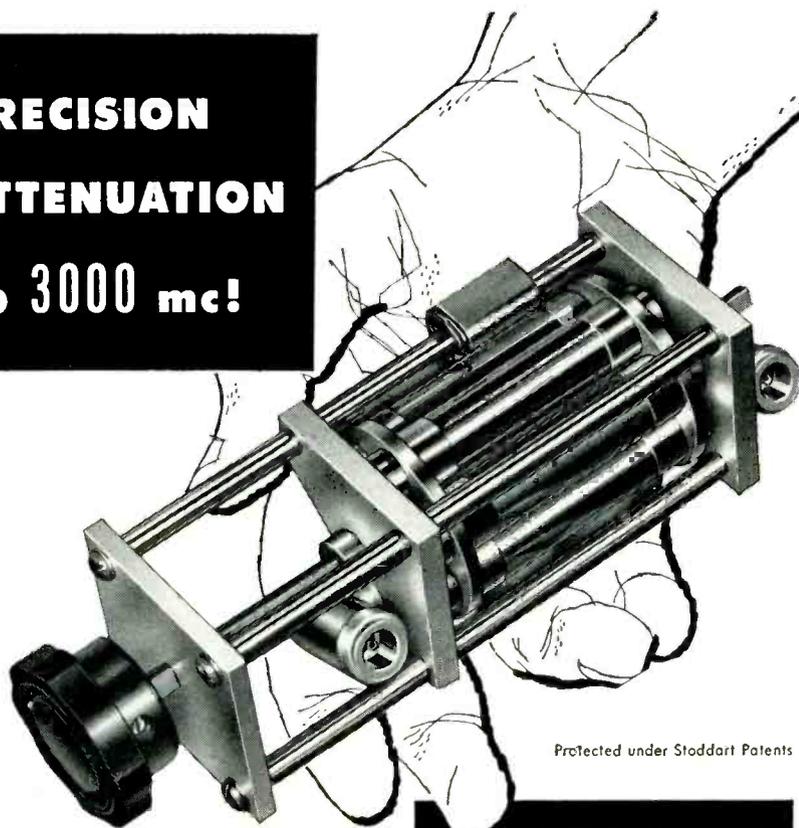
CEDAR RAPIDS, IOWA

261 Madison Avenue, NEW YORK 16, NEW YORK
1200 18th Street N.W., WASHINGTON, D. C.
1930 Hi-Line Drive, DALLAS 2, TEXAS
2700 W. Olive Avenue, BURBANK, CALIFORNIA

COLLINS RADIO COMPANY OF CANADA, LTD.
74 Sparks Street, OTTAWA, ONTARIO



PRECISION ATTENUATION TO 3000 mc!



Protected under Stoddart Patents

six-position TURRET ATTENUATOR

featuring **PULL-TURN-PUSH** action

FREQUENCY RANGE: dc to 3000 mc.

CHARACTERISTIC IMPEDANCE: 50 ohms.

CONNECTORS: Type "N" Coaxial female fittings each end.

AVAILABLE ATTENUATION: Any value from 1 db to 60 db.

VSWR: 1.2 max., dc to 3000 mc/s, values from 10 to 60 db. As value decreases below 10 db, VSWR increases to not over 1.5.

ACCURACY: ± 0.5 db.

POWER RATING: One watt sine wave power dissipation.

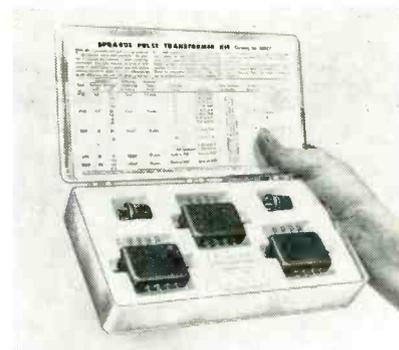
SINGLE "IN-THE-LINE" ATTENUATOR PADS and 50 ohm COAXIAL TERMINATIONS

This new group of pads and terminations features the popular Type C and Type N connectors, and permits any conceivable combination of the two styles. For example, the two connector types, either male or female, can be mounted on the same attenuator pad, with or without flanges, so that it may serve as an adapter as well as an attenuator. Frequency range, impedance, attenuation, VSWR, accuracy and power rating are as designated above. Send for free bulletin entitled "Measurement of RF Attenuation."



STODDART AIRCRAFT RADIO Co., Inc.

6644-A Santa Monica Blvd., Hollywood 38, California · Hollywood 4-9294

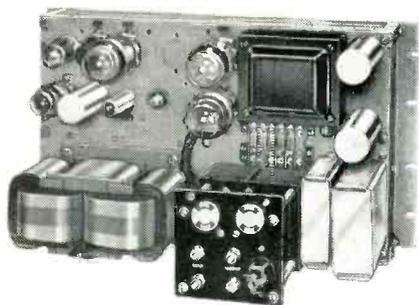


contains 5 laboratory-type pulse transformers especially chosen to cover a wide range of practical applications, with primary inductance values from 0.5 mh to 50 mh, and turns ratios as high as 8 to 1. Each miniature transformer has multiple windings, permitting the engineer to easily select the characteristics best suited to his application—whether in push-pull driving, blocking oscillator, pulse gating, pulse amplifier or impedance matching circuits.

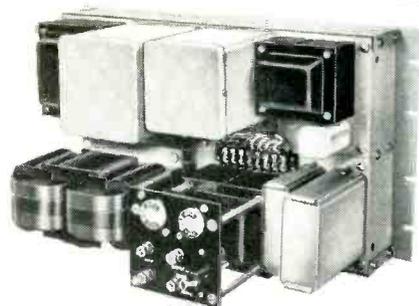


D-C SUPPLY with high resolution

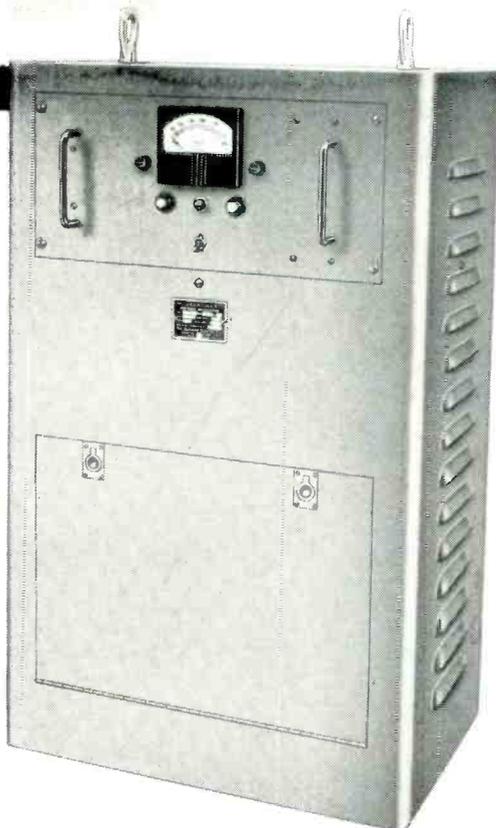
JOHN FLUKE MFG. CO., INC., 1111 W. Nickerson St., Seattle 99, Wash. Designed for instrument calibration work, the model 406 high resolution d-c supply has excellent stability. Coarse, fine and vernier output controls permit setting the output to within 2 mv of the value desired over the entire 530-v range. Regulation against 20-percent line voltage change or 100-ma load change is 0.01 percent or 50 mv. Ripple is less than 1 mv and short-term stability is better than 0.01 percent. Auxiliary outputs are 0 to 225 v bias and 6.3 v, 3 amperes a-c. Precision wire-wound resistors are used throughout in sampling circuits and at critical points. The compact, portable unit has an illuminated 4½-in. meter selectively switched to



INSTANTANEOUS ELECTRONIC (type IE)
For instantaneous correction and extremely close control. Completely electronic. No moving parts.



TUBELESS MAGNETIC (type TM)
For unattended locations and critical uses where tube failure cannot be tolerated.



ELECTRO MECHANICAL (type EM)
For large industrial loads or for applications requiring zero waveform distortion and high efficiency.

STABILINE AUTOMATIC VOLTAGE REGULATORS

*Designed to
Maintain
Root Mean Square
Voltage*

Here is a complete line of automatic voltage regulators designed with the application in mind . . . with *operating* characteristics that *always* equal or better the nameplate rating.

Of special importance is the fact that STABILINE maintains the root mean square voltage — the voltage rating for which all electrical equipment is designed. Before you purchase automatic voltage regulation equipment, make sure it is R.M.S. responsive.

We have detailed information about STABILINE automatic voltage regulators. Send the coupon for your copy of our Bulletin S351.



Be sure to see Superior Electric's Mobile Display when it is in your area.

FOR OUR COMPLETE
PRODUCT LINE... SEE
electronics **302-303**
'55 BUYERS' GUIDE



THE SUPERIOR ELECTRIC COMPANY

SALES OFFICES: The Superior Electric Company
1436 N. Serrano Avenue
Hollywood 27, California
P. O. Box 946, 1246 Junipero Ave.
Redwood City, Cal.
453-A Eglinton Ave., West, Rm. 202
Toronto 12, Ontario, Canada
REPRESENTATIVES
Beryl R. Hill Company
19481 James Couzens H'wy.
Detroit 35, Mich.

The Superior Electric Company
P. O. Box 48, 721 So. Boulevard
Oak Park, Illinois
250 Park Ave., Rooms 502, 503, 504
New York, New York
P. O. Box 132, 250 So. Court St.
Middletown, Ohio
4515 Prentice St., Rm. 201
Dallas 6, Texas
Fred H. Haight Company
3512 Eastlake
Seattle 2, Washington

THE SUPERIOR ELECTRIC COMPANY

209 Reynolds Avenue, Bristol, Conn.

Please send my copy of the STABILINE Bulletin

Name

Position

Company Name

Company Address

City Zone State

KEARFOTT ANNOUNCES a new rotation-type ferrite isolator*

FERRITE ISOLATOR
MODEL W152-1A

The new Ferrite Isolator is a useful device with applications such as oscillator isolation with the following advantages to system performance:

- Reduces long-line loading
- Prevents undesired frequency shift
- Insures uniform power output
- Improves transmitted pulse spectrum

The charts indicate the exceptional performance of this light-weight unit (less than 2 lbs.)

REVERSE ISOLATION

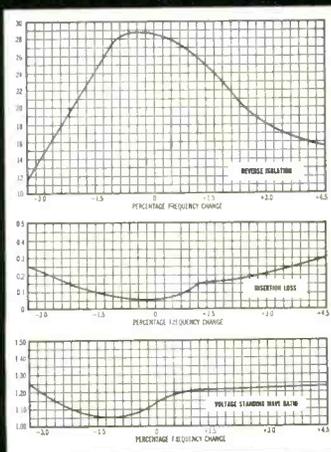
This shows very clearly the good unilateral decoupling effect between the antenna and transmitter.

INSERTION LOSS

This illustrates the exceptionally low loss from the transmitter to the antenna.

VOLTAGE STANDING WAVE RATIO

The VSWR introduced into the transmission line by the 'Isolator.'



Special units can be produced by Kearfott to meet your frequency requirements.

FERRITE RESONANCE ABSORPTION TRANSVERSE FIELD ISOLATOR for use where high power handling capacity is required. This new model operates over a 10% band width, with these electrical characteristics:

- Greater than 9 db isolation
- Less than 0.4 db insertion loss
- VSWR less than 1.03

Write or call today for complete detailed information on Kearfott components and their application to your Radar Systems.

Kearfott COMPANY, INC.

LITTLE FALLS, NEW JERSEY
WESTERN MANUFACTURING DIVISION
14844 OXNARD ST. • VAN NUYS, CALIF.
A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION

SALES OFFICES

Eastern Office:
1378 Main Ave.
Clifton, N.J.

Midwest Office:
188 W. Randolph St.
Chicago, Ill.

South Central
Office:
6115 Denton Drive
Dallas, Texas

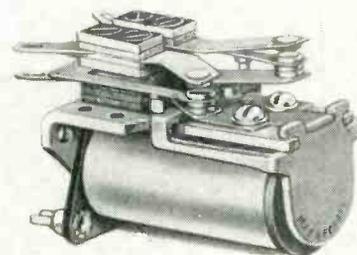
Western Area
Office:
253 Vinado Ave.
Pasadena, Calif.

read output current, output voltage and bias voltage.



MOTOR GENERATOR is subminiature type

JOHN OSTER MFG. Co., 1 Main St., Racine, Wis. Type MG301 3 motor generator measures only 1 in. o-d by 2.625 in. long and weighs 6.2 oz. Output is 1.25 v per 100 rpm when operated into a load of 100,000 ohms. Speed is continuously variable for 200 to 8,700 rpm. The output remains completely linear over the entire speed range. Harmonic distortion is under 5 percent. Magnetic detent stops the output shaft in any of 4 positions within 5 deg accuracy. The motor is a 115 v, 400-cycle, 2-phase drive motor with a stall torque of 0.15 oz-in.



POWER RELAY is a miniature type

MAGNECRAFT ELECTRIC Co., 3350 W. Grand Ave., Chicago 51, Ill. Switching of heavy currents up to 10 amperes and high operating sensitivity are combined in a new miniature power relay. The new heavy current contacts can be furnished in combination with bifurcated contacts for switching both heavy loads and low level signal loads with the same relay. Coil and contact terminals at mounting end of the relay facilitate concealed wiring of either

AVAILABLE NOW!

**NEW HUDSON
STANDARD
CASES
STANDARD
RECTANGULAR
SIZES**

HU—764:
DIMEN. A—63/64"
DIMEN. B—1 57/64"
LENGTH—3"

HU—769:
DIMEN. A—2 5/16"
DIMEN. B—6 15/16"
LENGTH—3 3/32"

HU—770:
DIMEN. A—2 33/64"
DIMEN. B—4 9/32"
LENGTH—3 11/32"

HU—783:
DIMEN. A—5/8"
DIMEN. B—1 5/16"
LENGTH—1 7/16"

HU—788:
DIMEN. A—1 5/32"
DIMEN. B—1 13/32"
LENGTH—7/8"

HU—791:
DIMEN. A—2 19/64"
DIMEN. B—2 13/16"
LENGTH—1 43/64"

HU—797:
DIMEN. A—1 7/16"
DIMEN. B—2"
LENGTH—2 1/2"

HU—799:
DIMEN. A—27/32"
DIMEN. B—1 25/64"
LENGTH—1 47/64"

**STANDARD
ROUND SIZES**

HU—695:
OUTSIDE DIA.—2 15/32"
LENGTH—6"

HU—707:
OUTSIDE DIA.—1 29/64"
LENGTH—1 1/8"

HU—721:
OUTSIDE DIA.—1 61/64"
LENGTH—2 5/8"

HU—749:
OUTSIDE DIA.—1 19/64"
LENGTH—3"

HU—757:
OUTSIDE DIA.—1 7/8"
LENGTH—2 1/2"

HU—787:
OUTSIDE DIA.—1 41/64"
LENGTH—3 1/8"

HU—798:
OUTSIDE DIA.—2 25/32"
LENGTH—5 1/2"

HU—803:
OUTSIDE DIA.—1 1/16"
LENGTH—2 1/2"

**STANDARD
SQUARE SIZES**

HU—692:
DIMEN. A—1 7/8"
LENGTH—3 3/16"

HU—723:
DIMEN. A—1 17/64"
LENGTH—1"

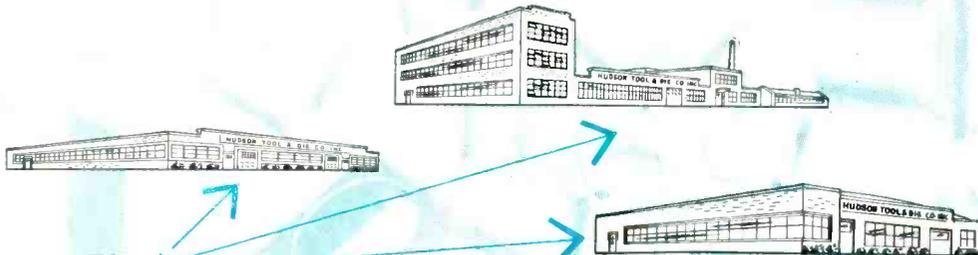
HU—737:
DIMEN. A—1 5/16"
LENGTH—1 7/8"

HU—768:
DIMEN. A—1 1/2"
LENGTH—3 1/2"

HU—781:
DIMEN. A—45/64"
LENGTH—1 3/8"

HU—785:
DIMEN. A—1 1/64"
LENGTH—2"

**FILE THIS PAGE for
FUTURE REFERENCE**



3 FULLY-EQUIPPED PLANTS



**Offering the Most
Complete Line of
Precision Drawn
Cases and Covers
in the Industry!**

...THREE COMPLETE SERVICES!*

Hudson Standard Metal Closures

Over 1000 economical standard types mean HUDSON can supply precision components at commercial prices. A wide variety of optional features make it possible to solve all but the most unusual closure requirements with standard types selected from HUDSON stocks.

Hudson Quality Metal Stampings

Metal parts produced to your exact specifications at prices that reflect the economies of mass production methods. Hudson can work to close tolerances and maintain uniformity throughout production runs. Quotations supplied promptly on receipt of drawings.

Hudson Sheet Metal Facilities

Depend on HUDSON for expert fabrication of simple or complex sub-assemblies. Facilities include certified welding of alloys, silver soldering, brazing and chrome plating.

**NEW
CATALOG
READY,
NOW!**

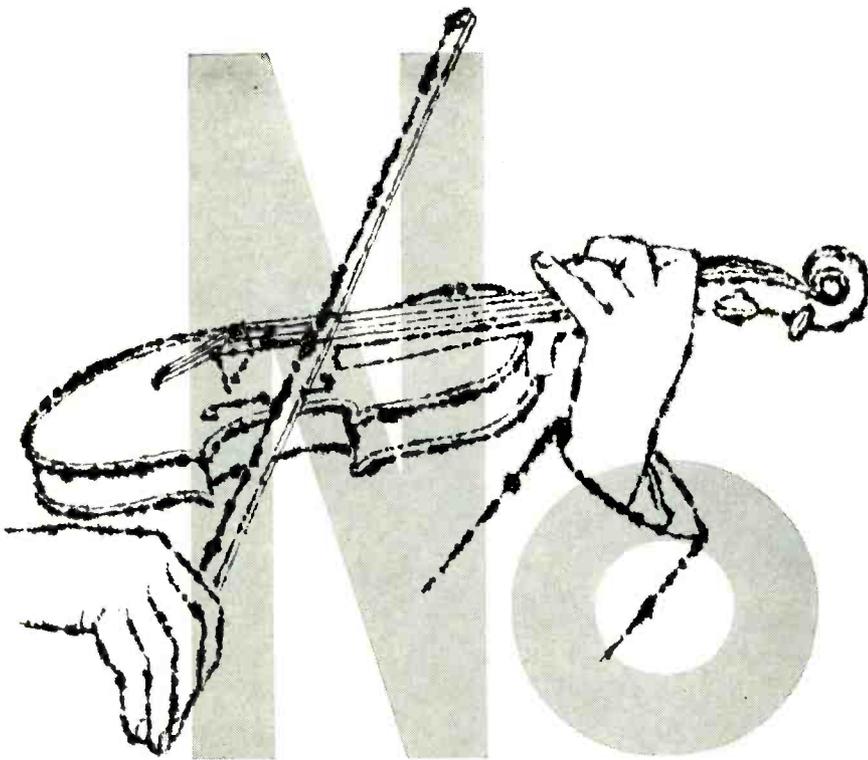


The Hudson story is contained in one handy catalog. Full descriptions of all standard items and complete information on Hudson metal working facilities. Call or write for your copy, now!

Precision Components of
Steel, Aluminum, Copper,
Brass, Mu Metal



**HUDSON
TOOL & DIE COMPANY • INC.**
118-122 SOUTH 14th ST., NEWARK 7, N. J.



violin music

The demand exceeds the supply. It's that simple!

With 3 engineering jobs available for every 2 engineers, some 5,000 companies are bidding for you with offers, inducements and background music. But don't be mistaken! Most of today's "opportunities" are *jobs*, not futures.

We, too, want engineers. But we're offering no violin music—only the opportunity for intelligent and careful evaluation—you of us and we of you—with the possibility of your joining one of the finest team operations in the whole new world of flight systems development.

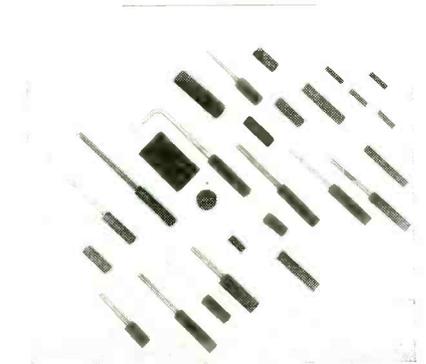
Most of the people on that team are young, and moving ahead fast. They weren't lured here. They found out—and figured out—for themselves. We hope you'll do that too.

Write to J. M. Hollyday, Dept. E-9, The Glenn L. Martin Company, Baltimore 3, Maryland.

MARTIN
BALTIMORE · MARYLAND



individually mounted or strip mounted relays. Contact combinations up to 4pdt can be furnished, also hermetically sealed or dust tight enclosure.



FERRITE CORES in assorted types

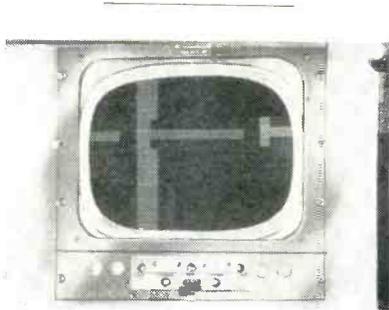
SUPEREX ELECTRONICS CORP., 4-6 Radford Pl., Yonkers, N. Y., has announced an assortment of 27 representative ferrite cores for engineers and designers. The cores included vary from flat stick cores, to disks, pigtail cores, standard studded cores; spaghetti cores, as well as other types listed. Price of the kit is \$2.25.



UHF THERMOCOUPLES range from 5 ma upwards

BEAM INSTRUMENTS CORP., 350 5th Ave., New York, N. Y. A number of uhf thermocouples, ranging from 5 ma upwards, have been added to the standard line. They are extremely small in size featuring both minimum capacitance and inductance. The thermocouples are electrically insulated from the heaters and tested to 100 v d-c. Resistance tolerances for heater or thermocouple are ± 10 percent. Nominal output is 7 mv. Current ratings can be exceeded by a 50-percent overload for long periods of time without risk or damage to the thermo-

couple; heaters will withstand transient overloads of 100 percent. Overall temperature coefficient does not exceed 0.2 percent. Dimensions do not exceed $\frac{3}{8}$ in. approximately. Close electrical consistency is maintained.



PULSE MONITOR for tv broadcasting

TELEVISION UTILITIES CORP., 1315 Jericho Turnpike, New Hyde Park, L. I., N. Y., has announced a new Private Eye pulse cross monitor, designed for color or monochrome broadcasting, for use in master control rooms and remote studios. It checks the number of equalizing pulses, sync generator waveforms including front to back porch, remote and local sync, and provides a continuous check on operation even with Genlock types of sync generator locking devices. The pulse cross visually displays the number and width (in microseconds) of all pulses contained in standard composite RETMA video signals.

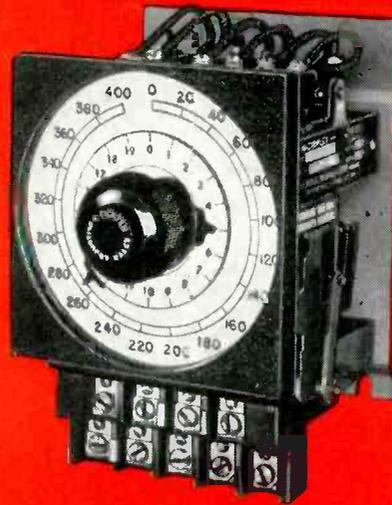


JUNCTION TRANSISTOR for low-power audio uses

RADIO CORP. OF AMERICA, Harrison, N. J. The 2N77 is a germanium alloy junction transistor of the *pn*p type designed especially for a-f amplifier service in hearing-aid ap-

EAGLE

Microflex reset counter



for
machine tool
and industrial
processes

makes shutdown and feed-down automatic

Convert machine tool and industrial processes from manual to automatic operation — with this Microflex Reset Counter. For example, use it to feed a grinding wheel down after a preset number of operations. Or employ it to shut down a machine at the desired number of operations. This reset counter is ideal for controlling chemical feeding processes by shutting down a pump after the desired number of operations.

The Microflex Reset Counter is actuated by a series of electrical impulses. Models are available with 400 and 1000 count dials. Dial settings easy to make — counting range from 1 to 400 in steps of 1 with 100% accuracy. On 1000 count range, dial settings are in steps of 1 with accuracy of ± 1 count. Spring reset in less than 1 second.

MAIL COUPON TODAY

EAGLE SIGNAL CORPORATION
Industrial Timers Division, Dept. E-955
MOLINE, ILLINOIS

Please send free Bulletin 720 containing full data on Microflex Reset Counter.

NAME AND TITLE _____

COMPANY _____

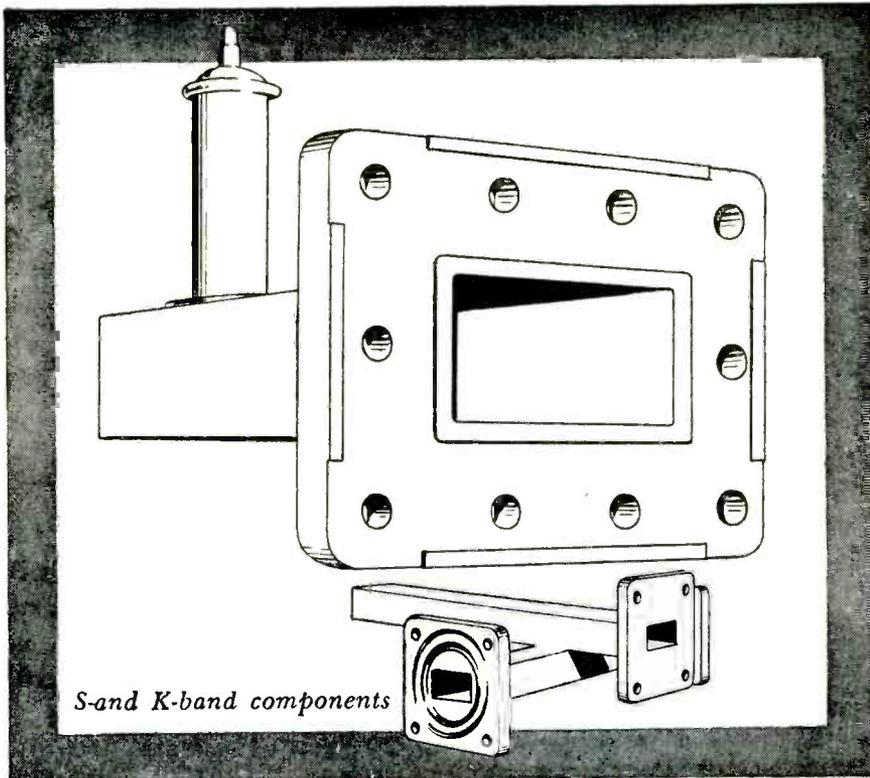
ADDRESS _____

CITY _____

ZONE _____ STATE _____

EAGLE TIMERS SAVE TIME . . . SAVE MONEY





S-and K-band components

how
small
can a
wave
guide
get?

Well, alongside some of the stuff we're working with now, the radar plumbing we used during World War II gets to look like air-conditioning duct. What's more, some of our boys here seem to regard anything below S-band as practically pure D.C. Naturally, we're up to our hips as usual in work on military equipment. However, we do occasionally have some extra creative capacity available, so if you have a problem involving something special in wave guide components (real small ones, too) and like that, maybe we can help. Drop us a line.



L. H. TERPENING COMPANY

DESIGN • RESEARCH • PRODUCTION

Microwave Transmission Lines and Associated Components
16 West 61st St. • New York 23, N. Y. • Circle 6-4760

applications. The transistor is hermetically sealed, utilizes an insulated metal envelope, and has flexible leads which may be soldered or welded into the associated circuits. It measures 0.240 in. in diameter and has a maximum length (excluding flexible leads) of 0.405 in. The 2N77 features an average noise factor of 6.5 db, a matched-impedance, l-f power gain of 44 db, and a collector-to-emitter alpha frequency cutoff of 700 kc.



COAXIAL CABLE features low capacitance

MICRODOT, 1826 Fremont Ave., South Pasadena, Calif., has announced new coaxial cable types designated 93-3913 and 93-3914. With capacitance of just 12 μmf per ft, the o-d of the cables is held to 0.132 in. maximum so that three of the cables occupy equivalent space to one RG-62/U. Characteristic impedance is 98 ohms. Velocity of propagation, 80 percent, is related to their construction with cellular polyethylene dielectric. A thin wall of nylon under the braid permits soldering both center conductor and braid. Temperature rating is -65 to $+120$ F.

SPLICING TAPE for high-voltage use

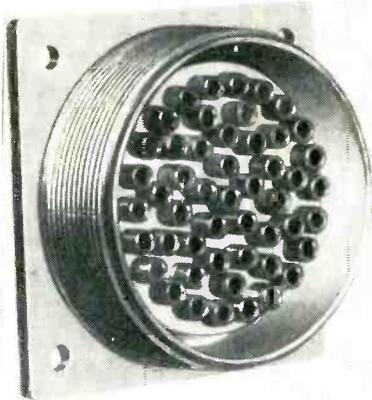
BISHOP MFG. CORP., 10 Canfield Rd., Cedar Grove, N. J., has developed a new h-v splicing tape that incorporates all of the features desirable for the new ozone resistant power cables operating at higher conductor temperature ratings of 85 C up to and including the 15,000 v

range. Bishop No. 30 is recommended for use on all cables insulated with ozone-resistant compounds and operating at 2,000 v or more. It has superior resistance to the erosive action of both corona and ozone, as well as superior aging properties.



D-C POWER SUPPLY one of 22 models

OPAD ELECTRIC Co., 69 Murray St., New York 7, N. Y. This low cost 0 to 28 v d-c 10-ampere power supply operates from 115 v 60 cycles a-c, and is one of the 22 standard models described in bulletin No. 178. The bulletin covers unfiltered units rated from 5 to 150 amperes and from 6 to 230 v d-c, all having continuously adjustable outputs and for both 115 v and 230 v a-c operation.



AIRLINE CONNECTORS for manometer boards

CANNON ELECTRIC Co., 3209 Humboldt St., Los Angeles 31, Calif. Airline tubes in place of current carrying circuits, but using standard AN type shells and coupling nuts, make up the company's line of manometer connectors. Based on the quick disconnect principle of the electrical connector, these manometer fittings are used largely in

TEFLON

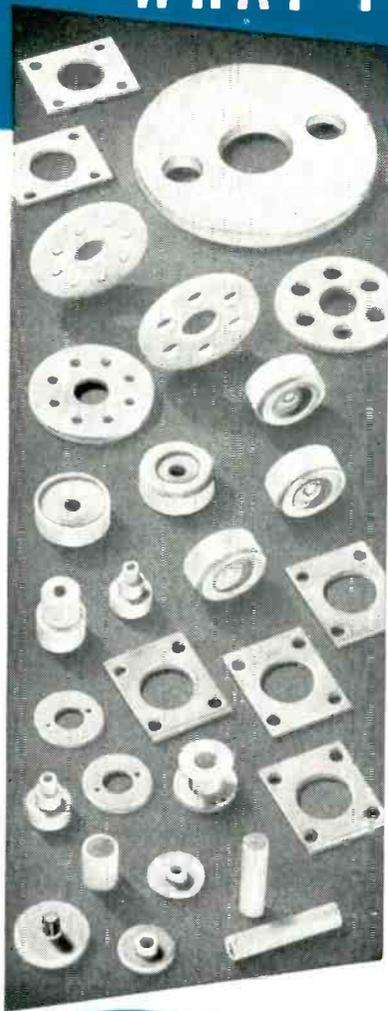
PARTS OR MATERIALS
FOR UHF APPLICATION?

FOR MINIATURE AND
SUB-MINIATURE COMPONENTS?

YOU CAN GET JUST WHAT YOU WANT

from

JOHN CRANE



FOR: insulators of all types, sleeves or inserts, capacitor seals, feed through insulators, bushings, slot liners, coaxial spacers, layer insulation or any other parts or forms subject to high charge, extended frequency range, mechanical and thermal shock, extreme temperatures and climatic conditions.

You can order in any quantity and be sure of true Teflon performance, because "John Crane" gives you these *plus* factors: complete uniformity throughout, high density control, freedom from flaws and rigid adherence to your specifications.

"John Crane's" complete fabrication facilities assure you prompt delivery on *exactly* what you want. If you have an entirely new requirement, no standard design or procedure—"John Crane's" laboratory facilities, know how, research and engineering experience go to work on *your particular need*.

Now is a good time to put "John Crane" to test. Contact Crane Packing Company today.

Crane Packing Co.,
1802 Cuyler Ave.,
Chicago 13, Illinois

In Canada: Crane
Packing Co., Ltd.,
617 Parkdale Ave.,
N., Hamilton, Ont.



*TEFLON

DuPont
trademark

Dielectric Strength: 480 v/mil.
Dielectric Constant (60 to 10⁸ cycles): 2.0
Power Factor (60 to 10⁸ cycles): <0.0005
Volume Resistivity: 10¹⁵ ohm-cm
Surface Resistivity: 3.6x10⁶ megohms
Surface Arc-Resistance: does not track
Temperature Range: -450° to +500°F.
Chemical Resistance: completely inert
Moisture Absorption: zero

JOHN CRANE

CRANE PACKING COMPANY

38 YEARS
INDUSTRIAL PROGRESS

OFFICES IN ALL PRINCIPAL CITIES

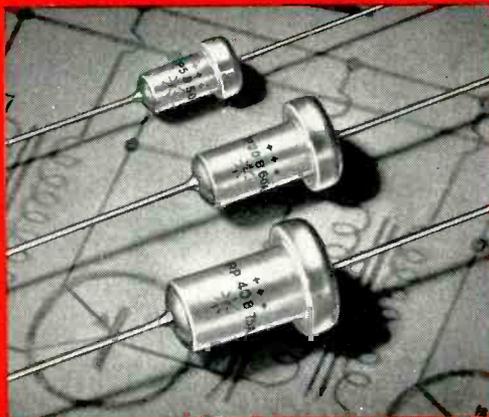
Fansteel

TANTALUM

CAPACITORS

Four basic advantages

1. **Greatest Capacity in Small Space**
2. **Practically Unlimited Life**
3. **Maximum d-c Leakage 0.000008 amp.**
4. **Stable Characteristics over Wide Temperature Range**



Incorporating a porous tantalum anode assembly, tantalum capacitors derive their unusual stability from the characteristics inherent in tantalum itself—the most stable of all anodic film forming metals. During twenty years of ever increasing use, these important advantages have become accepted: No important changes of characteristics occur, even in long periods of operation. No shelf aging. Large capacity in extremely small size. Maximum stability and temperature range.

Fansteel offers Tantalum Capacitors in 58 sizes and ratings. All sizes are available from stock. Write for current technical bulletins.

DISTRICT OFFICES:

BOSTON—5 Barlow Lane, Westwood DEdham 3-0467
 NEW YORK—30 Church Street WOrth 2-2674
 PHILADELPHIA—1215 Old York Road, Abington TUrner 4-4016
 CLEVELAND—2147 Prospect Avenue SUperior 1-5908
 CHICAGO—3304 North Harlem Avenue TUXedo 9-3200
 MILWAUKEE—2609 West National Avenue ORchard 2-4091
 LOS ANGELES—1015 Hope Street, South Pasadena PYramid 1-2125
 DALLAS—6310 Denton Drive DIXon 4038
 HOUSTON—1301 Caudle Drive HOIbrook 5-3644



FANSTEEL METALLURGICAL CORPORATION

North Chicago, Illinois, U.S.A.

C555A

TANTALUM CAPACITORS . . . DEPENDABLE SINCE 1930

NEW PRODUCTS

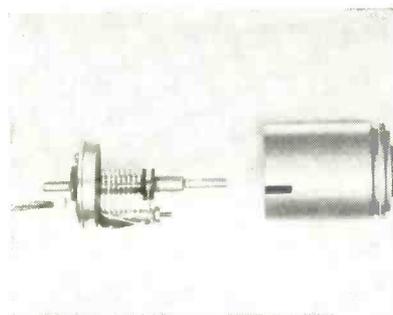
(continued)

wind tunnels for testing of aircraft models, flight tests and other laboratory uses. Up to 200 pressure lines may be routed to a 100-tube manometer board from various parts of the airplane. Ask for bulletin SR-AL-1.



SIGNAL GENERATOR for aligning tv receivers

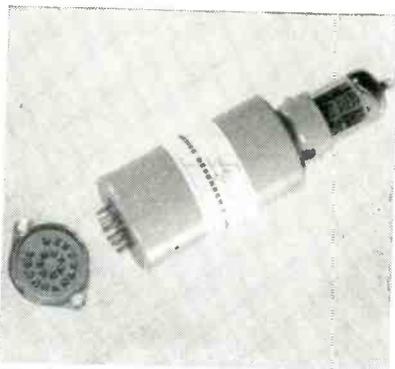
KAY ELECTRIC CO., 14 Maple Ave., Pine Brook, N. J. The Xtalator, a highly accurate vhf signal generator, is designed to eliminate errors in testing and aligning tv receivers. Elimination of f-m is achieved through the use of a decade switched, crystal stable oscillator. Other features include direct reading and continuous frequency coverage. Range is 50 mc to 250 mc; frequency, direct reading and continuous; output, attenuated 0.5 μ v to 0.5 v; frequency accuracy, ± 0.005 percent; modulation percentage, 0 to 30 percent; output impedance, 50 or 75 ohms; and price, \$1,795.



SELECTOR SWITCH is ultra low torque type

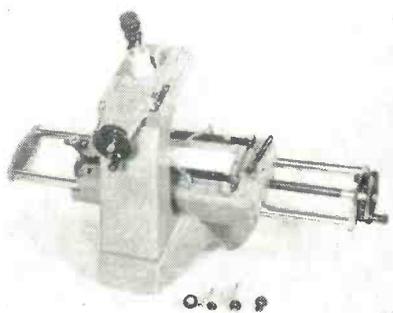
THE ELECTRO TEC CORP., South Hackensack, N. J., has developed a switch with several different brush and circuit combinations. Illustrated is a selector unit with 10 input circuits and one output (break before make). It consists of a rotating element and stationary

brushes. The rotating element is actually a slip ring assembly with a series of commutator segments interconnected to the individual rings. Overall size is less than 1 in. in diameter by 2 $\frac{3}{8}$ in. long. The unit is designed for ambient temperatures in excess of 350 F.



BUILDING BLOCK for digital systems

MAGNETICS RESEARCH Co., 142 King St., Chappaqua, N. Y., has available a basic building block for doing complicated switching operations at speeds up to 200 kc. The Logiblock contains 4 cores, 3 diodes and a buffer amplifier tube. A maximum of 8 input signals can be accepted by the Logiblock and combined to give output signals in accordance with the built-in logic. The Logiblock is split into 2 output sections, each capable of providing inputs to 4 other Logiblocks.



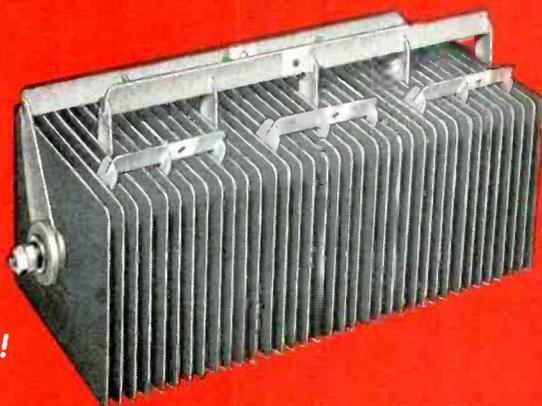
OPTICAL MEASURING INSTRUMENT is high precision unit

EPIC INC., 154 Nassau St., New York 38, N. Y. The Askania MAM 300/60 is a high precision optical two-dimensional measuring instrument designed and built for efficient and accurate measuring of lengths of recording on photo-

Fansteel

SELENIUM RECTIFIERS

a
31
year
record
of
DEPENDABILITY!



Whatever your rectifier requirements, you can depend on Fansteel's experience and facilities to meet them . . . exactly! From standard Fansteel selenium cells, more than 400,000 different rectifier stack combinations are available. Since 1924, Fansteel's continuing research and development program has paced American Industry's growing demand for selenium rectifiers engineered to fill specific needs.

Fansteel High Temperature Rectifiers

Designed for continuous operation at ambient temperatures up to 100°C. with no derating whatsoever. About one-third the size and one-quarter the weight of a standard rectifier rated at 45°C. Another "First by Fansteel"!

Write for current bulletins

DISTRICT OFFICES:

BOSTON — 5 Barlow Lane, Westwood DEdham 3-0467
 NEW YORK — 30 Church Street WOrth 2-2674
 PHILADELPHIA — 1215 Old York Road, Abington TUrner 4 4016
 CLEVELAND — 2147 Prospect Avenue SUperior 1-5908
 CHICAGO — 3304 North Harlem Avenue TUXedo 9-3200
 MILWAUKEE — 2609 West National Avenue ORchard 2-4051
 LOS ANGELES — 1015 Hope Street, South Pasadena PYramid 1-2125
 DALLAS — 6310 Denton Drive Dixon 4038
 HOUSTON — 1301 Caudle Drive HOlbrook 5-3644



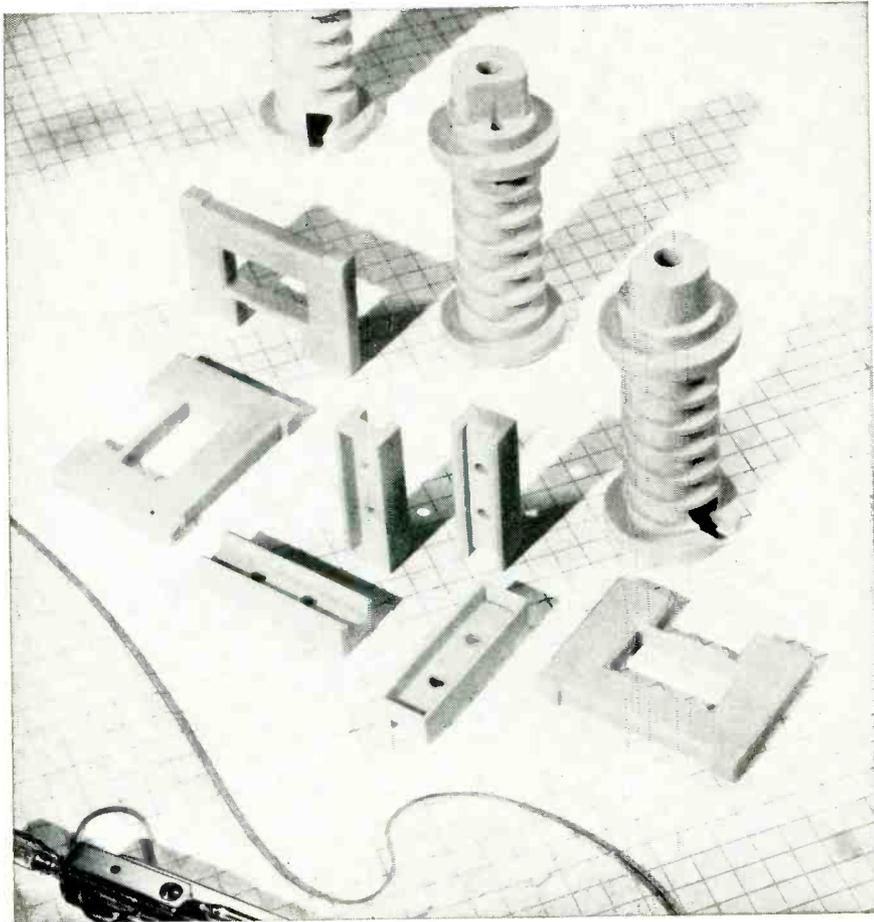
FANSTEEL METALLURGICAL CORPORATION
 North Chicago, Illinois, U.S.A.

E557A

DEPENDABLE RECTIFIERS SINCE 1924

Stupakoff

PRECISION CERAMICS



PRECISION speeds assembly... aids MINIATURIZATION

The high degree of precision maintained by Stupakoff in the manufacture of ceramic parts sharply reduces assembly costs, particularly for miniaturized assemblies. Tolerances of ± 0.001 in. are not unusual, even in large production quantities.

Stupakoff Precision Ceramics can be made of alumina, steatite, zircon, magnesia, Stupalith® Titanates, and other materials. Parts are formed by modern methods and may be complex, plain, ground, machined, metallized or assembled.

Complete research and engineering facilities are available to assist you in the design and development of your parts.

WRITE DEPT. E
for CATALOG
SECTION 301 de-
scribing Stupakoff
Precision Ceramics.



Illustration shows a telephone discharge block with precision-made Stupakoff ceramic base. By holding close tolerances on critical dimensions, assembly is speeded and accurate fit assured.

Stupakoff

CERAMIC & MANUFACTURING COMPANY • LATROBE, PA.

Division of The CARBORUNDUM Company

NEW PRODUCTS

(continued)

graphic plates and for any precision graduation on glass or metal surfaces. Measuring range is approximately 12 in. in x-direction and approximately $2\frac{1}{2}$ in. in y-direction; graduated optionally in millimeters or inches. Accuracy of reading is 0.01 mm. The measuring slide has 6 ball bearings. The microscopic eyepiece has 4 interchangeable objectives of 12, 24, 54 and 74x magnification.



DIGITAL OHMMETER is completely automatic

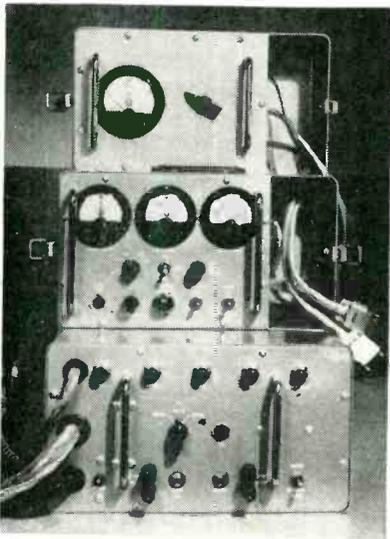
ELECTRO INSTRUMENTS INC., Box S, Old San Diego Station, San Diego 10, Calif. Model D040 completely automatic digital ohmmeter displays 4 digits accurate to 0.05 percent ± 1 digit from 0.1 ohm to 1 megohm in 4 ranges. Range is indicated by a lighted automatically located decimal point and by the symbol Ω or $K\Omega$ in the extreme right window. Average reading time is approximately 1 sec. The unit is essentially a self-balancing bridge with the unknown resistance one arm of the bridge. Balance is achieved by automatically adjusting a digital rheostat with stepping switches.

COMPUTER TYPE TUBE features high perveance

SYLVANIA ELECTRIC PRODUCTS INC., 1740 Broadway, New York 19, N. Y. Type 6350 is a miniature T-6 $\frac{1}{2}$ twin triode, designed and developed for use in high-speed digital computers. Featuring long life, high perveance and good power handling, it has a plate dissipation rating of 3.5 w per section. Each section features a



high zero bias plate current, sharp cutoff and a separate cathode connection. The cathode of the new tube is designed to operate at low temperature and special alloys used in its composition control sublimation and cathode interface formation to a slow rate. The test specifications are designed around computer applications that include fixed grid current testing and long life test with factory precautions to minimize interface formation.

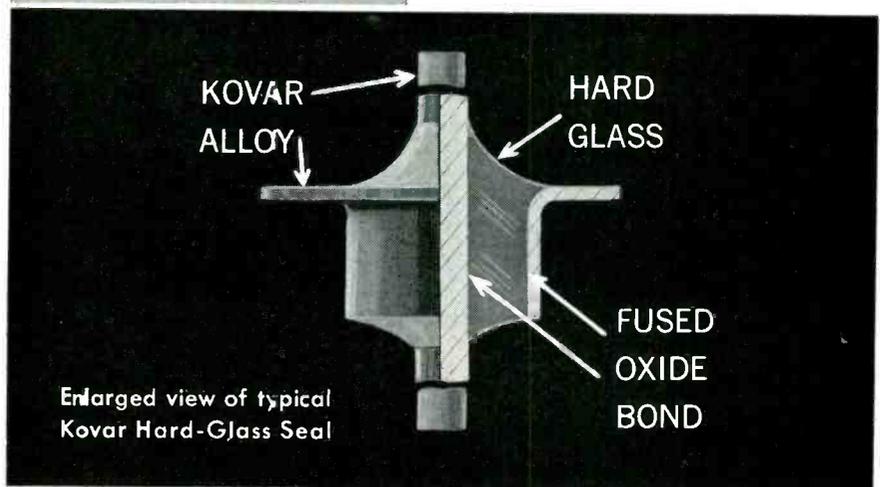


TEST SET in compact transit case

CAL-TRONICS CORP., 11307 Hindry Ave., Los Angeles 45, Calif. Model 604 test set, contained in a compact transit case, is designed especially for check out of any section of the AN/ARC-34 with minimum of effort and positive results. The test equipment is comprised of a voltage point test set (CTC 10617) similar to the MI-25137, a junction box (CTC 10618) and a tuning control test set (CTC 10619) similar to MI-25138 and an instruction book

Stupakoff

Kovar **HARD GLASS** Seals



Here are 5 practical reasons why
KOVAR AND HARD GLASS
make the Best hermetic seals

BEST for thermal endurance

—because the thermal expansion of Kovar matches exactly that of hard glass over the entire working range.

BEST for insulating value

—because of the high dielectric strength of hard borosilicate glass. No silicone treatment is required.

BEST for hermetic tightness

—because the fused oxide bond is a chemical bond, forming a true hermetic seal, free from strains at all working temperatures.

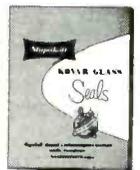
BEST for miniaturization

—because insulating efficiency and high mechanical strength of hard glass permit the use of seals of minimum size and weight.

BEST for your product

—because Stupakoff's broad experience, engineering skill and modern manufacturing methods provide hermetic seals that are right for your product. You get all the advantages that can be secured *only with Kovar and Hard Glass*.

WRITE DEPARTMENT E
for Catalog 453A, which shows
all the standard and many of the
special types of Stupakoff Her-
metic Seals.



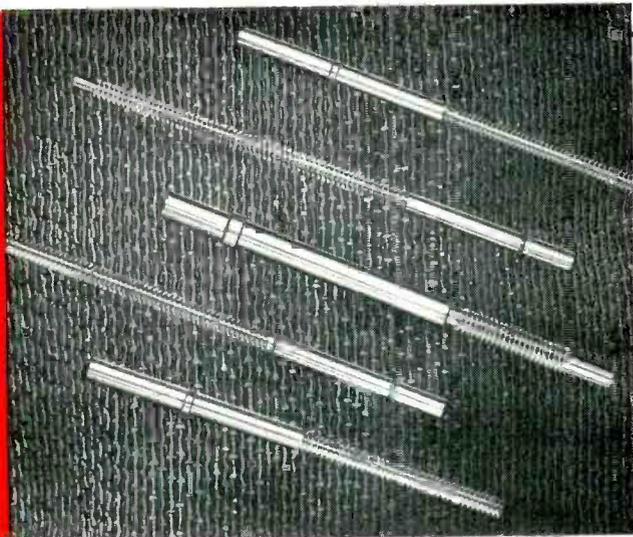
Stupakoff

CERAMIC & MANUFACTURING COMPANY • LATROBE, PA.

Division of The **CARBORUNDUM** Company

20
TO
200 D.P.

SEND YOUR
PRINTS FOR
QUOTATION



SPURS • HELICALS • WORM AND WORM GEARS • STRAIGHT BEVELS
LEAD SCREWS • RATCHETS • CLUSTER GEARS • RACKS • INTERNALS • ODD SHAPES

THE *Finest*



IN GEARS

Beaver Gear Works Inc.

1021 PARMELE STREET, ROCKFORD, ILLINOIS

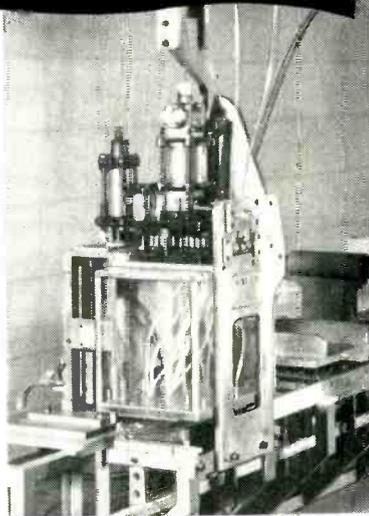
**Now... MALCO AUTOMATIC PIN AND CONTACT INSERTING
MACHINE FOR PRINTED CIRCUIT APPLICATIONS**

**... the Most Important
Cost-Saving Advancement
Yet Offered**

Malco's Automatic Pin and Contact Inserting Machine can materially reduce your assembly costs—and at the same time step up production to practically any desired level.

Operation is completely automatic. Up to 40 or more self-retaining terminals are inserted into the printed circuit board in any symmetrical or non-symmetrical pattern within a 3-second cycle. A special platen engages the self-retaining snap-in feature of the terminals, and the board is ready for immediate further assembly and dip soldering.

Malco Automatic Inserting Machines can be engineered to your particular application or production requirements.



Request Bulletin 551. Better yet, give us the facts about your operation. We'll show you how your costs can be lowered and your production increased.

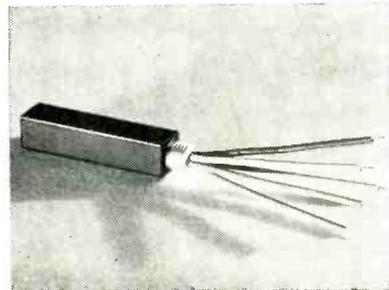
Malco

TOOL and MANUFACTURING CO.

4023 W. LAKE ST.,

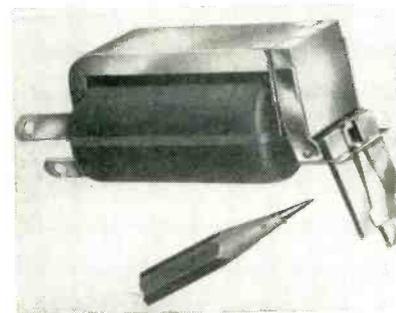
• CHICAGO 24, ILLINOIS

along with special purpose patch cables and tools for ease of trouble shooting any of the individual sub-chassis detached from the main assembly.



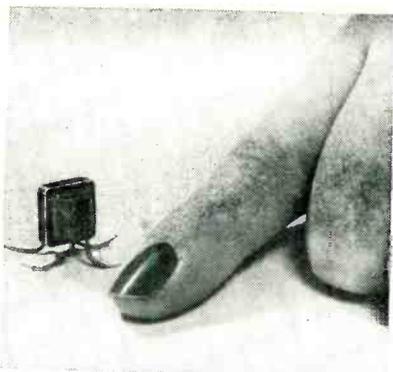
MISSILE RELAY is compact and sensitive

PRICE ELECTRIC CORP., Frederick, Md. Smaller than a cigarette, a new subminiature sensitive relay especially designed for guided missile and other applications requiring an extremely small, compact and sensitive relay has been announced. The new model, Husky 503, is provided with one set of spdt contacts rated at 0.5 ampere, 120 v d-c noninductive. When adjusted to a sensitivity of 0.050 w, the 503 will resist 30-g vibration up to 2,000 cycles. It will withstand operating shock of 50-g for 0.011-sec duration, mechanical shock of 2,000 ft lb and 1,000-g rotary acceleration. The relay contains a new internal mechanism and is less than 2 in. in length and only $\frac{3}{8}$ inch square.



JAMES CUNNINGHAM, SON & Co., INC., Rochester 8, N. Y., has announced the model 22A electromagnetic solenoid actuator. Featured is the linkage system available in either a push or pull

arrangement, which magnifies the original air gap movement in an 8 to 1 ratio. The actuator is extremely compact, displacing 1.4 cu in. and weighing 50 grams. It operates on 1.8-w input, within 7 milliseconds at normal voltage. The new linkage design permits even motion with minimum friction-induced loss of energy. The actuator remains cool in continuous operation.



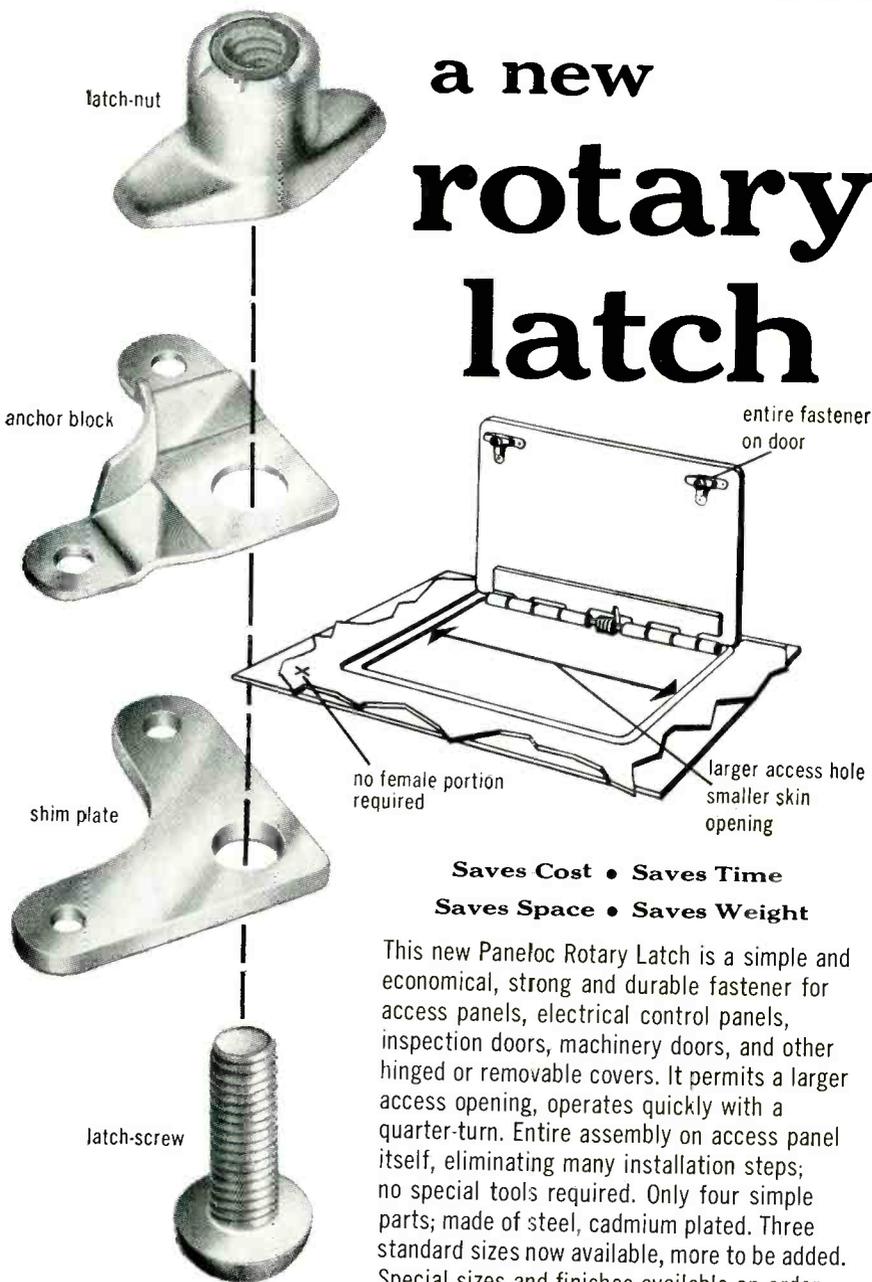
TINY TRANSFORMER for many industrial uses

TELEX, INC., Telex Park, St. Paul 1, Minn. Redesign of a miniature interstage transistor transformer has produced a model 1/3 smaller than the recent prototype. Measuring $\frac{3}{8} \times \frac{3}{8} \times \frac{3}{8}$ in., the transformer has numerous industrial uses in audio amplifiers, hearing aids, control circuits and other transistorized circuitry. Impedance of the interstage primary is 20,000 ohms, and the secondary is 1,000 ohms. Frequency response is ± 3 db from 150 to 15,000 cps, with 0.25 ma (d-c) in the primary. This transformer will handle up to 0.5 mw.

RELAY rugged and supersensitive

OLYMPIC RADIO & TELEVISION INC., Olympic Bldg., Long Island City 1, N. Y., has announced a new rugged supersensitive relay with wide applications in a-c and d-c control circuits. The unit will operate on as little as 20 μ w of control power, from d-c to 50 mc a-c. The relay can be packaged for plug-in or wire-in types of assemblies. It is capable of withstanding shocks of 10 g minimum and vibration of 10 g from 10 to 500 cycles without opening or

PANELOC announces a new rotary latch



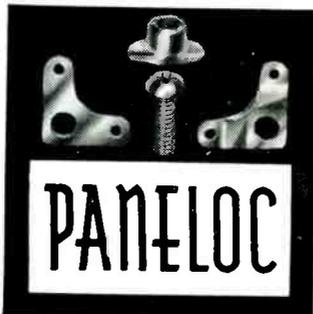
**Saves Cost • Saves Time
Saves Space • Saves Weight**

This new Paneloc Rotary Latch is a simple and economical, strong and durable fastener for access panels, electrical control panels, inspection doors, machinery doors, and other hinged or removable covers. It permits a larger access opening, operates quickly with a quarter-turn. Entire assembly on access panel itself, eliminating many installation steps; no special tools required. Only four simple parts; made of steel, cadmium plated. Three standard sizes now available, more to be added. Special sizes and finishes available on order. Cost very low, performance unsurpassed. Write for a catalog and price list for your file.

PANELOC... America's most versatile line of aircraft fasteners . . . Rotary Latches, Styles 1, 2, and 3 Panel Fasteners, High Performance Fasteners, Snap Fasteners.



PANELOC—A product of Scovill



Scovill Manufacturing Company, Aircraft Fastener Div.
46 Mill Street, Waterbury 20, Connecticut
Please send me fastener catalogs checked:
 Rotary Latch Style 3 (MIL-F-5591A)
 Styles 1 & 2 (MIL-F-5591A) High Performance (NAS-547)
 Snap Fasteners (AN 227)
 Send to:
 Name _____ Title _____
 Company _____
 Address _____

PRECISION

The Only **COMPLETE**
COIL FORM SERVICE
Available...

- SQUARE TUBES
- ROUND TUBES
- RESINITE COIL FORMS
- BOBBINS
- MANDRIL SERVICE
- FABRICATING SERVICE

SQUARE AND RECTANGULAR TUBES

Produced in any length, shape or size from $\frac{1}{16}$ " to 8", wall thickness from .010 to .125. Fabricated from dielectric kraft, fish paper, quinterra or combinations, including mylar. Bowed sidewall or Di-Formed construction.

ROUND TUBES

Produced in any decimal size up to 8" I.D. Fabricated from kraft, fish paper, cellulose acetate, mylar, polystyrene, quinterra, fibre glass and other dielectric materials.

RESINITE COIL FORMS

These coil forms have the highest resistivity of any resinated product. Furnished plain, embossed, internally threaded or triangular shape . . . also flyback transformer forms.

BOBBINS

Supplied round, square or rectangular. Cores fabricated from any of the above materials. Metal, asbestos, plastic or fibre flanges. Constructed to fit smaller spaces and permit multiple winding.

MANDRIL SERVICE

Accurately ground steel and aluminum coil mandrils at cost economy comparable to commonly used undependable wood or undersized steel mandrils.

FABRICATING SERVICE

We have modern high speed equipment to provide you with any special shape or form . . . rolled, spun, flared, punched or formed to your particular requirement.

*Ask about Precision's complete coil form service.
Request informative bulletin.*



closing contacts. It is completely hermetically sealed to eliminate the effects of humidity and contamination on the relay operations. Power gain available is approximately 75 db for a-c or 80 db for d-c control signals. These relays will function from d-c to at least 50 mc for a-c control inputs. They are available with this power gain in spst to spdt or more complicated arrangements. The unit requires $65 \mu\text{a}$ and 0.15 v for switching a spdt contact rated at 10 amperes, 115 v a-c. The relay requires an auxiliary power input of 1 w.



SONIC ANALYZER for nondestructive testing

KINETIC INSTRUMENT Co., Highland Park, Ill. Model E30A E-scope is a sonic analyzer for nondestructive testing of solid and visco-elastic materials. Features are accuracy, portability and operating convenience in providing measurement of effects of natural or induced deterioration, flaws or inclusions, or product uniformity. It is a self-contained instrument designed for laboratory use, field testing or production quality control. The E-scope



PRECISION PAPER TUBE COMPANY

2041 West Charleston Street, Chicago 44, Illinois

Plant No. 2: 79 Chapel Street, Hartford, Conn.

Representatives throughout United States and Canada

permits sonic testing of glass, wood, metals, plastics, tile, brick, carbon, graphite, ceramics, adhesives, rubber and abrasive wheels.



FLUTTER BRIDGE is portable and rugged

TELECTRO INDUSTRIES CORP., 35-18 37th St., Long Island City 1, N. Y. The new flutter bridge is specially designed to measure flutter and wow in turntables, tape recorders, wire recorders and motion picture equipment. Measurements in either the 0 to 0.5 percent or 0 to 2 percent ranges are indicated clearly on a large 4-in. square meter. The flutter bridge requires no external power source, is lightweight, portable and rugged. It is presently available for testing equipment with either 4, 8, 16 or 500-ohm impedances.



L-F GENERATOR features low distortion

DONNER SCIENTIFIC Co., 2829 7th St., Berkeley, Calif. Model 15 1-f generator is a precision source of sinusoidal and square wave voltages having a frequency coverage which is continuous from 0.01 cps to 1,000 cps. The instrument generates a true sine wave without discontinuity of slope, so that differentiation of the waveform yields a signal

AUTOMATIC PRODUCTION AND QUALITY CONTROL TESTING

with the

CTI Supertester

The CTI Supertester is an automatic, precision instrument for production testing, fault analysis, and preventive maintenance. It checks electronic and electrical products more completely and in a fraction of the time required by present methods.

Providing complete flexibility and rapid interchangeability between products, the Supertester can be programmed for any combination or sequence of the following measurements:

Impedance	A-C Voltage	Leakage
Resistance	D-C Voltage	Continuity



★ REDUCE TEST COSTS

Requiring only an untrained operator, the Supertester frees valuable technical personnel for specialized work. One

Supertester is the equivalent of a series of custom built, single product testers, or a benchful of precision bridges and meters.

★ SPEED PRODUCTION

Complex circuits, gain and frequency measurements, involved relay operations—all are checked at the rate of 180

tests per minute. Hours of manual test procedure have been reduced to minutes. Time is not wasted checking good units.

★ INCREASE PRODUCT QUALITY

Accurately checking every production unit against design values and tolerances, the Supertester does not overlook tests or pass questionable circuits. Original specifications are

tirelessly and rigidly adhered to. Instead of checking only the essential circuit parameters, the Supertester tests equipment completely, quickly, and at far less cost.

Proved in Use!

The Supertester is being used daily by a number of the nation's leading manufacturers. Their testing applications include printed circuits, telemetering units, guided missile circuitry and pre-flight tests, and aircraft electronic equipment.

Whatever the problem, rigid test specifications, high production rates, or reducing test costs, automatic testing is the solution, and the CTI Supertester has proved itself to be the efficient, money saving means to this solution.

COLOR TELEVISION INCORPORATED



SAN CARLOS 1, CALIF.

marion
*advancement
 in instrument
 design*

**NO
 GASKETS
 NO
 CEMENTS**

The
"ORIGINAL"

MIL-M-10304
**RUGGEDIZED
 PANEL
 INSTRUMENT**
 Hermetically sealed
 glass-to-metal

MIL 2½" and 3½" sizes. ua,
 ma, amp, mv, volt, kv, AC rectifier
 types for voltage, decibel and VU
 measurement, manufactured to
 MIL-M-10304. Standard ranges from
 stock. Twelve page booklet on request.



marion electrical instrument co.
 Grenier Field, Manchester, N. H., U. S. A.
 Manufacturers of Ruggedized and "Regular"
 Panel Instruments and Related Products.

copyright 1955 M.E.I. Co.

marion meters

**Earn Extra Income
 in MOBILE-RADIO
 MAINTENANCE!**



It's now a big business
 (650,000 installations) . . .
 fast-growing (70% increase
 just last year) . . . special-
 ized . . . and high-paying!

Learn how to turn this opportu-
 nity into cash—write today for free
 booklet "HOW TO MAKE MONEY
 IN MOBILE-RADIO MAINTENANCE!" It's
 published as a service to radio engineers
 by Lampkin Laboratories, Inc., manufactur-
 ers of the well-known 105-B Micrometer
 Frequency Meter and 205-A FM Modula-
 tion Meter.



LAMPKIN LABORATORIES, INC.
 Instruments Div., Bradenton, Fla.

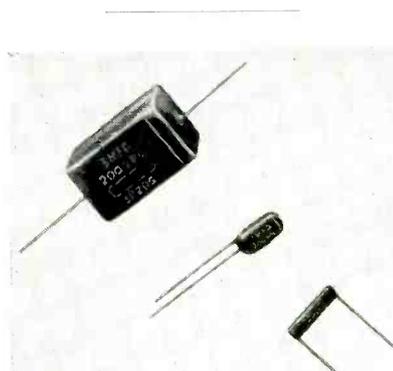
At no obligation to me please send "HOW
 TO MAKE MONEY IN MOBILE-RADIO MAIN-
 TENANCE."

Name _____
 Address _____
 City _____ State _____

NEW PRODUCTS

(continued)

with low noise. Feature are excep-
 tional frequency stability and low
 distortion. Total frequency drift is
 less than 0.5 percent. Frequency
 range is covered in five decade
 bands and tuning is by means of a
 6-in. high-resolution, individually-
 calibrated dial accurate to within 1
 percent. The instrument uses a 4
 in. zero-center meter with mirror-
 scale to facilitate accurate setting
 of the sinusoidal output level at any
 frequency. The meter indicates rms
 value in the frequency range from
 1 cps to 1,000 cps. Below 1 cps the
 meter indicates the instantaneous
 value of output voltage, showing
 both amplitude and phase of the
 oscillation.



LEADS
 conserve space

HOPKINS ENGINEERING Co., 2082
 Lincoln Ave., Altadena, Calif. Axial
 leads, radial leads and single-end
 parallel leads are the newest fea-
 tures of the company's subminia-
 ture metallized paper capacitors.
 The new lead locations not only lend
 themselves strongly to the elec-
 tronic field of automation, but also
 are important for maximum space
 conservation. These leads are avail-
 able in all capacitor sizes as well
 as on special units designed for
 specific requirements. Hopkins
 metallized paper capacitors are
 fungus-resistant plastic encased and rec-
 tangular in shape.

R-F WATTMETER
 of the calorimetric type

M. C. JONES ELECTRONICS Co., INC.,
 Bristol, Conn., has developed a
 calorimetric type r-f wattmeter that
 measures r-f power with the pre-

**Scouting
 for
 Incapsulated
 Coils?**



DANO MAKES THEM!

Dano, makers of a wide variety of coils,
 is fully equipped to meet the increasing
 demand for these special coils. Keeping
 pace with modern design, Dano offers
 incapsulated coils with tough, molded
 covers that spell extra electrical insula-
 tion with freedom from moisture.

Every Dano Coil is custom-made to
 your specific requirements. Call or
 write today, and Dano's quote will be
 on the way!

- Incapsulated Coils
- Bakelite Bobbin
- Paper Section
- Coils for High Temperature Applications
- Also, Transformers Made To Order
- Form Wound
- Cotton Interweave
- Acetate Bobbin

The DANO Electric Co.
MAIN ST., WINSTED, CONN.

BE SAFE WITH

Q-max
A-27

LOW-LOSS LACQUER & CEMENT

- Q-Max is widely accepted as the
 standard for R-F circuit components
 because it is chemically engineered for
 this sole purpose.
- Q-Max provides a clear, practically
 loss-free covering, penetrates deeply,
 seals out moisture, imparts rigidity and
 promotes electrical stability.
- Q-Max is easy to apply, dries quickly
 and adheres to practically all materials.
 It is useful over a wide temperature
 range and serves as a mild flux on
 tinned surfaces.
- Q-Max is an ideal impregnant for
 "high" Q coils. Coil "Q" remains nearly
 constant from wet application to dry
 finish. In 1, 5 and 55 gallon containers.

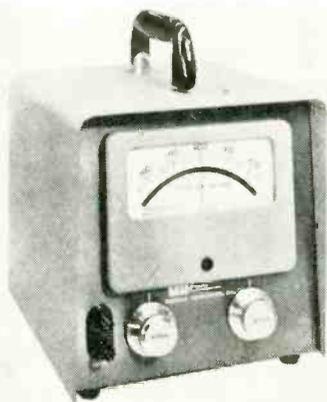
*Communication
 Products Company, Inc.*

MARLBORO, NEW JERSEY
 (MONMOUTH COUNTY)
 Telephone: FReehold 8-1880





cision of a primary standard. The 641N wattmeter can be used to check the accuracy of other types of r-f wattmeters, and to determine the actual output of an r-f power source, the approximate magnitude of which is known. Over the entire frequency range of 0 to 3,000 mc the instrument has an accuracy of better than ± 2 percent of full scale, using the calibration curve supplied. It measures power in the range from 0 to 300 w. For more accurate measurements it may be calibrated by the user at d-c or 60 cycles.



FREQUENCY METERS
accurate to $\pm 1/4$ cycle

SHASTA DIVISION, Beckman Instruments, Inc., P.O. Box 296, Richmond, Calif., has available a unit designed for fast, accurate monitoring of frequency. It was designed originally for making production inspection measurements on the frequency regulation of motor and engine-driven generating units, but has found many other applications, particularly where a permanent record of frequency is required. Input voltage harmonics of 5 percent, or changes in input voltage of ± 10

SMALL PARTS can play a BIG PART in...

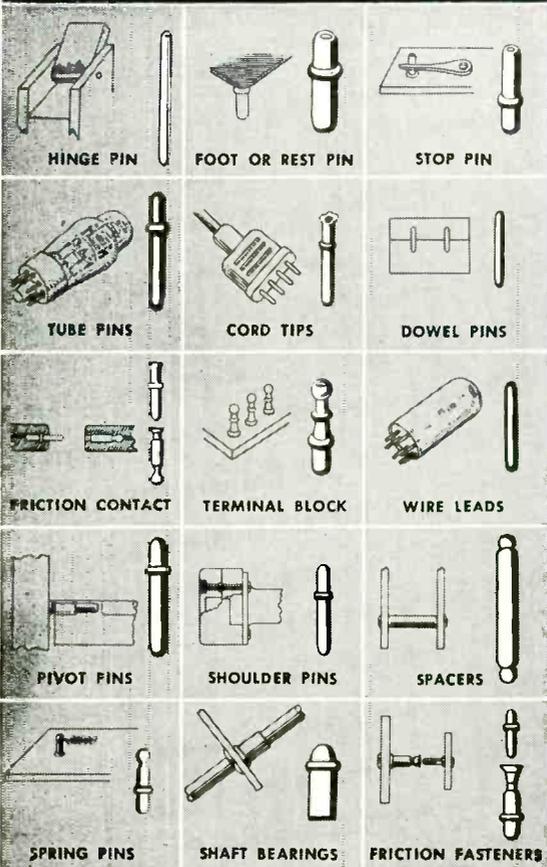
Lower Production Costs!

Leading manufacturers in the electronics, machinery, appliance and toy fields have been saving substantially by using precision Multi-Swage parts instead of those previously made by turning, drilling, stamping or forming.

LET BEAD CHAIN MAKE YOUR

Tiny Parts to your Specifications at far less cost!

HERE ARE ONLY A FEW TYPICAL TINY PARTS MADE BY BEAD CHAIN'S Economical, Dependable MULTI-SWAGE METHOD



The advanced manufacturing method developed and used exclusively by Bead Chain swages practically any type of small tubular part from flat stock into precision forms with positive, tight seams . . . and does it *Automatically*. If you can use high-volume production . . . we can deliver it at a much faster rate . . . and at far less cost! Scrap is eliminated! Deliveries to you are dependably prompt!

We can supply you with parts that are beaded, grooved, shouldered and made with almost any metal. Diameters up to 1/4", lengths to 1 1/2"

This catalog can save you a lot of production time and money! Write for it



GET PROOF-POSITIVE COST COMPARISONS!

Send us a blueprint or sample and quantity requirements. We will quickly show you the big economies we can deliver.

BEAD CHAIN
Original and World's
Largest Producer of Bead Chain

THE BEAD CHAIN MFG. CO.
BRIDGEPORT 5, CONNECTICUT

Please send me your Catalog of Multi-Swage Parts

NAME _____

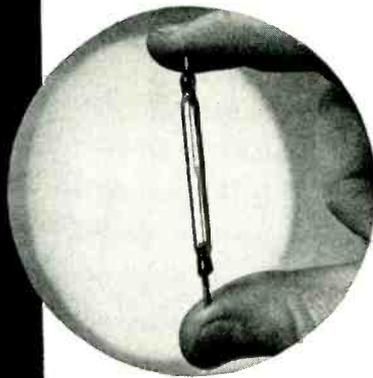
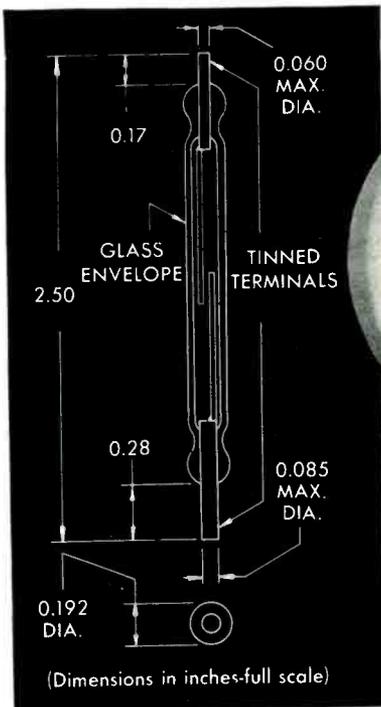
TITLE _____

COMPANY _____

ADDRESS _____

KEY NO. 88

THE BEAD CHAIN MANUFACTURING CO., BRIDGEPORT 5, CONN.



the mighty little glaswitch*

LIGHTNING RESPONSE . . . SEALED IN GLASS

The magnetically actuated reeds in this tiny Revere GLASWITCH make contact in just 1 millisecond . . . at rates up to 400 cycles per second. Hermetically sealed in an inert, dry atmosphere, with lightning fast snap action, both shelf and contact life are extremely long. Smaller than a cigarette, the GLASWITCH can be located anywhere . . . in any position . . . even in explosive atmospheres . . . individually or in multiples for multi-contact use.

Whenever you need faster, more positive response . . . where extreme sensitivity is a must . . . where light weight is important . . . investigate the Revere GLASWITCH. Write today for complete specifications and suggested uses.

CHARACTERISTICS:

Type—Single pole single throw—normally open—snap action
Enclosure—Hermetically sealed glass tube containing inert dry atmosphere

Operating Time—1 millisecond

Operating Rate—Up to 400 cycles per second

Contact Surfaces—Electroplated Rhodium

Contact Resistance (measured terminal-to-terminal)

Closed Circuit—0.050 ohms maximum

Open Circuit—500,000 megohms minimum

Contact Ratings

D.C. Loads at 28 volts

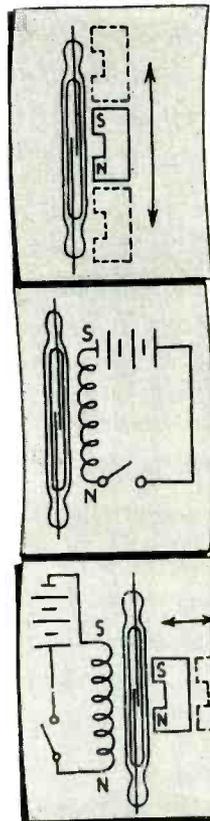
0.5 amps resistive

0.5 amps inductive (L/R—0.026)

A.C. Loads at 115 volts, 60 cycles

10 watt lamp load

Ambient Temperature Range— -85°F to $+500^{\circ}\text{F}$



METHODS OF ACTUATION:

A moving permanent magnet or controlled external electromagnetic field are all you need . . . and the sky's the limit on imagination!

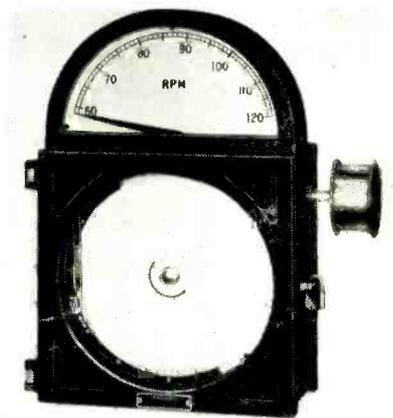
* Trademark



Revere CORPORATION OF AMERICA

WALLINGFORD, CONNECTICUT A subsidiary of Neptune Meter Company

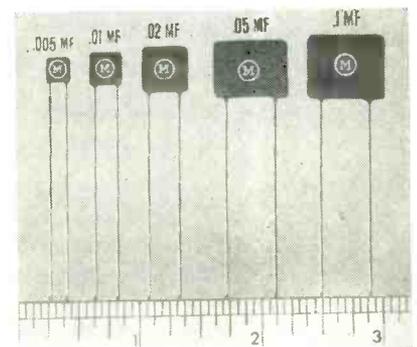
percent will not cause errors in frequency indication greater than $\pm\frac{1}{2}$ cycle for the model 401 or $\frac{1}{4}$ cycle for the model 601.



TACHOMETER

indicates and records

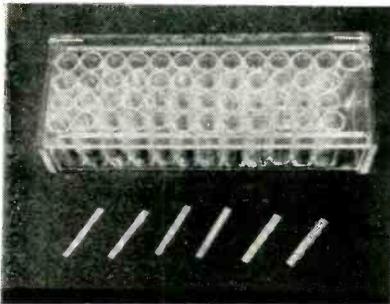
AMTHOR TESTING INSTRUMENT CO., INC., 45-53 Van Sinderen Ave., Brooklyn 7, N. Y. Type No. 317 indicating and recording tachometer automatically records the operation of the machine on which it is installed. It shows the speed and rate of production at any time and every change in speed. It shows the starting and stopping times, all slow-downs and nonproductive periods, the time and duration of each, and the actual producing and idle time. These data are valuable in increasing operating efficiency, cutting production costs and enforcing strict observance of schedules.



SMALL CAPACITORS for transistor circuits

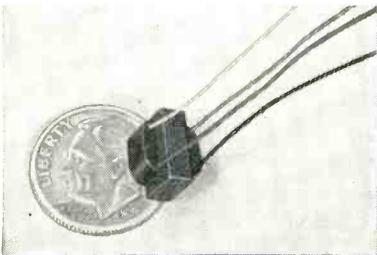
MUCON CORP., 9 St. Francis St., Newark 5, N. J., announces a line of high-capacitance subminiature ceramic capacitors whose small size

makes them ideal complements for transistors. Rated at 25 v d-c, these units are available in 5 stock capacitance values ranging from 0.005 μ f to 0.1 μ f, measuring 13/64 in. sq. max. to 17/32 in. max. by 21/32 in. max., with thickness from 0.090 in. max. to 0.110 in. max. Made of Super-K ceramic material, these capacitors have radial No. 26 leads, and are normally used from 5 C to 40 C. The units are finding wide application for bypass, coupling and tone control circuits in personal transistor radios, auto receivers and other subminiature equipment.



TAPE RESISTOR KIT
useful for laboratory work

HANSEN ELECTRONICS Co., 7117 Santa Monica Blvd., Los Angeles 46, Calif. Designed for laboratory use in experimental or development work involving the use of tape resistors, the type RNP-1C kit includes 10 each of the 49 standard MIL-R-11A values from 100 ohms to 1 megohm, inclusive, in ± 10 percent tolerance. The kit is etched to show the various values, making it easy to identify each type RNP value quickly and accurately. Price of the complete kit is \$49.50.



TRANSFORMER
reduced in size and weight

GRAMER-HALLDORSON TRANSFORMER CORP., 2734 N. Pulaski Rd., Chicago

**Save Time, Reduce Errors...
Determine and Record Data
Automatically with These Two
Versatile Berkeley Instruments**



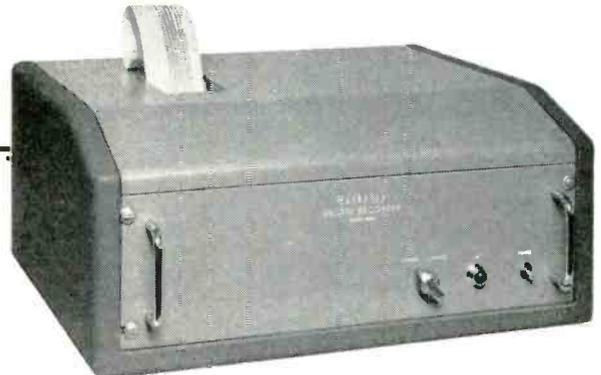
Model 5510 Universal Counter and Timer offers direct-reading digital display of count, frequency or microsecond time interval. Time bases from 1 mc. to 1 cps; gate times from .00001 to 10 sec. Accuracy ± 1 count, \pm crystal stability (1 part in 10⁹). Price \$1,100.00 f.o.b. factory.

1. UNIVERSAL COUNTER AND TIMER, Model 5510, combines the functions of four instruments in one single, compact unit. It will:

- a. Count at speeds to 1 million per second.
- b. Count events occurring during a selectable, precise time interval.
- c. Measure time intervals in 1 microsecond increments, from 3 microseconds to 1 million seconds.
- d. Determine frequencies or frequency ratios from 0 cps to 1 megacycle.
- e. Operate directly the BERKELEY printer (below), BERKELEY digital-to-analog converter, or BERKELEY data processor to drive IBM card punches, typewriters or teletype systems.

2. BERKELEY DIGITAL RECORDER, Model 1452, combines scanner and high speed printer in a single unit; prints up to 10 digits on standard adding machine tape. Can be modified to print "Time" or "Code" information simultaneously with count data on same tape.

Model 1452 prints 6 digits (8 or 10 on special order) on standard adding machine tape. Is only 19" wide x 10 1/2" high x 14" deep, weighs 60 lbs. Price, \$750.00 f.o.b. factory.



Write for complete specifications and data; G-9

M-43

Berkeley *division*

BECKMAN INSTRUMENTS INC.
2200 WRIGHT AVE., RICHMOND, CALIF.

INDUSTRIAL INSTRUMENTATION AND CONTROL SYSTEMS • COMPUTERS • COUNTERS • TEST INSTRUMENTS • NUCLEAR SCALERS

9 8 7 4 3 6 5 2 9
5 6 7 8 9 0 1 2 3 4 5 6 7 8 9

CO-AX

4 mmf/ft

★
ULTRA LOW capacitance & attenuation

WE ARE SPECIALLY ORGANIZED
TO HANDLE DIRECT ORDERS OR
ENQUIRIES FROM OVERSEAS
SPOT DELIVERIES FOR U.S.
BILLED IN DOLLARS—
SETTLEMENT BY YOUR CHECK
CABLE OR AIRMAIL TODAY

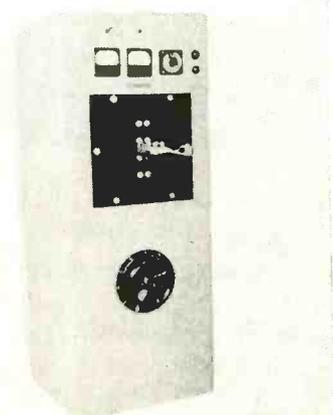


TYPE	$\mu\text{mf/ft}$	IMPED. Ω	O.D.
C1	7.3	150	.36'
C11	6.3	173	.36'
C2	6.3	171	.44'
C22	5.5	184	.44'
C3	5.4	197	.64'
C33	4.8	220	.64'
C4	4.6	229	1.03'
C44	4.1	252	1.03'

NEW 'MX and SM' SUBMINIATURE CONNECTORS
Constant 50 Ω -63 Ω -70 Ω impedances

TRANSRADIO LTD. 138_A Cromwell Rd. London SW7 ENGLAND CABLES: TRANSRAD, LONDON

39, Ill., has introduced a new Mini-former miniature transformer. Designed primarily to meet the smaller space requirements of hearing aid components, it also has applications in computers, pocket radios, f-m transceivers, telephone recorders and airborne equipment. The unit measures only $\frac{1}{4}$ in. \times $\frac{1}{8}$ in. \times $\frac{3}{8}$ in. and weighs but 0.004 lb. The 100W72 interstage transformer illustrated has a match impedance of: primary, 20,000 ohms; secondary, 1,000 ohms. Primary d-c resistance is 1,030 ohms; secondary, 167 ohms. Power rating for primary inputs from 1 v to 7 v is 2.5 mw. Other impedance matches are also available. Leads are color-coded, high-temperature plastic insulated.



INDUCTION HEATER for light heat treating uses

LINDBERG ENGINEERING Co., 2450 W. Hubbard St., Chicago 12, Ill. A new 3-kw h-f induction heating unit (Model LI-3) is designed for brazing, hardening, and other light heat treating applications. It is also used for quickly melting small quantities of ferrous and nonferrous metals for spectroscopic analysis, and like operations, in research laboratories. The all steel cabinet is heavily constructed to protect internal components from damage and minimize r-f radiation. A double compartment shields h-f oscillator from d-c power supply and controls. Heavy duty industrial type vacuum tubes are used throughout with oscillator tube air cooled to eliminate large volume water requirements. Filament voltages to all tubes are automatically

**SPACE SAVERS FOR
MODERN CIRCUITRY —
MONEY SAVERS FOR
PRODUCTION ECONOMICS —**

IN-RES-CO TYPE IR WIRE WOUND RESISTORS

The practical, low cost solution for circuit designers striving for the sub-miniature. Type IR units offer precision resistance values capable of retaining stability through long periods of continuous or intermittent service. Type IR resistors are available at prices based on mass production methods of manufacture. Wound to a tolerance of $\pm 1\%$, they are permanently accurate. Conservative ratings allow ample safety margin in all classes of service. Special Bakebrite forms eliminate shrinking, swelling and temperature effects. IN-RES-CO moisture and fungus proof coating offers absolute protection against climatic extremes. Specify IR Type resistors for all applications where precision performance and limited space are important determining factors.

**INSTRUMENT
RESISTORS CO.**

COMMERCE
AVENUE



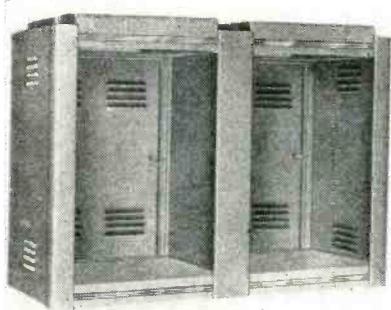
UNION
NEW JERSEY

APPLICATION-DESIGNED RESISTORS FOR ELECTRONICS AND INSTRUMENTATION

WRITE FOR NEW RESISTOR
HANDBOOK — Contains
complete data and recom-
mended applications
for resistors for every
purpose.



controlled by voltage regulating transformers. Bulletin 1470 gives additional details.



MULTIPLE RELAY RACK available in four sizes

PREMIER METAL PRODUCTS Co., 3160 Webster Ave., New York 67, N. Y., has announced a multiple relay rack unit. Enclosed relay racks for standard 19-in. rack panels can now be jointed together to make multiple units by a solid center partition bolted to the top and bottom. Each multiple section consists of a top, bottom, rear door and center partition. Multiple units are available in four sizes: 36½ in., 42 in., 61½ in. and 77 in.



T-W TUBE AMPLIFIER for C-band use

HUGGINS LABORATORIES, INC., 711 Hamilton Ave., Menlo Park, Calif. This traveling-wave tube features broadband operation from 4 to 8 kmc without the necessity of making any electrical or mechanical adjustments. It finds its greatest use where this broadband characteristic can be utilized such as r-f preamplifiers and untuned r-f receivers in systems applications. It is also used extensively in broadband microwave measurement techniques in the laboratory. Grid control is provided for variable gain and power output applications. Approximate operating characteristics over this band are 30-db gain and 10-mw output. The unit requires a 300-

HEILAND OSCILLOGRAPH

CHARTS

"NIGHTGLOW"

ON LONELY MOUNTAIN PEAK



Dr. Franklin E. Roach, consulting physicist to the National Bureau of Standards, loads a record take-up drum into the Heiland oscillograph.

On wind-swept "Fritz Peak" in the Colorado Rockies, the broad capacity of the Heiland 712 oscillograph goes to work on every cloudless and moonless night, charting the airglow in the sky.

Charting these night-light phenomena formerly required 30 minutes, but a complete record of the skies is now taken every 3 minutes.

A 4-telescope Photometer—installed at the top of the 9,000 foot mountain—sends information on the amount and quality of light in the skies to the Heiland 712 Oscillograph located in the trailer laboratory below. Heiland galvanometers convert these data into clear, easily-readable oscillograms for later study.

The National Bureau of Standards "Airglow" Project is engaged in a study of the earth's upper atmosphere. It is expected that this research will reveal high-speed fluctuations in the airglow, which originates in that part of the upper atmosphere known as the ionosphere.

Heiland Series 700-C Recording Oscillographs provide record widths as great as 12 inches, accommodate up to 60 channels and have record speeds through 144 inches per second. Galvanometers with unequalled sensitivity ratings are available in frequencies up to 5000 cps.

- Write for Bulletin 700 CFPK for details.
Visit the Honeywell Booth, ISA Show

Heiland®

A DIVISION OF MINNEAPOLIS-
HONEYWELL
130 E. 5th Ave., Denver 3, Colo.

Designed for
Application



**The No. 90901
One Inch
Instrumentation Oscilloscope**

Miniaturized, packaged panel mounting cathode ray oscilloscope designed for use in instrumentation in place of the conventional "pointer type" moving coil meters uses the 1" 1CP1 tube. Panel bezel matches in size and type the standard 2" square meters. Magnitude, phase displacement, wave shape, etc. are constantly visible on scope screen.

**JAMES MILLEN
MFG. CO., INC.**

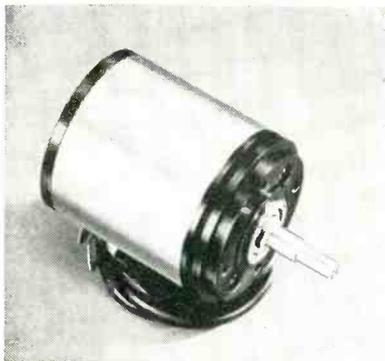
MAIN OFFICE AND FACTORY
**MALDEN
MASSACHUSETTS**



NEW PRODUCTS

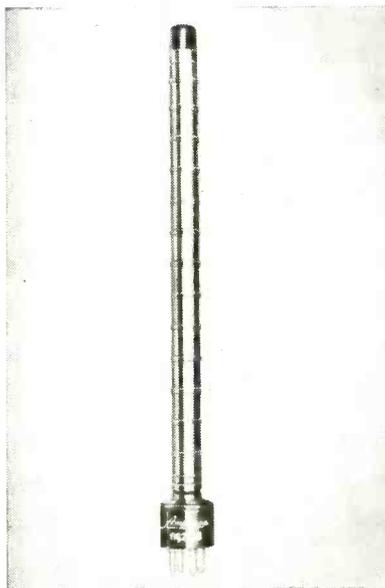
(continued)

gauss field and a 700-v regulated power supply.



MAGNETIC CLUTCH

STERLING PRECISION INSTRUMENT CORP., 34-17 Lawrence St., Flushing 54, N. Y. Model T502 is a high-speed, precision electromechanical component for all types of control, computer and servo systems. It can be mounted on a single hanger like any standard servo motor. Mounting is identical to Mk8 Mod 0 servo motor.



**GEIGER TUBE
with 7-in. cathode**

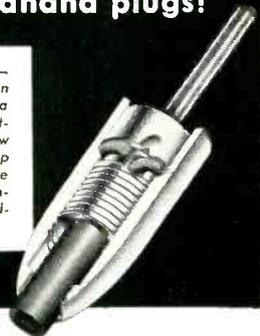
AMPEREX ELECTRONIC CORP., 230 Duffy Ave., Hicksville, L. I., N. Y. The type 912NB Geiger tube, because of its 7-in. cathode, obtains much higher sensitivity and greater pulse height. It is used for the detection of beta and gamma radiation in monitoring equipment and



NOW!
more for your
connector dollar...

with these rugged nylon
tip and banana plugs!

Illustrated above—
Johnson's new nylon
insulated banana
plug. Below—a cut-
away view of the new
nylon insulated tip
plug... two of the
toughest, most dura-
ble connectors avail-
able today!



Look at these features:

- Shock-proof nylon insulating handles—won't chip or crack with the hardest usage.
- provides high voltage insulation.
- Highly resistant to extremes of heat, cold and moisture.
- Special design for simplified solderless connection of up to 16 gauge stranded wire.
- Economical—simple, functional engineering design gives you top quality at low cost.

SPECIFICATIONS

BANANA PLUG—nickel-plated brass construction with nickel-silver springs. Spring plug is .175" diameter, fits all standard banana jacks. **TIP PLUG**—recessed metal head is fully insulated, preventing exposure of metal surfaces when tip plug is engaged in any standard tip jack. Metal parts are brass, nickel-plated. Pin is .081" diameter—fits all standard tip jacks. Available in 11 bright colors to match Johnson nylon tip jacks.

Also New

**NYLON TIP JACK AND
INSULATING SLEEVE**

Complete assembly includes a standard nylon tip jack with a threaded nylon insulating sleeve. Ideal for patch cards, this assembly is also excellent for panel mounting, where an insulated rear connection is desired.



Investigate today! Write for prices, further information.

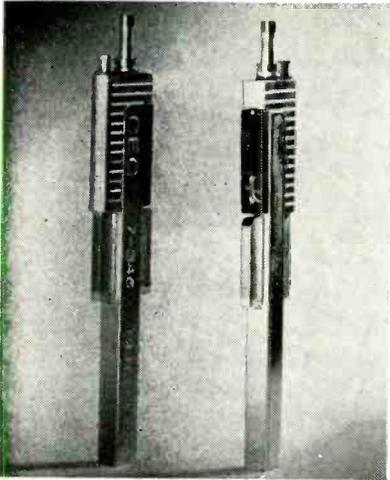


E. F. JOHNSON COMPANY

2331 SECOND AVE. S.W. • WASECA, MINN.

For additional information on all items on this page, use post card on last page.

survey instruments. The 912NB has a stainless steel cathode, 39/64 in. i.d. and a wall thickness of 30 mg per cm². Minimum plateau length is 200 v; operating voltage is 900 v. The tube is fully described in the radiation tube catalog, which is available on request.



GALVANOMETERS for direct recording

CONSOLIDATED ENGINEERING CORP., 300 N. Sierra Madre Villa, Pasadena 15, Calif., has released the first five of a new high-performance series of galvanometers. The instruments permit accurate recording of dynamic signals up to 200 cps without amplifiers. Several of the units are electrically interchangeable with CEC's present 7-300 units, but feature extended frequency response. Other members of the high-performance family are distinguished by extremely high sensitivity and are expected to be used where maximum resolution or recording of low-level signals is required. Types are available for direct connection to commonly used 120, 180, and 350-ohm strain gages and resistance-type pickups. Further information and complete specifications are given in bulletin 1559.

PHOTOCONDUCTIVE CELL

cadmium-sulfide type

RADIO CORP. OF AMERICA, Harrison, N. J., has introduced a small

brand new!

BRUBAKER
electronics, inc.

**marker
pulser***

**A PRECISION MARKER-GENERATOR
AND PULSE-GENERATOR FOR MANY
LABORATORY AND PRODUCTION LINE USES!**



SPECIAL FEATURES

- Output pulse width, 0.1 to 10 microseconds
- Output pulse rise and fall time, 0.03 microseconds
- Output pulse repetition rate 100 to 5000 pps
- Synchronizing pulse width 3 microseconds
- Forced air cooling
- Compact construction
- Illuminated panel and markings
- Inset rear deck for ease of connections, with detachable line cord and standard video and sync cables

* Trade Mark

Now you can make precision time measurements with one combination marker-generator and pulse-generator. Use the time-tested Brubaker Marker-Pulser (with a broad-band oscilloscope) for measurements of delay lines, filters, video-pulse amplifiers, pulse transformers, and pulse-forming networks. Use it to calibrate other test equipment. All outputs are locked together to provide completely jitter-free synchronization of output pulses, scope-marker pulses, and scope synchronizing pulses. And for flexibility of use, the output pulses and scope-synchronizing pulses are variable with respect to each other as well as to the scope markers. Measurements of time delays in increments of 0.01 microseconds are made rapidly by means of a calibrated dial which reduces necessity for operator interpolation of scope traces.

The Marker-Pulser is time tested. It has been used continuously to test Brubaker delay lines. And Brubaker is the LARGEST PRODUCER OF PRECISION DELAY LINES. We will be glad to quote on YOUR requirements.

BRUBAKER ELECTRONICS, INC.
9151 Exposition Drive • Los Angeles 34, California

BIRD Model 43 *ThruLine* DIRECTIONAL WATTMETER

Reads Directly . . . WATTS FORWARD
WATTS REFLECTED . . . In 50 Ohm Coaxial Lines

Measures POWER into the antenna in the actual operating circuit. Continuous monitoring if desired.

Measures reflected power, direct reading. In antenna matching work, results show directly in lower reflected power. Ideal for mobile equipment.

Tests 50 ohm r-f lines, antenna connectors, filters—quickly. **ACCURATE** because of high directivity and small frequency error.

DIRECT READING—no calibration charts, no full scale meter adjustments needed. Meter scale reads directly for all ranges and is expanded for better down-scale reading.

CONVENIENT—does not require reversal of r-f connections. No auxiliary power required.

Negligible power loss and insertion VSWR.

Full scale power range and frequency range are determined by the selection of plug-in elements from the following list.

Frequency Range—25-1000 megacycles in five ranges vis. 25-60 (A), 50-125 (B), 100-250 (C), 200-500 (D), 400-1000 (E).

Power Range—10, 25, 50, 100, 250, and 500 watts full scale. Available in most frequency ranges.

Accuracy—5% of full scale.

Write for literature.



Model 43 with front element in operating position. Dimensions: 7" x 4" x 3" Weight, 4 pounds. SO239 jacks for PL259 plugs available.

cadmium-sulfide photoconductive cell of the head-on type designed especially for light applications where a single tiny photosensitive device is required. The new cell (6694) features high luminous sensitivity, extremely low background noise, and a signal output which is directly proportional to the intensity of the light falling upon the cell. It is useful for light-controlled relay applications, in computer systems, and in light meters for measuring the brightness of small luminous spots. The cell's spectral response covers the visible range from 3,500 to 5,500 angstroms with maximum sensitivity in the green region of the spectrum. The 6694 has a maximum length of only 0.19 in., a maximum width of 0.34 in., and a maximum depth of 0.185 in. Minimum photosensitive area is 0.02 x 0.018 in. Ratings, characteristics and operating considerations are included in an available technical bulletin.



BIRD
ELECTRONIC CORP.
1800 EAST 38TH ST., CLEVELAND 14, OHIO
TERMALINE Coaxial Line Instruments

VAN GROOS
COMPANY
Sherman Oaks, Cal.

RON MERRITT
COMPANY
Seattle

DIRECT
TEMPERATURE
MEASUREMENTS

UP TO **3700° F.**

IRIDIUM vs. RHODIUM IRIDIUM
THERMOCOUPLE WIRE

The only thermocouple material which may be used at these very high temperatures in an oxidizing atmosphere.

Ductile wire made possible by high purity and our advanced melting and drawing techniques.

Output: Over 10 millivolts at **3700° F.**

UNIFORM • REPRODUCIBLE

Write for List of Products

Since 1901



SIGMUND COHN CORP.

Metallurgists and Producers of Small Wire

121 SOUTH COLUMBUS AVE., MOUNT VERNON, N. Y.

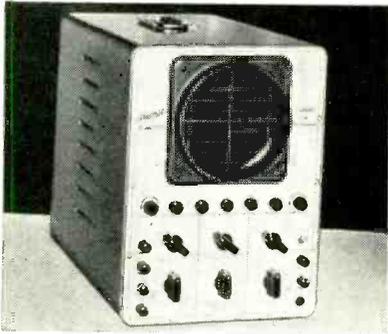
Specialists in the
Unusual



DECADE COUNTERS with plug-in construction

RANSOM RESEARCH, P. O. Box 382, San Pedro, Calif., has developed miniaturized electronic decade counters weighing 6 to 8 oz with miniature tubes in place they employ the new direct-reading EIT decade-scaler tube and replace older versions weighing 11 oz. Four types are available—a 20-kc scaler, a 40-kc scaler, a 100-kc scaler and an output stage scaler operating at 10 cps which can be used to feed a

mechanical counter. The 20-kc, 40-kc and 100-kc counters are available with or without an input-shaper circuit. Plug-in construction makes them particularly useful as building blocks to form any desired combination. Dimensions of all models are 1½ in. × 2¾ in. × 3¼ in. exclusive of tubes. One to three miniature-type tubes supplement the EIT decade-scaler tube.



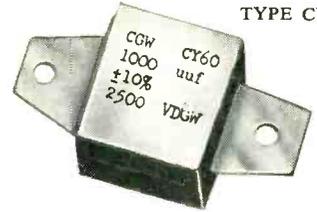
FIVE-IN TV SCOPE has wide-band response

HICKOK ELECTRICAL INSTRUMENT Co., 10527 Dupont Ave., Cleveland 8, Ohio. Model 675 high-sensitivity wide-band scope features a calibrated and illuminated scale with a green filter to reduce reflections caused by incidental illumination. The scope has a frequency response of 1 cps to 4.5 mc (within 3 db) and is flat through the color burst frequency of 3.58 mc. Sensitivity is 20 mv rms per in. Variable writing speeds are available from 25,000 µsec per in. (based on 4 in.). Additional technical features are available from the company.

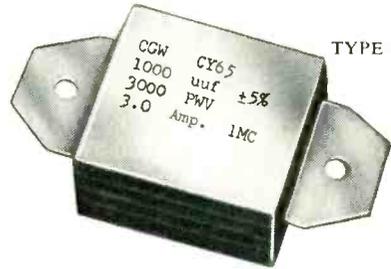
Literature

Relays and Switches. Automatic Electric Sales Corp., 1033 W. Van Buren St., Chicago 7, Ill. Bulletin RH No. 8 describes how the company's electric relays and stepping switches are being utilized in the design and construction of an advanced circuit analyzer used in the testing of electrical systems. Use of the relays and switches discussed

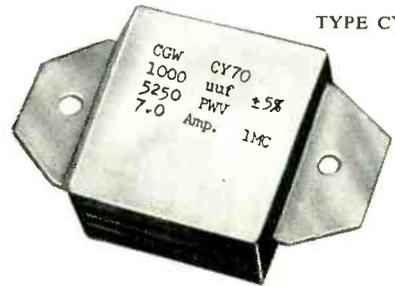
Electrically, Corning Glass Capacitors replace mica types CM45 thru CM70. The CY60 is physically interchangeable with mica types CM45-CM61.



TYPE CY60



TYPE CY65



TYPE CY70

Corning

Medium-Power

Transmitting Capacitors

offer the dielectric uniformity and stability of all-glass design

You'll notice a definite departure in physical form between these capacitors and those previously available for RF use.

The purpose of this is to take full advantage of glass in medium-power transmitting work in power amplifiers, low-power transmitters, low-power oscillators, TV transmitters and other electronic devices in grid, plate, coupling, tank and bypass functions.

Their small size and light weight make them ideal for aircraft and other mobile transmitters.

Characteristics and advantages

Glass Dielectric is formed as a homogeneous, continuous ribbon free of holes, cracks, foreign inclusions and other imperfections. This creates a

highly-stable, low-loss dielectric.

Temperature Coefficient . . . +140 ppm/° C. over a range of +25° C. to +85° C. Variations in TC between capacitors at any given temperature up to 125° C. are negligible; and the TC remains the same after repeated cycling.

Capacitance Drift . . . In no case exceeds ±.1% +.1 uuf.

Capacitance, Voltage and Power Ratings . . . Available in capacitance values to 100,000 uuf; voltage ratings to 6,000 peak-working volts; power ratings to 7.8 KVA at one megacycle.

You can get Corning Medium-Power Transmitting Capacitors now. For full, detailed information, write, wire or phone.

You can also get Fixed Glass Capacitors with Pigtail Leads and Glass Sub-miniature Tab-Lead Capacitors with many unusual advantages. Ask for facts.



CORNING GLASS WORKS

New Products Division • 36-9 Crystal St., Corning, N. Y.

Corning means research in Glass

Please send me the descriptive catalog sheet on Corning Medium-Power Transmitting Capacitors.

Name..... Title.....
 Company.....
 Address.....
 City..... Zone..... State.....

HEAVY DUTY

Multiple Arm

RELAYS by SIGNAL

Versatile — Rugged
Cast Aluminum Base
High Shock and Vibration
Resistant
Available AC — DC
Contact Capacities Available
10; 35; 50 amp.
Contact Combinations on
Same Base
Designed to Meet Many
MIL Spec's

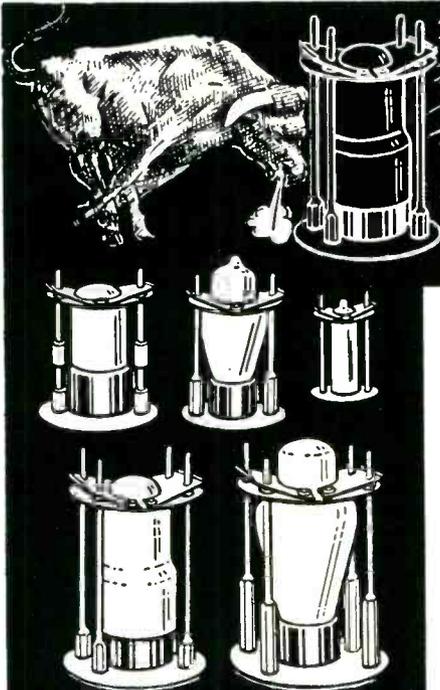


A superior relay that has endured the test of time . . . Specified for many years by America's largest manufacturer of electrical controls and communications equipment.

For complete data, write for Bulletin No. 30-6

Engineering
representatives
in principal cities

Wheelock RELAYS
SIGNAL
ENGINEERING & MFG. CO.
LONG BRANCH, NEW JERSEY



SHOCK PROOF

VACUUM TUBE RETAINERS

These retainers are used to secure Vacuum Tubes and to resist side motion of Vacuum Tubes used in radio equipment which is subject to shock and vibrations. These retainers meet the requirement of all JAN specifications. The insulated portion is made of a melamine base Fibre Glass Phenol which provides 300 volts insulation to ground and withstands a temperature of 350 F. The insulated plate can readily be fastened or released by hand.

*Manufacturers of
Electronic Components*

Available for envelope types T7, T8, MT8, T9, T12, ST12, T12ZDI, ST14, S14, ST16, T5½, T6½, MT-IC, ST19, T14, ST128CT-9.

JAMES IPPOLITO & CO., INC.
401 CONCORD AVENUE, BRONX 54, N. Y.

has produced an analyzer with improved speed, accuracy ease of operation and dependability.

Portable Potentiometers. Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa. Complete information about single, double and triple-range portable potentiometers widely used for numerous emf measurements in plant and laboratory, is available in data sheet E-51(2). The concise sheet lists instrument features and tabulates the characteristics of each potentiometer for ready comparison.

Continuous Thickness Measurements. Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44, Pa. Data sheet No. 10.9-1a describes thickness or weight control of pages, rubber, foil, coatings and other moving sheet materials. Thickness or weight per unit are continuously measured and controlled by Tracerlab beta gages equipped with Brown Electronik instruments. Applications, principles, features and instrumentation are given as well as sections on accuracy and personnel protection.

Computer Brochure. J. B. Rea Co., Inc., 1723 Cloverfield Blvd., Santa Monica, Calif., is offering a 12-page brochure on the READIX, a general purpose, fixed and floating point computer designed for business data processing, scientific computation, data reduction or automatic control. In addition to operational data on the READIX, the brochure covers such features as the low price, built-on test equipment and simplified maintenance.

Rectifier Recording Instruments. The Esterline-Angus Co., Inc., P. O. Box 596, Indianapolis 6, Ind. Bulletin 455 illustrates and describes the model AW rectifier recording instruments. Uses shown are typical of applications to be found in any plant. Specifications for the 50 ma split-core current transformers are included.

Components Catalog. Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass. Catalog 500 includes complete specifications, actual size illustrations and schematic

drawings of all the company's standard electronic and electrical components. Solder terminals and swagers, terminal boards, hardware, insulated terminals, coil forms and wound coils, and capacitors are each given a complete section and full details for ordering the many types of each unit are included. The catalog is three-hole punched for easy reference and filing.

Magnetic Components. Raytheon Mfg. Co., 100 River St., Waltham 54, Mass. A 16-page bulletin 4-100, describes in detail the wide variety of specialized magnetic components produced by the company for use in all types of electrical and electronic equipment. Well illustrated with photos, circuit diagrams, and output curves, the booklet covers equipment designed for both power and signal applications such as transformers, magnetic amplifiers, filters and delay lines. Also included is a section on unusual and interesting design features incorporated in many of the Raytheon units.

A-F Carrier. North Electric Co., Galion, Ohio. A new low-cost signaling system designed specifically to fill expanding subaudio or d-c signaling needs is described in a 4-page bulletin. The system described utilizes either frequency shift or frequency modulation for transmitting signaling information. It permits teletype, telegraph, telemetering, and other subaudio or d-c signaling to be multiplexed over open wire, telephone carrier, radio, microwave or any system capable of carrying voice frequencies. The bulletin contains photographs and specifications of the system.

Laboratory Standard Instruments. Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J. The company's laboratory standard instruments and standard cells are fully illustrated and described in catalog A46A. Also included is expanded information on frequency coverage, frequency compensation and waveform effect pertaining to the model 326 voltmeters, ammeters and wattmeters.

Digital Converter. Norden-Ketay Corp., 555 Broadway, New York 12,

transistor and digital computer techniques

APPLIED TO THE DESIGN, DEVELOPMENT
AND APPLICATION OF

AUTOMATIC RADAR DATA PROCESSING,
TRANSMISSION AND CORRELATION
IN LARGE GROUND NETWORKS

Engineers & Physicists

Digital computers similar to successful Hughes airborne fire control computers are being applied by the Ground Systems Department to the information processing and computing functions of large ground radar weapons control systems.

The application of digital and transistor techniques to the problems of large ground radar networks has created new positions at all levels in the Ground Systems Department. Engineers and physicists with experience in the fields listed, or with exceptional ability, are invited to consider joining us.

FIELDS INCLUDE

TRANSISTOR CIRCUITS • DIGITAL COMPUTING NETS •
MAGNETIC DRUM AND CORE MEMORY • LOGICAL DESIGN •
PROGRAMMING • VERY HIGH POWER MODULATORS AND
TRANSMITTERS • INPUT AND OUTPUT DEVICES •
SPECIAL DISPLAYS • MICROWAVE CIRCUITS

*Scientific and
Engineering Staff*

HUGHES

RESEARCH
AND DEVELOPMENT
LABORATORIES

Culver City, Los Angeles County, California

70 mm.

for

one

millivolt

yet drift-free



TYPE M

THE OFFNER DYNOGRAPH

0.001 volt input d-c gives 70 mm. deflection with this high-speed direct writing oscillograph, many times that for competitive units. The Dynograph with *one amplifier* is used for all types of inputs for measuring speed, temperature, position, vibration, and other variables. Patented, chopper amplifier design makes it sensitive, stable, and versatile. Available in both 6 channel console model and single and dual channel portable models. *Get bulletin L742—compare the Dynograph with all competitive models—it combines sensitivity with absolute stability.*

**OFFNER
ELECTRONICS INC.**

5324 N. Kedzie Avenue
Chicago 25, U. S. A.

N. Y. The recent 4-page bulletin No. 360 has applications, specifications, characteristics and an installation drawing of the new ADC-1 digital converter. The converter described has an unambiguous output of 13 binary digits and operates at high speed in clockwise or counter-clockwise operation.

VTVOM. Hycon Mfg. Co., 2961 E. Colorado St., Pasadena 8, Calif. Model 614 vacuum-tube volt-ohmmeter is illustrated and described in a single-page flyer. Included are the many advantages, specifications and price (\$87.50).

Tube Selection Chart. General Electric Co., Schenectady 5, N. Y. A selection chart listing 40 of the company's 600-ma series-string receiving type tubes—all of controlled heater warmup design—is now available. It classifies the tubes according to elements; lists typical service, heater voltages, maximum plate and screen dissipation ratings; and gives average characteristics. Ask for ETD-1163.

Resistance Precision Meter. Federal Telephone and Radio Co., 100 Kingsland Road, Clifton, N. J., has available a catalog sheet describing the type RGV resistance precision meter. Resistance range of the unit discussed is from 0.01 ohm to 100 megohms in seven ranges. Technical specifications, dimensions, weight, uses and operation data are included in the catalog sheet.

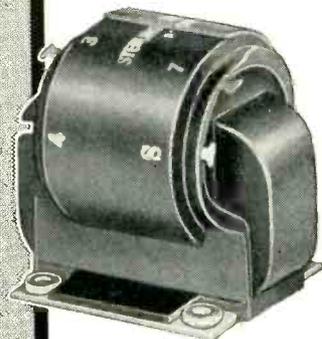
Program Control. Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44, Pa. Bulletin 1130, "Program Control of Process Variables," describes the methods and advantages of employing automatic, time-conditions control for many industrial processes and tests. A convenient selection chart aids in choosing the right instruments for any program control application.

Transistor Noise Figure Test Set. Radio Receptor Co., Inc., 251 W. 19th St., New York 11, N. Y., has available a bulletin giving a general description and technical specifications for the model TS-101 transistor noise figure test set. The

MOLDED OPEN TYPE TRANSFORMERS

THE CLIPPER

SERIES



Built to pass MIL-T-27 specifications, including Grade I humidity tests, and to operate continuously at 150°C (Class C).

Result: Savings up to 50% in space and weight without sacrifice in performance.

**SAMPLES?
SPECIALS?
SHORT RUNS?**

The Clipper is only one of the many types we make. We specialize in custom-built transformers to your specifications. Let our engineering staff help solve all your transformer problems.

*Samples delivered in
1 to 3 weeks*

Write for Literature

STERLING
TRANSFORMER
CORPORATION

297 North 7th St. Brooklyn 11, N. Y.
STag 2-4200

equipment described is intended primarily for production test service by both manufacturers and users of transistors.

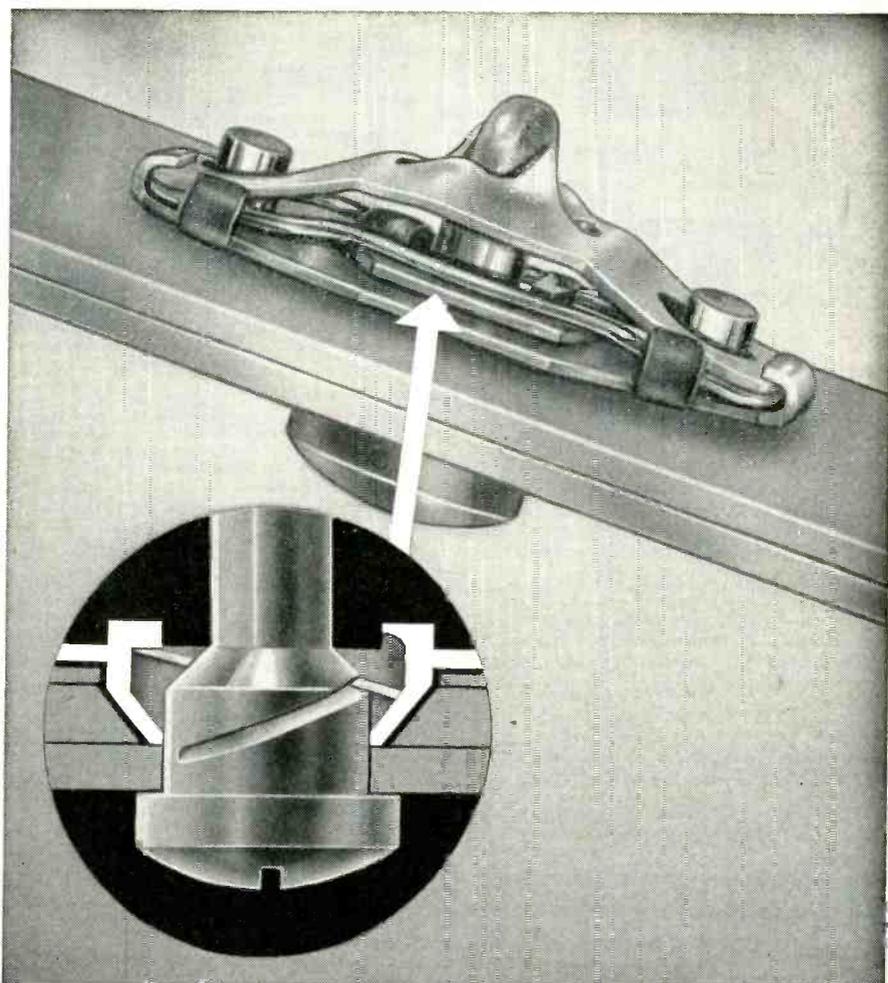
Ruggedized Panel Instruments.

Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J. Catalog A38B fully illustrates and describes the complete line of ruggedized and sealed panel instruments in 1½ in., 2½ in., 3½ in. and 4½ in. sizes, a-c, d-c, r-f and thermo, in both commercial and military types. Instruments in 2½, 3½ and 4½ in. have an external zero corrector, and all instruments may be readily opened and resealed using only an ordinary screwdriver. The catalog includes information on design and construction features, and on the test procedures employed to insure dependable accuracy in service under extremes of shock, vibration, temperature, humidity and general abuse.

Connectors. Alden Products Co., 117 No. Main St., Brockton, Mass., has released a new handbook section featuring integrally molded h-v cable disconnects and tube caps. The connectors described provide a low cost method of connecting and disconnecting voltages up to 30 kv, including corona free tube caps up to 25 kv. Originally developed to meet rigid color tv requirements, the connectors discussed can satisfy similar requirements in transmitters, x-ray gear, h-v supplies and other similar applications. A choice of insulation and wire types is provided so as to meet unusual operating conditions.

TV Transmitters. Allen B. DuMont Laboratories, Inc., Clifton, N. J. Bulletin TR-884 covers the series 100 (channels 2-6) and series 200 (channels 7-13) 50-w tv transmitters. Included are an illustrated description and technical specification listings for the aural and visual transmitters.

Ultrasonic Cleaning Equipment. Acoustica Associates, Inc., Shore Road, Glenwood Landing, L. I., N. Y. Bulletin DR-400 describes ultrasonic cleaning equipment for production cleaning and degreasing of precision products for elec-



New Lion "Hi-Strength" fastener completely assembled. Cutaway shows the beveled counter sink. Beveling substantially increases the area over which stress is distributed.

NOW! Shear strength twice that of any other fastener!

New Lion "Hi-Strength" design fills every need for parts that must be fastened, taken apart, buttoned tight quickly

Here's a new and better answer to your problem of metal-to-metal fastening where high shear stress and vibration are factors.

It's the Lion "Hi-Strength" fastener, combining speedy quarter-turn opening and closing with a shear strength of 4750 lbs!

This "Hi-Strength" fastener is remarkably strong because shear load is distributed evenly over the area of the fastened parts. The secret lies in the beveled counter sink in the sheet and the nut. It's the same high shear prin-

ciple used for years by the automotive industry for wheel lugs.

In addition to high shear strength, its tensile strength is 3000 lbs. Sheet separation is zero up to 4750 lbs. Misalignment is as much as .125 with high shear qualities. Regardless of the number of times it's opened or closed, there is no wear. It cannot be overtightened (up to 3750 lbs.). It cannot be fastened incorrectly. It is no larger than a standard No. 5!

To test it yourself, write for a free mounted working sample. Just drop us a line on your company letterhead.

LION Quarter-turn
FASTENERS

one of the

SOUTHCO

FASTENERS

Southco Division
South Chester Corp
233 Industrial Highway
Lester, Pa.

I found it!

say leading design and development engineers . . .

ACEPOT

the smallest wire-wound precision potentiometer

1/2" Size—Linearity .3%—High Resolution—200-Ω to 50K*

torque: .035 oz./in. @ 20° C.
power rating: 2 watts for 60° C. rise
meets applicable portions of MIL-E-5272A standards

ambient temperature: —55° C. to 125° C.

*Resistance Range: 200 Ω to 50K standard, ± 2%. Higher or lower on special order.

Standard, servo or flush mountings . . . dual or up to 6-gang units.

The case and threaded mounting bushing is one-piece anodized aluminum for maximum heat dissipation. The shaft is centerless ground stainless steel. Standard bearing in aluminum or bronze insert. Available for lower torque requirements with ball or jewel bearings. All units fully sealed, moistureproofed, fungicide treated.

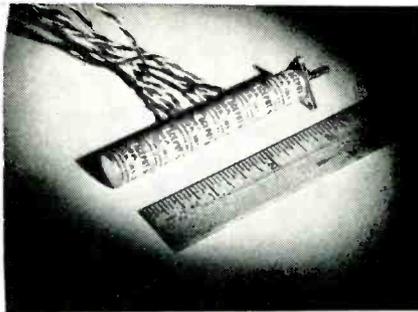
Our unique manufacturing and testing facilities assure you of controlled quality. Each ACEPOT is performance tested and a Polaroid picture record is supplied showing linearity and resolution.

Send for specification sheet, application data sheet and prices. Your inquiry will receive prompt attention.

ACE ELECTRONICS ASSOCIATES

125 Rogers Avenue, Somerville 44, Mass.

ACEPOT, ACETRIM trademarks applied for.



Available single or up to 6-gang units on one shaft.

ACETRIM

1/2" size
linearity 3%
10 Ω to 50 K ± 5%

ACETRIM . . . a low-priced, sub-miniature trimmer potentiometer with the same fine characteristics as the ACEPOT. Meets MIL standards. Available standard or shaft lock. Stops if required.



unique in design — rugged in construction

GREEN PANTOGRAPH ENGRAVERS

THE NEW HEAVY-DUTY MODEL D-2



THE FAMOUS MODEL 106

The three-dimensional bench Model 106 cuts costs — engraves, routs, models and profiles, giving you expert results even by unskilled workers.

The Model D-2 heavy-duty two dimensional Pantograph is a precision machine with a multitude of new features. Open on three sides, it permits complete freedom for engraving, milling, profiling large panels (up to 30" in diameter) or bulky pieces. Single, micrometer adjustment controls vertical depth of cut, automatically adjusting copy table with pantograph. Range of reduction ratios from 2-to-1 to infinity! Vertical range over 10 inches!

For complete information, write to

GREEN INSTRUMENT COMPANY

363A Putnam Ave.

Cambridge, Mass.

tronic, electrical, radio and tv, photographic and instrument manufacturing industries. A photograph of the ruggedly constructed, portable one-knob control unit, an explanation of its above-audibility sound wave principle of operation, and complete specifications are presented.

Soft Solder Alloys. Alpha Metals, Inc., 56 Water St., Jersey City 4, N. J., has new literature available showing some of their special soft solder alloys in chart form. The bulletin also contains brief descriptions of the alloys and some of their suggested uses.

Silicon Junction Diodes. Hughes Aircraft Co., Culver City, Calif. A new 8-page booklet illustrates and describes a line of silicon junction diodes that are particularly useful in applications for which germanium devices are not suitable by virtue of temperature limitations. The silicon diodes discussed are characterized by excellent forward conductance, together with extremely high back resistance. Specifications and general product information are included.

Overpotential Testers. Beta Electric Corp., 333 E. 103rd St., New York 29, N. Y., has prepared a databook giving full information on d-c overpotential testing. It contains a detailed compilation of data on the principles involved and a bibliography of material on testing techniques. Full description of the portable and mobile series 3000 testers is included.

Electromagnet System. Varian Associates, Palo Alto 2, Calif., has published data sheets and specifications on the V-4004 completely matched 4-in. electromagnet system. The system described is ideal for studies of susceptibility, Zeeman or Hall effects; for testing magnetic materials; for lecture demonstrations; and for many other applications requiring a magnetic field.

Motor Catalog. The Peerless Electric Co., West Market St., Warren, Ohio. An 8-page catalog describing the company's line of 1/2 to 30-

hp, single-phase, polyphase and d-c motors is now available. Bulletin SDA-155 gives information on how to select the proper motor; things the manufacturer should know about the motors you require; standards and specifications to which Peerless builds; and data on fractional and integral horsepower frame sizes.

Power Supply. John Fluke Mfg. Co., Inc., 1111 W. Nickerson St., Seattle 99, Wash. A recent flyer covers the model 400 BDA 500 to 5,100-v dual polarity d-c power supply. Complete freedom from annoying jitter, bounce and corona, and inherently excellent stability make the unit described ideal for exacting requirements of photomultiplier, proportional counter and ionization chamber work. Specifications are included.

Fastener Catalog. The Palnut Co., 61 Cordier St., Irvington 11, N. J. A 16-page catalog of lock nuts and fasteners for radio, tv and electronic assembly has been published. Included are complete details of advantages, dimensions and applications of lock nuts for assembly of chassis, speakers, controls, switches, record changers, tone arms, transformers and rectifier stacks. Also included are wing lock nuts for antennas and focus coils; shield can fasteners; coil tube fasteners; tension type lock nuts for tuners; plus information on power and manual wrenches and assembly methods.

Electronic Tachometer. Sunshine Scientific Instrument, 1810 Grant Ave., Philadelphia 15, Pa. Catalog No. 19 is a 4-page bulletin covering an electronic tachometer that will measure speed over a range of 0 to 1,000 cps, or 0 to 60,000 rpm, with a sustained high accuracy of 0.2 percent. Chief features, applications, operation information, specifications and ordering directions are given.

Audio Products. Electro-Voice, Inc., Buchanan, Mich. Condensed catalog No. 123 on the company's product lines is now available. The 16-page booklet includes basic information on tv and broadcast,

VHF

... Very High Frequencies



• **RADIO INTERFERENCE**
• **and FIELD INTENSITY***
• **measuring equipment**

• **Stoddart NM-30A • 20mc to 400mc**

• **Commercial Equivalent of AN/URM-47**

PRINTED CIRCUITRY... Modern printed circuits offer many advantages over conventional wiring, lighter weight, more compact units and freedom from many of the troubles normally encountered in conventionally-wired electronic equipment. Vibration becomes even less of a problem with printed circuits, adding to the many portable features already available with Stoddart equipment.

ADVANCED DESIGN... Specialized engineering and modern production techniques have produced one of the most advanced instruments for the accurate measurement, analysis and interpretation of radiated and conducted radio-frequency signals and interference ever manufactured. Designed to laboratory standards, rugged, and with matchless performance, the versatile NM-30A is an outstanding example of modern instrumentation. Its frequency range includes FM and TV bands.

SMALLER SIZE... A wider frequency range and higher standard of performance is incorporated into an equipment whose size is one-third that of any similar equipment ever manufactured.

SENSITIVITY... Sensitivity ranges from one to ten microvolts-per-meter, depending upon frequency and antenna in use.

APPLICATIONS... Field intensity surveys, antenna radiation pattern studies, interference location and measurement for checking radiation from virtually any mechanical or electrical device capable of generating or radiating radio-frequency signals or interference.

Stoddart RI-FI* Meters cover the frequency range 14kc to 1000mc

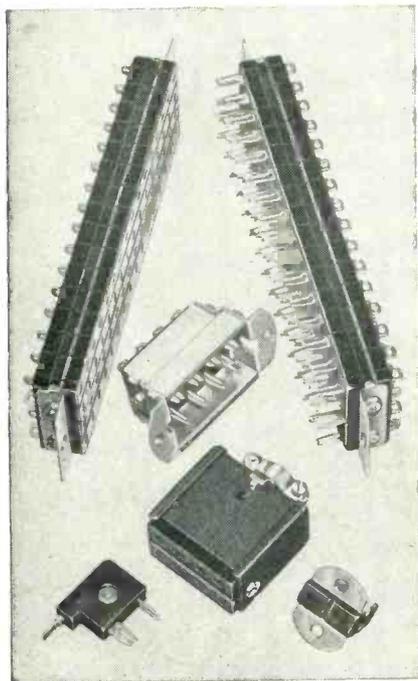
VLF
NM-10A, 14kc to 250kc
Commercial Equivalent of AN/URM-6B. Very low frequencies.

HF NM-20B, 150kc to 25mc
Commercial Equivalent of AN/PRM-1A. Self-contained batteries. A.C. supply optional. Includes standard broadcast band, radio range, WWV, and communications frequencies. Has BFO.

UHF
NM-50A, 375mc to 1000mc
Commercial Equivalent of AN/URM-17. Frequency range includes Citizens band and UHF color TV-band.

STODDART AIRCRAFT RADIO Co., Inc.
6644-A Santa Monica Blvd., Hollywood 38, California • Hollywood 4-9294

IF IT'S NEW . . . IF IT'S NEWS . . . IT'S FROM **ELCO**



MAKING CONNECTIONS FROM COAST-TO-COAST

Every day, more and more quality manufacturers are joining the imposing list of those "Variconizing" their designs. For Elco's Varicons offer an almost infinite number of combinations. Here, for example, are but three combinations; and all are possible from only four basic parts: end sections, center section and contacts. Elco has furnished from 2 to 64 contact Varicons, for commercial and military usage, in polarized or keyed combinations. The Varicon has been termed the "engineer's dream" — you design, we align! Available in general purpose phenolic, low loss mica, general purpose phenolic color, and alkyd (if quantity sufficiently large). Contact material, tested and approved in general use, is phosphor bronze, silver plated. Varicons are available in single tier and double tiers, with brackets, handles, covers, recessed housings — and now, for printed circuitry. Write, phone, wire for complete information.

ELCO CORPORATION, M STREET BELOW ERIE, PHILA. 24, PA., CU 9-5500

**this is what
a good
COLOR TV
TRANSFORMER
looks like**

● Nothing takes the place of an Acme Electric power transformer to provide the proper performance, long life and minimum of service expense in color TV as well as monochrome receivers. As cooperating pioneers in the development of transformer components for television applications, Acme Electric has accumulated valuable experience which may benefit you.



ACME ELECTRIC CORPORATION
319 WATER STREET CUBA, N. Y.

West Coast Engineering Laboratories: 1375 W. Jefferson Blvd. • Los Angeles, Calif.
In Canada: ACME ELECTRIC CORP. LTD. • 50 Northline Rd. • Toronto, Ontario

Acme ACME Electric
TRANSFORMERS

public-address, recording, communications and special-purpose microphones and accessories. It also gives information on E-V Circotron amplifiers, and explains the CDP compound diffraction, p-a loudspeaker systems.

Voltage-Regulated Power Supplies. Kepco Laboratories, 131-38 Sanford Ave., Flushing 55, N. Y. Twenty voltage-regulated power supplies for research and industrial use are illustrated and described in a 2-color 6-page folder. Voltage, current, regulation and ripple for each are listed in tabular fashion. A price sheet is also available.

VTVM's. Hewlett-Packard Co., 3327A Page Mill Road, Palo Alto, Calif., has available a 4-page catalog folder on its vacuum-tube voltmeters. Included are illustrated descriptions and specifications for the models 400AB (10 cps to 600 kc), 400D (10 cps to 4 mc) and 410B (20 cps to 700 mc).

Terminal Bulletin. Hermetic Seal Products Co., 29-37 South Sixth St., Newark 4, N. J., has available a 4-page brochure on Vac-Tite compression, single terminal feed-throughs and standoffs. The parts illustrated are of Vac-Tite (glass-to-metal chemically bonded compression) construction. Complete technical data and drawings are included.

Toggle Switches. Network Mfg. Corp., 213 W. Fifth St., Bayonne, N. J., has available a specification sheet on the series 1600 UL approved toggle switches of a single-hole flush mounting design. It provides illustrations, complete ordering data, mechanical and electrical information.

Electronic Flow Meters. The Hays Corp., Michigan City, Ind. Publication 55-1074-222 is a 12-page bulletin discussing several mercury-less transmitters offered with the company's electronic flow meters. The instruments described are designed for measurement of differential pressures; liquid level; fluid, gas, air or steam flow; temperatures and pressures. They fea-

ture 6-counter continuous integration, 12-in. uniformly graduated charts and choice of several style indicators. A combination of flows or flow and level can be recorded on the same chart.

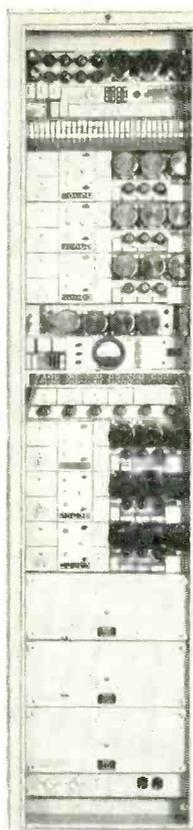
Radio Communications Equipment. Raytheon Mfg. Co., 100 River St., Waltham 54, Mass. Product data sheet PD 3-255 describes the cue-link model ACL-3, a frequency-modulated radio communications system designed to provide a means of maintaining permanent or mobile two-way communications between transmitter and receiver microwave sites. The literature carries data on design features and operation of the equipment as well as a description and specifications of this highly portable communications system.

Engineering and Research Booklet. Stromberg-Carlson Co., 100 Carlson Road, Rochester 3, N. Y., has available a booklet that outlines pictorially and in copy the company's activities and accomplishments in the fields of electronics and communications. The company's six engineering departments and three service laboratories are described and a detailed summary of what has been done and what can be done is included.

Recording Microphotometer. Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44, Pa. Data sheet No. 10.16-20 contains data on operation, construction, and accuracy, and general information on the new Wihtol recording microphotometer.

Radiation Instruments. Technical Measurement Corp., 140 State St., New Haven 11, Conn., has published a 20-page catalog illustrating and describing numerous new laboratory instruments. Included are such instruments as liquid phosphor counters, scalers, linear amplifiers, rate meters, ultrastable power supplies, scintillation detectors and crystals.

Toroidal Inductors. Torocoil Co., 1374 Mobile Court, St. Louis 10, Mo., has released a brochure con-



TYPE F2 CARRIER-TELEGRAPH SYSTEM

Provides up to 40 teletype circuits on a telephone channel.

This compact, economical, high-grade, long-haul, main-line voice-frequency carrier-telegraph system is available in two channel spacings. The type F2A system, employing 120-cycle spacing between channels, provides up to 40 channels in the band of 300 to 4980 cycles. The type F2B system, employing 170-cycle spacing, provides up to 28 channels in the band of 255 to 4835 cycles. Up to 15 channels with oscillators, relay test and metering facilities, jacks and bay terminals will mount on a single 8-ft. bay. A channel-terminal panel containing send and receive circuits for one channel requires only 5 1/4" and four channel oscillators only 1 3/4" of space on a 19" rack. A highly-developed level-compensation circuit provides practically undistorted signal reception over a wide variation of line net loss. Standard loop options are half- and full-duplex, battery normal and reversed.

New and exclusive techniques in the design and manufacture of filters and oscillator networks provide a higher degree of frequency stability than has previously been possible, with resultant reduction in signal distortion. This equipment is in current production, and early deliveries can be made of complete systems or of single panels.

Typical 6-channel packaged terminal of type F2 equipment. This is the type AN/FCC-12 (Channels 1-6) or AN/FCC-13 (Channels 7-12) Telegraph Terminal, as manufactured for the U.S. Army Signal Corps. It is complete with regulated-tube rectifiers for plate and bias supply, and positive and negative telegraph loop-current supplies, jack field, relay test panel, monitor circuits, fuses, spares, etc. The equipment is moisture- and fungus-proofed, and meets military standards where applicable. Up to four cabinets may be used together, to provide a completely self-contained 24-channel terminal.

RADIO ENGINEERING PRODUCTS

1080 UNIVERSITY STREET, MONTREAL 3, CANADA

Telephone: UNiversity 6-6887

Cable Address: Radenpro, Montreal

MANUFACTURERS OF CARRIER-TELEGRAPH, CARRIER-TELEPHONE AND BROAD-BAND RADIO SYSTEMS

for service and lab. work

Heathkit PRINTED CIRCUIT OSCILLOSCOPE KIT FOR COLOR TV!

① Check the outstanding engineering design of this modern printed circuit Scope. Designed for color TV work, ideal for critical Laboratory applications. Frequency response essentially flat from 5 cycles to 5 Mc down only 1 1/2 db at 3.58 Mc (TV color burst sync frequency). Down only 5 db at 5 Mc. New sweep generator 20-500,000 cycles, 5 times the range usually offered. Will sync wave form display up to 5 Mc and better. Printed circuit boards stabilize performance specifications and cut assembly time in half. Formerly available only in costly Lab type Scope. Features horizontal trace expansion for observation of pulse detail — retrace blanking amplifier — voltage regulated power supply — 3 step frequency compensated vertical input — low capacity nylon bushings on panel terminals — plus a host of other fine features. Combines peak performance and fine engineering features with low kit cost!



MODEL
O-10
\$69.50
Shpg. Wt.
27 lbs.

Heathkit TV SWEEP GENERATOR KIT ELECTRONIC SWEEP SYSTEM

② A new Heathkit sweep generator covering all frequencies encountered in TV service work (color or monochrome). FM frequencies too! 4 Mc — 220 Mc on fundamentals, harmonics up to 880 Mc. Smoothly controllable all-electronic sweep system. Nothing mechanical to vibrate or wear out. Crystal controlled 4.5 Mc fixed marker and separate variable marker 19-60 Mc on fundamentals and 57-180 Mc on calibrated harmonics. Plug-in crystal included. Blanking and phasing controls — automatic constant amplitude output circuit — efficient attenuation — maximum RF output well over .1 volt — vastly improved linearity. Easily your best buy in sweep generators.



MODEL
TS-4
\$49.50
Shpg. Wt.
16 lbs.

Heath
COMPANY
A SUBSIDIARY OF DAYSTROM, INC.
BENTON HARBOR 14, MICH.

WRITE FOR FREE CATALOG
...COMPLETE INFORMATION

THE
**Number One
Name**

In Socket Screws & Keys

ALLEN



Don't take it for granted that any hex socket screw is an Allen. Your Allen Distributor *alone* can offer you

- ALLENPOINT SET SCREWS** with the new smaller point — proved by impartial laboratory tests to have greater locking power and vibration resistance, plus uniformly high shaft holding power, compared with conventional cup point screws and those with serrated or angled points.
- LEADER POINT CAP SCREWS**, for substantially reduced chance of thread injury or damage to threaded holes.
- ALLENOY STEEL** — with the strength and temper to permit the use of smaller sizes, and make button head and flat head screws practical despite necessarily shallower sockets.
- ALLEN PROGRESSIVE PRESSUR-FORMING**, producing contoured uncut fiber flow, from head to point. A process originated and perfected by Allen.

Be sure to get Allens in the black and silver striped box, sold only through leading Industrial Distributors. Write us for technical information.



taining complete information for the use of the design engineer in selecting the particular high Q toroid most suitable to any desired application. Such necessary information as Q versus frequency, self-resonant frequency, current carrying characteristics and physical dimensions are included together with complete pricing information.

Capacitors and Company Facilities. Micamold Electronics Mfg. Corp., 1087 Flushing Ave., Brooklyn, N. Y. Plant facilities, typical capacitor products and a brief summary of the company's history of serving the industry are contained in a 12-page illustrated brochure. A number of capacitors, used for a variety of applications, are presented by means of photographs and text, as are the company's production facilities, shielded laboratories and test equipment. Biographies of key personnel are also included.

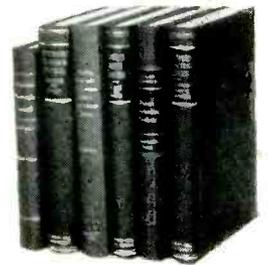
Clip Catalog. Mueller Electric Co., 1582 E. 31st St., Cleveland 14, Ohio, has issued a new, revised catalog on a line of electrical and electronic clips and insulators. The illustrated catalog No. 180 covers all late revisions, including the many new miniaturized and special insulated clips.

Experimental Transistor. Radio Receptor Co., Inc., 251 W. 19th St., New York 11, N. Y. Bulletin G-50A covers the RR125 transistor, which has been especially designed to meet the demand for a transistor that can be used by the professional or amateur experimenter who desires to familiarize himself with various circuits utilizing these devices. The bulletin contains specifications and a diagram for an experimental crystal receiver, with one stage of transistor audio amplification.

Transformers. Chicago Standard Transformer Corp., Addison and Elston Avenues, Chicago 18, Ill. A new 24-page catalog is a completely revised and expanded reference book, listing 543 transformers and related components. It contains illustrations as well as

Basic facts, data, and information you need for more effective **CONTROL WORK**

- 6 volumes assembled for your convenience
- 2413 fact-filled pages
- 1377 illustrations to clarify each point



WRITTEN by experts, this Library offers you a thoroughgoing foundation in control engineering — facts, data, and engineering know-how to make your work easier, faster, and soundly engineered. You have every help in designing, analyzing, using, and working with control equipment of all types.

The Library covers vital areas of control engineering—gives you practical facts and necessary theory on a host of subjects, together with reference information, drawings, and material in graphic and tabular form.

CONTROL ENGINEERS'

LIBRARY

Your Key to the coming era of **AUTOMATION**

Don't wait for this field to outgrow the background you already have in engineering. Use this Library now to prepare yourself for transition to control engineering — or to turn your foothold in the field into a springboard to success.

Look to this practical Library for vital data on control circuits . . . essential information on automatic feedback control systems . . . and the mathematical theory of servos.

In addition, you find outlined the mathematical and physical mechanisms developed for use in automatic computation, important facts and d-c analog computers, and help on observing analogous systems.

INCLUDES THESE VOLUMES: • *Cockrell's Industrial Electronic Control* • *Ahrendt and Taplin's Automatic Feedback Control* • *Thaler and Brown's Servomechanism Analysis* • *Engineering Research Associates' High-speed Computing Devices* • *Korn and Korn's Electronic Analog Computers* • *Soroka's Analog Methods in Computation and Simulation*

Save \$7.75

Special Library Price saves you \$7.75 over price of books bought separately.

10 DAYS' FREE TRIAL EASY TERMS

McGraw-Hill, Att: H. W. Behrow
Industrial & Business Book Dept.
327 W. 41st St., N. Y. 36, N. Y.

Send me the 6-volume CONTROL ENGINEERS' LIBRARY for 10 days' examination on approval. In 10 days, I will remit \$1.75, then \$5.00 monthly thereafter until \$34.75 is paid, or return books postpaid.

PRINT

Name

Address

City Zone..... State.....

Company

Position

For price and terms outside U. S. write McGraw-Hill Int'l., N. Y. C. 36

L-9-55

detailed electrical and physical specifications for each unit. The catalog has a comprehensive classified index and separate headings for each type of transformer to enable the user to quickly locate the transformers needed.

Power Motor-Gear-Train. John Oster Mfg. Co., 1 Main St., Racine, Wisc. A new catalog sheet illustrating and completely describing the company's power motor-gear-train is now available. Technical data include dimensional drawings, performance features and a table giving motor length, gear train length and related data.

Hydrogen Thyatron Tubes. Kuthe Laboratories, Inc., 730 South 13th St., Newark 3, N. J. An illustrated data sheet covers some of the company's hydrogen thyatron tubes. Included is the No. 6587, a miniaturized, ruggedized hydrogen thyatron (with hydrogen reservoir) capable of replacing the 5C-22, HT-415 and KU-25, and providing a higher rating, more rugged performance and longer life. Specifications are given.

Servomechanism Booklet. Norden-Ketay Corp., 555 Broadway, New York 12, N. Y. Bulletin 362 is a 16-page manual giving specifications and characteristics of over 130 synchros, servo motors, resolvers, and tools and adapters.

Quick-Disconnect Connectors. The Deutsch Co., 7000 Avalon Blvd., Los Angeles, Calif. Bulletin PD-1 discusses electrical quick-disconnect connectors which can be used where equipment requires frequent removal, repair or replacement, installation in cramped or inaccessible quarters, fast action such as on gun firing systems, or for frequently connected or disconnected test equipment. The bulletin also contains information on how the quick-disconnect works, and a description of the insulation material, pin and socket contacts. Specification information includes a brief description of various shells and dimensions on through wall mounting and box mounting receptacles, straight and 90-degree elbow plugs. There is also a listing of AN inserts which are available



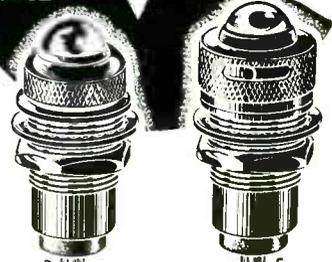
Sub-Miniature PILOT LIGHTS



A. [5]
PLASTIC PLATE LIGHT ASSEMBLIES



C. [5]
LIGHT SHIELD ASSEMBLY



D. [5] **E. [5]**
SUB-MINIATURE INDICATOR LIGHTS

A great aid to miniaturization
Require a single 15/32" hole

All lens colors
All units applicable to Mil Specifications

when you're CRAMPED for SPACE

(All illustrations are approx. actual size.)

Foremost Manufacturer of Pilot Lights

DIALIGHT

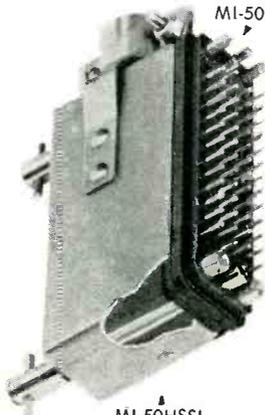
CORPORATION

60 STEWART AVE. • BROOKLYN 37, N. Y.
HYACINTH 7-7600

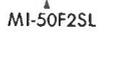
MI-50M2



MI-50HSSL



MI-50F2SL



MI-SL series (Miniature Screw Lock) available with 7, 8-4, 14, 18, 20, 21, 26, 34, 41, 50 and 75 contacts.

Typical cat. No.
MI-50HSSL-Side cable entrance hood
MI-50HRSL-Rear cable entrance hood
MI-50M2-Plug used with hood
MI-50F2SL-Receptacle used on chassis
MI-50F2-Receptacle used with hood
MI-50M2SL-PJug used on chassis

*Preserves performance of sensitively adjusted contacts with simple disassembly of hood
*Insured electrical and mechanical performance
*No limitations on number of contacts
*Vibrashock hood construction
*Screw Lock Hood Assembly independent of connector.

*Accessibility to wire junctions
*Insured electrical and mechanical performance
*Vibrashock hood construction
*Screw Lock Hood Assembly independent of connector.

Double-Lead Screw Locking also available with 980-SL and 990-SL series (Power Connectors)



U. S. COMPONENTS, Inc.

Associated with U. S. Tool and Mfg. Co., Inc.

454-462 East 148th Street, New York 55, N. Y. CYpress 2-6525-6

in the various quick-disconnect shells.

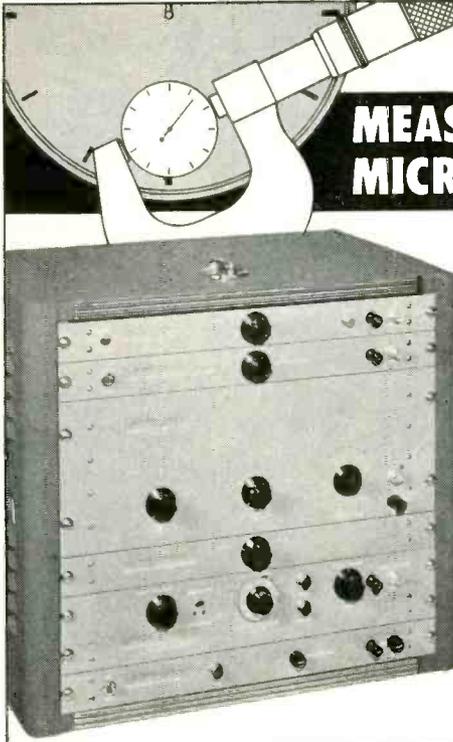
VHF Notch Diplexer. Prodelin, Inc., 307 Bergen Ave., Kearny, N. J. Bulletin 429 is a 2-page catalog sheet illustrating and describing the type DNTV-25 vhf notch diplexer which is necessary when diplexing visual and aural tv transmitters into a Prodelin tri-loop tv broadcasting antenna. Electrical and mechanical specifications and installation information are included.

Potentiometer. DeJUR-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y. Bulletin K-200-455 is a 2-page, illustrated color bulletin covering features, technical data and outline drawing of new high resolution potentiometers designed for low torque, high function angle applications.

Winder and Wire Insulating Equipment. Geo. Stevens Mfg. Co., Inc., Pulaski Road at Peterson, Chicago 30, Ill., has available a new catalog sheet. One side illustrates and describes model 418-AM automatic variable pitch space winder, including technical data on types of windings, maximum o-d of coil, maximum coil length, winding speed and similar information. The other side of the sheet illustrates model WS-1 wire insulating equipment and gives complete information on function, production capacity and wire sizes handled, description of unit, level-wind device, double insulation, motor equipment and multistrand Litz covered wire.

Rotary Stepping Switch. Automatic Electric Sales Corp., 1033 W. Van Buren St., Chicago 7, Ill. Bulletin RH No. 6 describes how one type of rotary stepping switch is being used in a new, improved electronic computing machine. The circular explains the part played by the switch in recording data, solving mathematical problems and delivering answers in printed form.

Chopper Data. James Vibrapowr Co., 4050 N. Rockwell St., Chicago 18, Ill., has released technical data on its 1200 series of choppers. The series described is a dpdt design incorporating a new operating mechanism. A group of standard



MEASURE TIME WITH MICROMETER ACCURACY

MODEL B-4 TIME MEASURING SYSTEM

Direct reading for simple, fast, accurate operation

Measures time intervals to an accuracy of ± 2 millimicroseconds

Provides marker signals of .1 μ s and 1 μ s spacing on synchroscope

Incremental control calibrated to ± 1 millimicrosecond

Complete self-contained integrated system

WE ALSO MAKE PRECISION WIDE-RANGE PULSE and TIME DELAY GENERATORS—DATA SHEETS AVAILABLE

Write for complete data: our Bulletin E-B-4

Rutherford ELECTRONICS CO. 3707 S. ROBERTSON BLVD. CULVER CITY, CALIFORNIA

REL RADIO ENGINEERING LABORATORIES, INC.

prove MAGNATRAN dependability



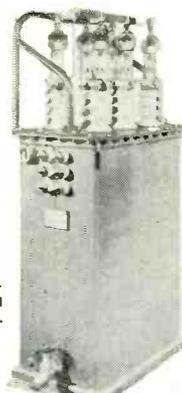
(Type L3-01) Askarel immersed Filter Reactor.



(Type J3-01) Askarel immersed high impedance Filament Transformer.



(Type N3-01) Unitized Rectifier askarel immersed for Klystron Bombarding.



(Type N3-02) Unitized Rectifier askarel immersed Beam Supply.

"Magnatran components have contributed considerably to the fact that REL now makes more beyond-the-horizon FM multiplex relay equipment than all other manufacturers combined. They have been proven in use to be very dependable, both in performance and maintenance."

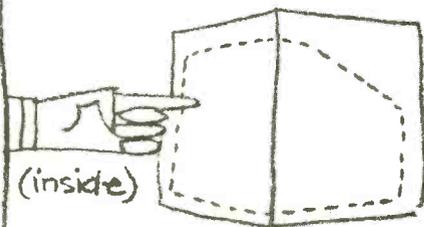
Join the ranks and enjoy reliable Magnatran magnetic components for the electronics industry.

Write for Catalog

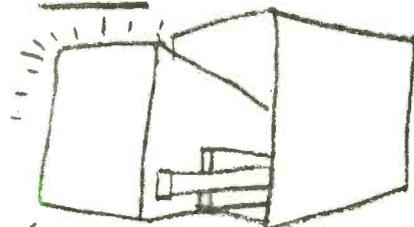
MAGNATRAN incorporated

KEARNY, NEW JERSEY, U. S. A.

Units normally
covered



are accessible
fast



When mounted
on slides



Will an industrial
slide solve your
problem?

If Sliding's
the answer,
see Grant

We have a folder that will give you an idea of the scope of Grant Industrial Slides which we'd like to send you. Write to Grant Pulley and Hardware Corporation, 31-77 White-stone Parkway, Flushing, N.Y.

models are available in assemblies for 40 to 120-cps operation. They are of the low residual noise type with top connected driving coils. Various models are offered with different contact closures. The l-f choppers described are excellent for instrumentation, computers and other precision applications. They also feature resistance to temperature, shock and vibration extremes. The second group of h-f choppers discussed will operate from 50 to 550 cps.

Transformers. Moran Electronic Components, Inc., 10502 Wheatley St., Kensington, Md., has available literature on its standard line of transformers (audio, filament and power), reactors and similar components. An expanded line of power transformers is discussed in 8 pages of new literature consisting of drawings and specifications.

Turret Punch Press. Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia 32, Pa. Bulletin 242 describes the RA-4P turret punch press for punching holes in printed wiring boards. The machine discussed will punch holes at a rate of 80 to 120 per minute and handles boards up to $\frac{1}{8}$ in. thick. The first board of a lot is drilled to its etched layout and used as the template to complete the run. Holes are pierced as rapidly as the operator can depress a stylus point into color coded holes in the template.

Pulse Transformers. Berkshire Laboratories, 506 Bank Village, Greenville, N. H. Types PT-1, PT-2 and PT-3 plug-in type pulse transformers are covered in a loose-leaf perforated catalog sheet. Uses, advantages, diagrammatical specifications, characteristics and prices are given. The descriptive sheet is obtainable on request.

AN Connectors. The Deutsch Co., 7000 Avalon Blvd., Los Angeles, Calif. Bulletin PN-1 covers the company's complete line of AN electrical connectors. It briefly describes the fields of application, and provides general information on performance requirements, size and capacity, basic parts and the

WHETHER FOR
INTERPLANETARY
EXPERIMENTATION

OR
SUB
SPOTTING



AINSLIE REFLECTORS
GIVE ACCURATE PERFORMANCE

Complete coordination of design, manufacture and performance gives permanent reliability to AINSLIE Reflectors. We deliver, from stock, mesh reflectors from 4' diameter to 18'; spun reflectors from 4' to 10'; larger sizes and radar reflectors made on special order to your specifications.

Designed and Manufactured for:

- RADIO-ASTRONOMY
- MICRO-WAVE RELAY
- AIRCRAFT
- MISSILES
- RADAR

Send for our NEW illustrated brochure. Quotations on request without obligation.



We will gladly work with you in the development of any unusual antenna requirements.

Ainslie
CORPORATION

312 QUINCY AVENUE, QUINCY, MASS.

CODE MARK Anything!

WITH



INDUSTRIAL MARKING INK

★ CODE MARKING INKS

For Resistors and Capacitors. For Machine or Hand Application.

Whatever the substance, Phillips has an ink to mark it permanently and legibly—or can make one. Marking experts insist on "Clear Print" Wood Block Stamp Pads and Opaque Inks. They get clear, sharp, fast-drying impressions. Also inks for brush, pen, stencil or machine application available in a variety of colors and quantity containers.

★ Quick Laboratory Service On Your Problem Markings.

★ To Permanently Mark . . . Metals, Plastics, Glass, Wood, Paper, Leather, Ceramics—glazed, varnished or lacquered surfaces and virtually every other known material.

WRITE FOR FREE BOOKLET



L. A. PHILLIPS, President

PHILLIPS PROCESS CO. INC.

192 MILL STREET
ROCHESTER 14, N. Y.

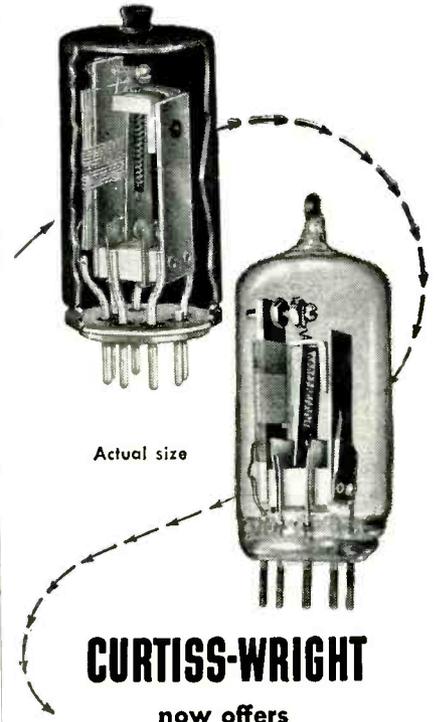
numbering system used. A detailed description is presented on the shell construction for wall mounting, cable-connecting and box mounting receptacles—straight, solid shell and 90-deg angle, split-shell plugs. Another section provides information on the inserts, which have an arc resistance of approximately 140 seconds, dielectric strength of 180 v and a post-mold shrinkage of only 0.001 in. per in. Installation instructions for the various types of shells are illustrated with assembly and disassembly drawings.

Color TV Microwave Relay. Raytheon Mfg. Co., Waltham, Mass. Bulletin 3-110 describes the KTR-100 system of color tv microwave relaying. The KTR-100 provides a one basic system for both color and monochrome transmission with built-in multiplexed audio signals and can be used as either a permanent or portable link for stl and remote pickups. It is adaptable to all bands. The literature gives data on applications, performance, specifications and accessories.

Analog Computers. Mid-Century Instrumatic Corp., 611 Broadway, New York 12, N. Y. A 16-page brochure describes the company's analog computers and allied equipment. Included are facts, specifications and photo reproductions of the MC-300 six-channel recorder; MC-400 analog computer; MC-500 d-c analog computer; MC-600 six-channel electronic function generator; and MC-700 a-m/f-m electronic multiplier. The Dian computing service is also discussed.

Delay Lines. E. S. C. Corp., 534 Bergen Blvd., Palisades Park, N. J. A new catalog now available describes the latest in delay lines, variable delay lines and pulse forming equipment.

Relays for Carrier Equipment. Lenkurt Electric Co., San Carlos, Calif. Volume 4 No. 7 of the "Demodulator" shows some types and applications of relays used in carrier equipment. Also included, for those who wish to purchase carrier or radio equipment on a completed project basis, is information on



Actual size

CURTISS-WRIGHT

now offers

THE "SNAPPER" THERMAL TIME DELAY RELAY

Relied on for positive action and long life in scores of applications involving time delay in electrical circuits, the "SNAPPER," formerly produced by Elly Electronics Corp., is now a Curtiss-Wright product.

Single pole, double throw contact action eliminates chatter. These unique relays feature snap action, double throw, reliability, small size. They are adaptable to military and commercial applications. Time delay periods: preset from 3 seconds up. Envelope: metal, miniature (7 and 9 pin) or octal (8 pin). Glass, 9 pin only.

High-Low Differential Thermostat

The "SNAPPER" Thermostat is a single pole, double throw snap action temperature sensitive switch. Its snap action principle has been extended to provide a low differential thermostat with precision characteristics, at low cost.



Write for detailed data

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

the "Engineer, Furnish and Install" service.

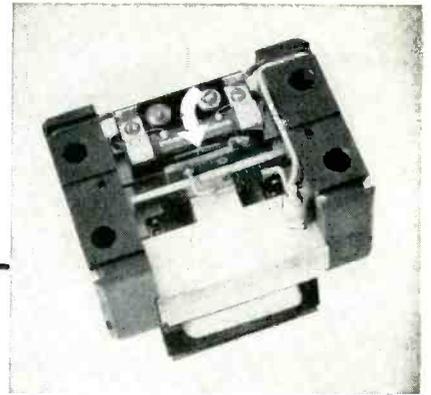
Photoelectric Press Control. Champlain Co., Inc., 88 Llewellyn Ave., Bloomfield, N. J. An electronic system that automatically controls cutoff and color register on high-speed web-fed presses and other rotary printing equipment is described and illustrated in a new 4-page bulletin. Two models of the Registron are discussed, with the principal components of each model listed. Basic units of the system described consist of a web scanner, photoelectric phase detector and automatic control panel. Eight photographs illustrate various components of the system. A block diagram, which outlines the electronic circuit for the automatic register unit, is also included.

Recording/Reproducing Heads. The Davies Laboratories Inc., 4705 Queensbury Road, Riverdale, Md. Bulletin 55-B gives complete information on multitrack magnetic recording and reproducing heads featuring adequate intertrack shielding and precise gap alignment. Designed and manufactured specifically for data recording applications, the heads described provide improved data reproduction. The heads are available for direct, f-m, or digital recording with a maximum width of 2 in.

Contact-Meter Relay. Assembly Products, Inc., Chesterland, Ohio, has available bulletin G-6 (which includes circuitry bulletin 112) on automatic contact meter-relay control with electromagnetic locking contacts. Applications for lab and industrial use are given. Specifications, ordering information and prices are included.

Magnet Wire Catalog. The Electric Auto-Lite Co., Wire and Cable Division, Port Huron, Mich. The newly revised magnet wire catalog includes all current magnet wire applications manufactured by the company; tables on diameters, tolerances, and physical and electrical properties of the various wires; inspection and testing facilities; and a new section covering thermal classifications of available insulations.

NEY'S small parts play a **BIG** part in precision instruments



The Ney Precious Metal Contact (indicated by arrow) is an important part of this Genisco Accelerometer.

Genisco Accelerometers are used in the guidance systems of missiles now in large-scale production. They are rugged, potentiometer-type instruments chosen for their reliability and precise performance.

For the double-contact wiper of the potentiometer, Genisco selected Ney's Precious Metal Alloy Paliney #7* because it provides the important advantages of holding noise at a minimum, excellent linearity, long life and satisfactory performance in temperatures from -65°F . to $+200^{\circ}\text{F}$.

Ney Precious Metal Alloys have high resistance to tarnish, are unaffected by most industrial corrosive atmospheres, and have ideal electrical characteristics. These precious metal alloys, developed by Ney especially for precision instruments, have been fabricated into slip rings, wipers, contacts, brushes, commutator segments and similar components. Call the Ney Engineering Department for the selection and design of the right Ney Precious Metal Alloy which will improve the characteristics and prolong the life of *your* precision instruments.

THE J. M. NEY CO. • 179 ELM ST., HARTFORD 1, CONN.
Specialists in Precious Metal Metallurgy Since 1812

*Registered Trade Mark

MANUFACTURERS and FABRICATORS of Printed Circuitry,

Acrylics, Ureas, Fabric and Paper Base Phenolics, Polystyrenes, P.V.C., Fibres, Butyrates and High Pressure Laminates USE and RECOMMEND . . .

Radialloy-Tipped^{*} Circular Saw Blades

CHIP-FREE CUTS • CLOSE TOLERANCES • LONG BLADE LIFE

These Super-Finished Blades operate *faster, smoother* and are available for *close tolerance* work, thus eliminating costly trial and error methods. And they *do not vibrate* on "tough sawing" materials. Why? *There's no variation in tooth construction!* They're engineered from the heat-treated shank out as carbide blades—they're *not* regular saws with carbide tips added!

RADIAL CUTTER 839 Bond Street
MANUFACTURING CORPORATION Elizabeth 4, N. J.

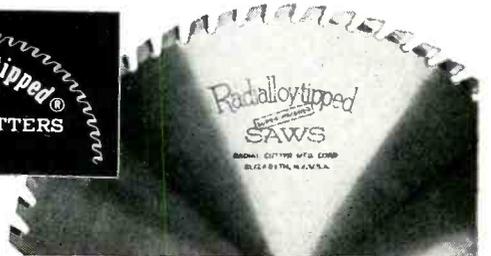
Specialists and Leading Manufacturer of Carbide-Tipped Saw Blades

HERE'S PROOF—
We'll furnish
sample cuts on
your materials to
illustrate their
superior cutting
quality.



WRITE for prices and brochure
for complete data.

*Reg. U. S. Pat. Office



Plants and People

Edited by WILLIAM G. ARNOLD

Engineers and executives in the industry are promoted and move to new responsibilities. Manufacturers continue plant and facility expansions by acquisitions and new construction. Industry associations and technical societies announce new activities

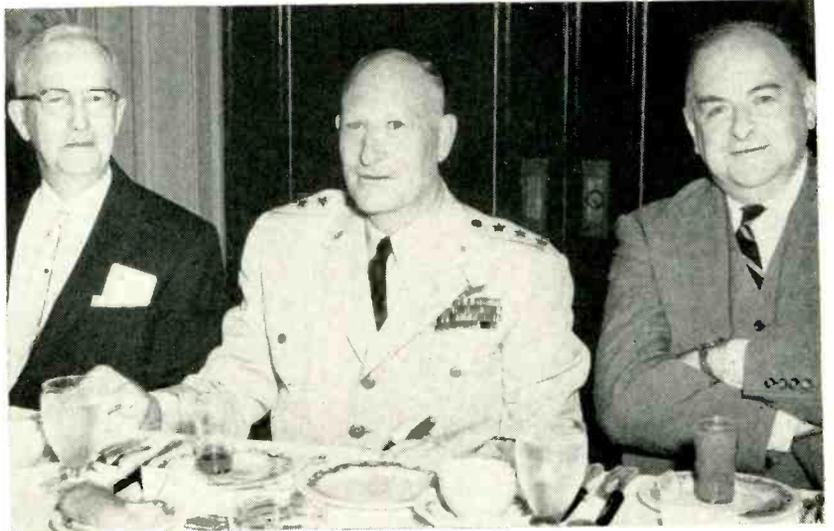
RETMA Streamlines Organization, Hears Air Force Chief

AT THE final business session of its three-day convention, RETMA amended several of its by-laws to streamline the Association to better serve the member-companies. The by-law amendments revised the dues schedule and provided for greater fiscal autonomy within the several divisions. Members authorized the establishment of a military products division.

Members also approved the consolidation of the former amplifier and sound equipment division as a section within the technical products division. The RETMA board abolished the former radio-television industry committee and the electronics industry committee and reduced its own membership from 62 to 41, including the treasurer and director of the engineering department. The board also eliminated all honorary directors and directors-at-large.

The division chairmen are as follows:

Set division—H. C. Bonfig, president of CBS-Columbia; tube division—R. T. Orth, vice-president



Lt. Gen. C. S. Irvine (center), Deputy Chief of Staff, Materiel Headquarters, U. S. Air Force, spoke on the weapon system concept of procurement at a luncheon session during the 31st annual convention of RETMA. Left is Max F. Balcom, director-consultant, of Sylvania Electric and former chairman of the RETMA Board of directors. To the right is Fred R. Lack, vice-president of Western Electric and RETMA vice-president representing the military products division

of Westinghouse electronic tube division; parts division—Herbert W. Clough, vice-president of Belden Manufacturing Co.; technical products division—James D. McLean, vice-president of Philco's industrial

division; military products division—T. A. Smith, vice-president of RCA's engineering products division.

Total RETMA membership stands at 389 companies.

Du Mont Ups Engineers, Builds West Coast Plant

A NEW technical products division has been formed by Allen B. Du Mont Laboratories.

The new division will be headed by P. S. Christaldi and will manufacture and sell the products formerly handled by the company's instrument division and communication products division. It is initiating a program of expansion and diversification with especial emphasis on elements and systems for automation of industrial processes.

Over-all administration for technical products is conducted by vice-

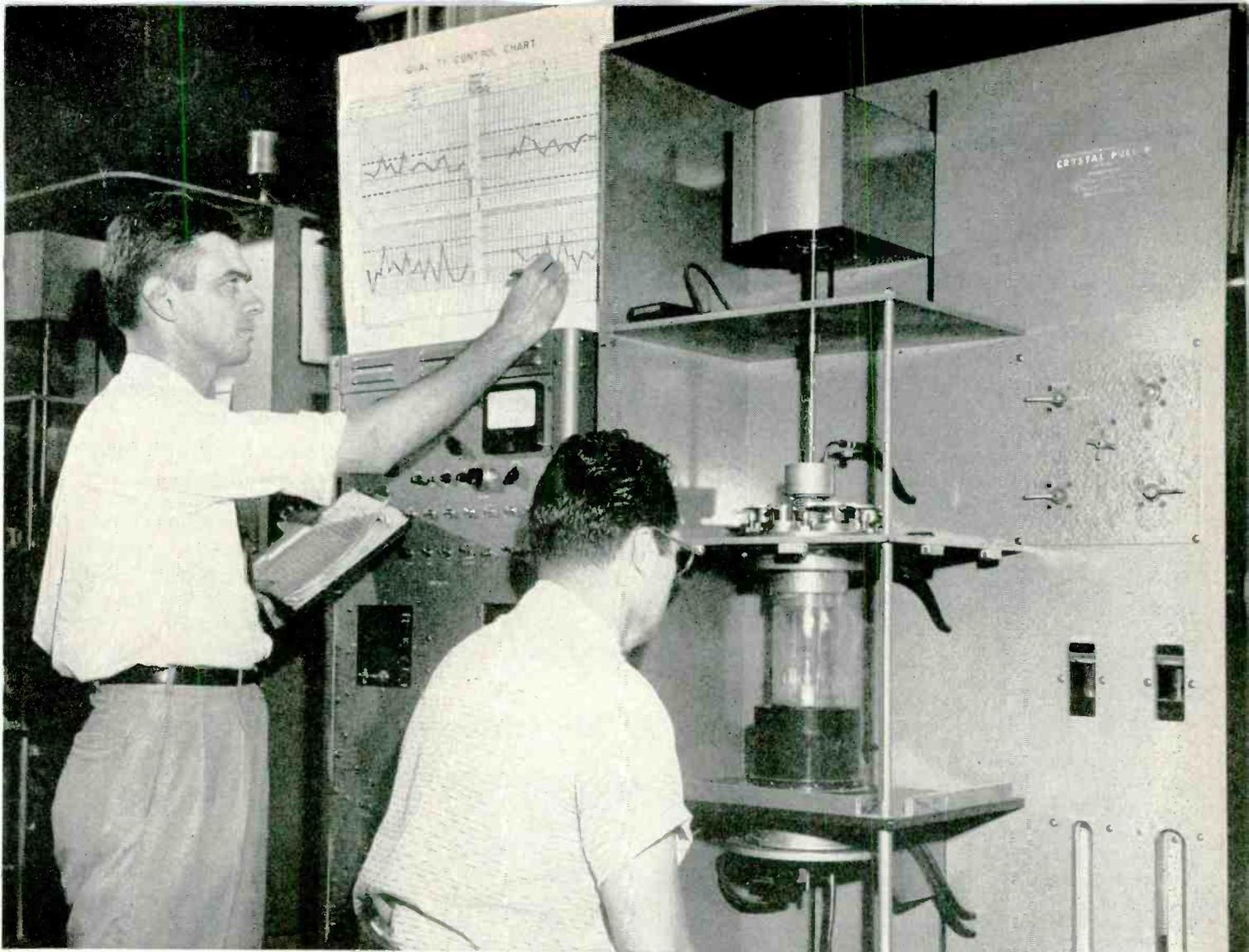
president Irving G. Rosenberg, whose responsibility encompasses both the new technical products division and the government manufacturing division.

Dr. Christaldi has been associated with Du Mont since 1938. His first duties were in the field of cathode-ray tube and cathode-ray oscillograph development, being expanded to include television receiving and transmitting operations when he was appointed chief engineer of the firm in 1941. In 1947 he became engineering manager of the

instrument division. He was made assistant manager of the division in 1952 and manager in 1953.

Robert E. Kessler has been named general manufacturing manager for the technical products division.

As general manufacturing manager he will supervise the engineering department headed by A. J. Talamini, the production control department headed by Morris Harris, purchasing headed by C. P. Martin, manufacturing which is headed by R. E. Svozil and inspection



CLOSE PARAMETER CONTROL MEANS

TI transistors standardize your production circuits!

You can now design transistorized circuits to standard device specifications. Texas Instruments *controlled parameter* semiconductor devices fit your specific applications without additional testing and selection. Parameter tolerances are closely held and accurately described in new comprehensive design data. All TI germanium and silicon transistors are manufactured and 100 per cent tested for exacting design characteristics.

This close parameter control has enabled Texas Instruments to pace the industry in transistor development and application. Newest TI germanium devices are n-p-n high speed switching transistors. An important step toward complete transistorization of computers, these grown junction units have beta spreads of two-to-one and are 100 per cent tested for switching characteristics. TI was also first to produce silicon transistors commercially, and *only* TI manufactures germanium transistors for *all* three transistorized pocket radios now on the consumer market. For radio, general purpose, and many specific applications, Texas Instruments manufactures both p-n-p alloyed junction and n-p-n grown junction germanium types.

For your own transistorized product development, specify the exact devices you need from TI's wide range of semiconductor products — germanium and silicon; p-n-p or n-p-n types; diodes, triodes, tetrodes. Write for new descriptive data and curves that will help simplify your production problems.

SEND THE COUPON FOR DETAILS

Please send comprehensive data and curves describing the semiconductor products checked below:

GERMANIUM

- Radio transistors, p-n-p and n-p-n types
- High speed switching transistors
- P-N-P alloyed junction general purpose transistors
- N-P-N grown junction general purpose transistors
- Phototransistors
- Grown junction tetrodes

SILICON

- General purpose transistors
- Power transistors
- Junction diodes
- Voltage reference diodes

Name _____

Company _____

Address _____

TEXAS INSTRUMENTS
INCORPORATED

6000 LEMMON AVENUE DALLAS 9, TEXAS



headed by D. M. Christie.

Immediately prior to this appointment, Kessler had served as manager of the communication products division. His background with the company goes back to 1936. He was the ninth full-time employee to be hired by Dr. Allen B. Du Mont.

G. Robert Mezger has been named general sales manager of the technical products division. He will supervise the television transmitter sales department headed by J. B. Tharpe, the mobile communications sales department headed by Fred M. Link and the technical sales department headed by Emil G. Nichols. Immediately prior to his new appointment, Mezger was assistant manager of the instrument division.



P. S. Christaldi

Du Mont also announced that a new building, containing approximately 30,000 sq ft of floor area is under construction in Los Angeles. It will fill the firm's need for more space and facilities to handle west coast electronics commitments and sales both for military and industrial purposes.



Robert E. Kessler

Ground has already been broken for the new building, and it is anticipated that occupancy will be possible during October of this year. Du Mont's west coast manager is Ralph B. Austrian, who will make his offices in the new building. The plant is also available for the cathode-ray tube division.

DeVore Joins Stewart-Warner As Electronics Head

LLOYD T. DEVORE, who has been manager of the electronics laboratory of GE since 1950, has been named general manager of the electronics division of Stewart-Warner Corp. The firm plans to step up its development and production of electronic products.

During World War II, Dr. DeVore was chief engineer of the special projects laboratory for the Army Air Forces at Wright Field, and was awarded the War Department Exceptional Civilian Service Medal in recognition of his achieve-



Lloyd T. DeVore

ments at the lab.

He was assistant professor of physics at Pennsylvania State College and professor of electrical engineering at the University of Illinois, where he also was chairman of the research committee and coordinator of research for the electrical engineering department of the university.

Stewart-Warner also announced that an agreement has been signed for the purchase of John W. Hobbs Corp., producer of specialty devices and equipment.

Hodgson Promoted By Fairchild Camera And Instrument



Richard Hodgson

RICHARD HODGSON has been elected a vice-president of Fairchild Camera and Instrument Corp. He has been promoted from the position of trend planning director to that of general manager of the company's reconnaissance systems division.

Hodgson was one of the organizers of Chromatic Television Laboratories, developers of Lawrence color television picture tubes. He was president of the firm until he joined Fairchild, and continues to serve on the board of directors.

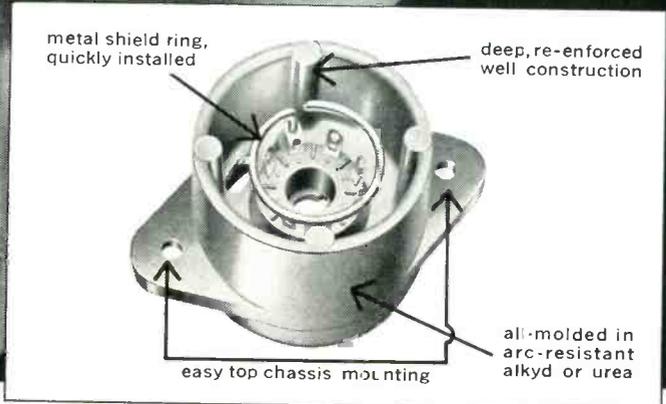
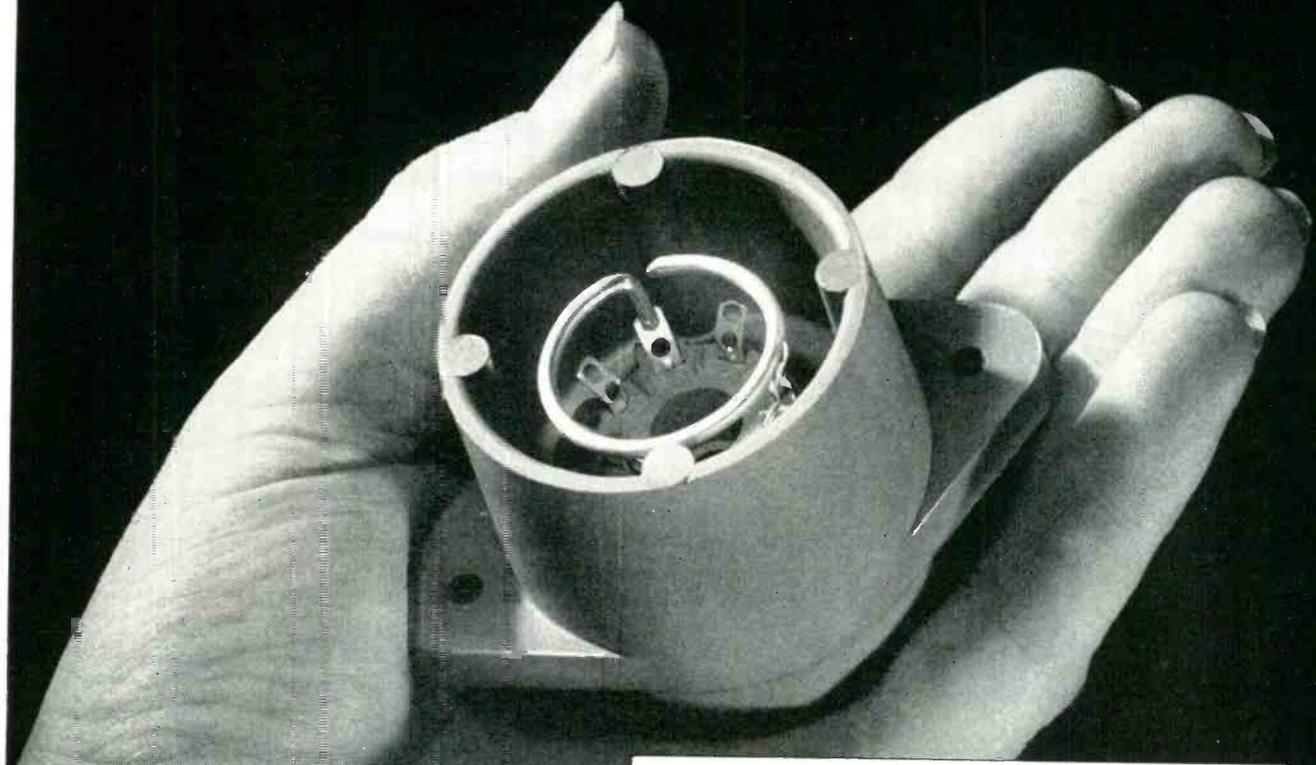
He has been director of television development for Paramount Pictures, assistant treasurer of DuMont Laboratories, head of the en-

gineering management division of Brookhaven National Laboratory, senior change board engineer for Lockheed Aircraft and a manufacturing and process economic analyst for Standard Oil of California.

Olympic Radio and Victoreen To Merge

PLANS have been made for the merger of Victoreen Instrument and Olympic Radio into a new corporation, Nuclear Electronics. David H. Cogan, chairman of Victoreen, is to be president of the new firm with C. W. Haller and Morris Sobin,

Designers and Production Engineers agree—



Sylvania's
H-V ANTI-CORONA
OCTAL SOCKET
—pays for itself
in performance

AS A DESIGNER, you'll find Sylvania's all-molded H-V anti-corona socket increases the efficiency of high-voltage circuit design—your product gives better, longer, trouble-free performance in the field.

Production engineers will say it cuts down production snags and expensive after-assembly "tailoring" to eliminate corona problems.

Whatever the nature of your electronic equipment, if high voltage circuits tend to exhibit corona problems, this is the socket for you. It's doing the job where other anti-corona measures prove inadequate.

Despite its extremely high efficiency you'll be surprised by the relatively low cost of Sylvania's H-V anti-corona socket. Write for data, address Dept. J-20S.



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

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

DC-AC CHOPPERS

0-500 cycles
DEPENDABLE



All military specifications met. Liberal factors of safety to meet emergency conditions.

1. Production sampled daily and life tested to check 1,000 hour rating.
2. Every Chopper given not only one but two tests over the full range of military temperatures before shipment.
3. Only gold contacts used for superior operation in the vital 0-1½ volt d-c range.
4. Liberal safety factors to meet emergency conditions.
 - a. 0-500 cps.
 - b. Input voltage $\pm 30\%$.

WRITE FOR THESE
CATALOGS:
No. 371, 0-500 CPS.
No. 370, 6C CPS.

STEVENS ARNOLD INCORPORATED

22 ELKINS STREET
SOUTH BOSTON 27, MASS.

SA-A-11

Want more information? Use post card on last page.

presidents of Victoreen and Olympic respectively, as vice-presidents of Nuclear.

Last year Victoreen reported sales

of \$1.5 million and a net loss of \$1.9 million. Olympic had 1954 net sales of \$18.3 million and net income of \$256,836.

General Instrument Merger Set

GENERAL Instrument Corp. has acquired Automatic Manufacturing Corp. of Newark, N. J., and elected an enlarged 11-man board of directors, which immediately moved to combine the executive forces of the two companies. Martin H. Benedek, president of Automatic Manufacturing, becomes chairman of the board of General Instrument and chief executive officer. Moses Shapiro, executive vice-president of Automatic, has been named to the

same position at General Instrument, a newly-created post for that company.

Monte Cohen, president of General Instrument was reelected to his post by the new board. Alois Konecny, Jr. and Louis Scadron continue as treasurer and secretary, respectively, and C. F. Sullivan and L. S. Grossman as assistant secretaries. Abraham Blumenkrantz was elected chairman of the finance committee.

Division Becomes Barnes Engineering

BARNES Engineering Co. is the new name of Olympic Development Co. of Stamford, Conn. Although formerly established as the development division of Olympic Radio & Television Co., it is now an independent engineering and manufacturing company, with R. Bowling Barnes as president.

The company is engaged in the development and production of infrared components and instrumentation for remote temperature measurement and control.

It also manufactures automatic assembly machines, through Multra Corp., a wholly-owned subsidiary and owns Clarksburg Television Cable Corp. which operates a community antenna system.

Charles J. Burton will continue to serve as vice-president and treasurer of the company.

The directors of the company, in addition to Dr. Barnes and Dr. Burton, are: Heywood Fox, general partner of Fox, Wells and Co., a private investment firm; James G. Rogers, Jr., an associate of Fox,



R. Bowling Barnes

Wells and president of KFSD of San Diego, Calif., and Glen McDaniel, general counsel of RETMA.

Other members of the executive and technical management group of Barnes Engineering are Eric M. Wormser, chief engineer of the infrared division; Donald M. Frothingham, chief engineer of the Binotrol division; Frank K. Lake, chief engineer of Multra Corp. and W. Randolph Tucker, president of Clarksburg Television Cable Corp.

Assembly Products Builds Desert Plant

NEAR Palm Springs, Calif. on 120 acres of the desert, a manufacturing plant for Assembly Products is being built. Instruments for measurement and control in industry will be assembled in small buildings of 1,500 to 5,000 sq ft, each designed and built for the type of work to be done in it. Residential lots of one to

three acres will be made available to employees who want to build homes on the desert. Construction has been started on a factory building, two residences and a swimming pool. These are scheduled for completion by September 1st. The first factory building of 1,500 sq ft will be used for an office and de-

velopment laboratory.

Several months of design and experimental testing will proceed any actual production in the desert plant. Bill Hotine, a relay and electronic engineer, has been employed to manage this research and development. For several years he has done product design on instruments and controls—most recently with Fairchild Camera Co. He holds several patents on contacts and assemblies for relays.

Westinghouse Names Computer Head

V. B. BAKER has been appointed to the newly created position of assistant engineering manager, executive department, East Pittsburgh divisions of Westinghouse. He was formerly with the firm's engineering headquarters staff.

He will have primary responsibility for developing and coordinating engineering applications of electronic computers in the East Pittsburgh divisions. He will report directly to the engineering manager. He joined Westinghouse in 1939.

Schultz Heads Nuclear Group

M. A. SCHULTZ of Westinghouse Electric has been elected chairman for the coming year of the administrative committee of the IRE professional group on nuclear science.

Minnesota Mining Promotes Two

ROBERT A. VON BEHREN has been promoted to research and development manager of the magnetic products division of Minnesota Mining & Manufacturing Co. Andrew H. Persoon has been named chief chemist of the division's laboratory.

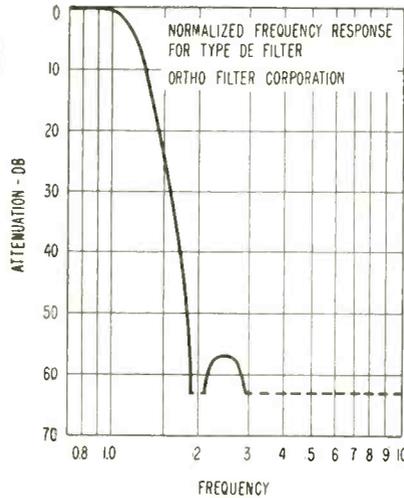
Since 1953 von Behren has been assistant technical director of magnetic products. He joined 3M in 1948 as a quality control engineer and was made technical service supervisor in 1951.

Persoon has been a section leader in the magnetic products laboratory since 1953. He joined 3M in 1943 as a chemist in the tape laboratory. He was made products engineer of



DISTORTION ELIMINATOR

For Eliminating Harmonics of a Signal



The Ortho Filter Type D.E. Filter provides a means for eliminating harmonics from a complex wave. Standard filters are readily available for use with any fundamental frequency from 20 cps to 2000 cps. The filters are available for use over a wide range of impedances. Specify the nominal impedance when ordering.



For further information write for the following bulletins:

Amplifiers ...OF 445	Embedded	Assemblies...X54	FiltersOC 127	Noise Suppressors ...OF 199
CircuitsOL 175	Embedded	Components...X55	NetworksMJ 487	Frequency Standards .LK 100
Delay Lines ..LJ 126	Embedded		Power SuppliesLC 788	Wave TrapsMN 135
			RectifiersJB 480	

Ortho Filter Corporation

196 Albion Avenue

MU lberry 4-5858

Paterson 2, N. J.

A New low voltage POWER SUPPLY



MODEL KM 88

0-28 Volts D.C.

20 Amperes

1% Ripple

\$195

Features

- An automatic ammeter cutout circuit for dynamotor and inverter starting.
- Delay type overload protection.
- Permanently etched control designations.
- Over-current warning indicator.
- Stepless output control.
- Compact, portable design.
- Zero maintenance.

ADDITIONAL SPECIFICATIONS:

OVERLOAD: 400% for 1/2 minute, 200% for 2 minutes.

REGULATION: D.C.V. at Full Load: 28.5. D.C.V. at 1/10 Load: 33.

CONTROLS: Power switch, voltage control, pilot light, overload warning light.

TERMINALS: Panel binding posts plus rear terminal board.

INPUT: 115 V.A.C., 60 cycles, single phase.

Write for Bulletin No. 100



ELECTRIC COMPANY

69-2 Murray Street • New York 7, N. Y.
Telephone: BEkman 3-7548

DRESS UP YOUR PRODUCT WITH JOHNSON Pilot Lights

1" and 1/2" ENCLOSED ASSEMBLIES



1" and 1/2" HORIZONTAL OPEN TYPES



3/8", 1/2", and 3/4" VERTICAL OPEN TYPES



In addition to the types illustrated above, many other models for both neon and incandescent lamps are available. For quick, easy pilot light selection, write for your free copy of the new Johnson Pilot Light Catalog No. 750.

Quick, easy selection...

Whether you're designing a new product or restyling an old "standard", Johnson pilot lights will add to its saleability and utility. In addition, it's easy to choose the "right" pilot light from the streamlined Johnson line. Classified according to "preferred" types, Johnson's new pilot light listings let you profit from research among leading design and development engineers... help you choose the pilot light you want, quickly... easily. Careful standardization, with an eye to replacement as well as interchangeability, makes Johnson pilot lights the first choice of many appliance manufacturers.



E. F. JOHNSON COMPANY

2320 SECOND AVE. S.W. • WASECA, MINN.

theoretical analysis
product development
test analysis
limited manufacture

These are the specialized services of

PARAMETERS

an able, experienced organization with notable achievements in these fields.

Our staff and well equipped facilities may well be the answer to some of your problems.

Proprietary rights protected.

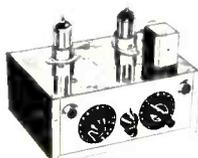
WRITE OR CALL:
Service Engineer

PARAMETERS, INC.

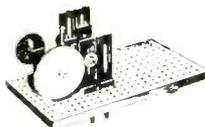
195 Herricks Road • Garden City Park, L. I., New York
Pioneer 6-0155



hydraulics



electronics



mechanical devices

the magnetic products laboratory in 1948.

Beckman Instruments Buys Liston-Becker

BECKMAN Instruments purchased the Liston-Becker Instrument Co. of Springdale, Conn., manufacturer of infrared gas analyzers and electronic amplifiers.

Last year Beckman acquired the Specialized Instrument Co. of Belmont, Calif., manufacturer of ultracentrifuges used in successful isolation of polio virus.

Max D. Liston, founder of the company, will continue as manager of Liston-Becker operation. No change in personnel or plant location is contemplated.

Phillips Control Names President



JOHN W. AYERS has been named president of Phillips Control Corp. of Joliet, Ill., a wholly-owned subsidiary of Thor Corp.

Ayers, who has been vice-president in charge of engineering for Phillips for the past 3 years, replaces John Mossman, resigned.

Gregory J. Oehmen, formerly assistant to the president of Phillips, was appointed to the post of general manager.

Budd Selects Fibre Division Heads

MEMBERS of the board of Continental-Diamond Fibre division of the Budd Co. include E. G. Budd,

ELECTRO DC POWER SUPPLIES

with less than

1%

RIPPLE

SPEED RESEARCH

in guided missiles . . . electronic equipment, radios, for aircraft, autos, tanks, marine craft . . . laboratory work of many kinds . . . operating low voltage devices.



NEW Model "EF" dual range **\$84.50**
0-28 v up to 5 amps, 0-14 v up to 5 amps

Only dual range unit with all these features at this low price on the market. Certified proof of less than 1% AC hum at maximum load furnished with each unit. High quality construction and components. Intermittent loads up to 10 amperes. Single-knob control —easy continuous voltage adjustment as load changes. Special conduction cooling gives 25% extra current capacity. Write for Bulletin EFCS.



Model "NF" heavy duty **\$195.00**
0-28 v up to 15 amps

Widely recognized and accepted in industry as the heavy duty unit of unmatched construction and performance for this low price. Intermittent loads up to 25 amperes. Certified proof of less than 1% ripple at top load. Single control gives continuous voltage adjustments. Patented EPL conduction cooling for long life, 25% more power. Write for Bulletin NF252.

NEW Model "GF" heavy duty
0-125 v up to 10 amps

Capable of servicing most DC equipment from AC lines. 20 amperes intermittent rating . . . less than 1% ripple at top load certified. Bridge-type rectifier, plus forced air cooling. Voltage control over entire range. Write for Bulletin GF.



Send Today For Complete Information

ELECTRO PRODUCTS LABORATORIES

4501-E North Ravenswood Ave., Chicago 40, Ill.
Canada: Atlas Radio Ltd., Toronto

Want more information? Use post card on last page.

ELECTRONICS — September, 1955

PLANTS AND PEOPLE

(continued)

who will also be president of the subsidiary; H. A. Coward and E. R. Schmidt, executive vice-presidents; Harry K. Collins, vice-president; G. E. Lallou, secretary and treasurer and E. E. Reardon, controller.

As vice-president and general manager, Collins will be the chief administrative officer of the new company. He will be assisted by J. Franklin Anderson and Ernest O. Hausmann, vice presidents. W. H. Walker will be purchasing manager; A. H. Haroldson, research and development manager; H. M. Dexter, general sales manager; J. Paul Jacquette, assistant secretary and assistant treasurer; Worth Tracy, employee relations manager; Martin J. Gauger, assistant controller and L. K. Winter, export sales manager.

Russell Sylk and Marvin C. Cain will continue as plant managers of the Newark and Valparaiso plants. George Kennedy will continue as acting plant manager of the Bridgeport plant.

Ampex Promotes Instrumentation Head

ROBERT SACKMAN, manager of the instrumentation division of Ampex Corp., has been elected an officer of the company.

Prior to assuming his new duties, Sackman was manager of Ampex's Washington, D. C., district office. He joined Ampex in 1953, after serving as the chief of a government research and development group with the Department of Defense. Previously, he was a civilian engineer for radar beacon and ground control approach development with the U. S. Navy. While with the Navy, he also established a laboratory for test and calibration of low frequency quartz crystals.

GE Expands Tube Facilities

A 112,000 sq ft plant costing \$1.2 million, needed primarily for expansion of the receiving tube warehousing and engineering development facilities, is planned by GE at Owensboro, Ky. Sections of present production facilities at Owensboro will be moved to the new plant to

advanced
technique



AVIONICS

sweep signal
generator

7 to 70 mc



multi-purpose generator for
wide band amplifier testing

Continuously tunable CW, sweep or pulsed RF output.

0.25% frequency accuracy and stability.

Continuously tunable spike or blanking marker derived from the CW oscillator. Range 4.9 to 85 mc.

Frequency deviation adjustable up to $\pm 30\%$ or 15 mc.

Independent use of 101 db attenuator.

High output — 0.5 volt across 50 ohm load.

Pulse output identical to modulating source

Internal 5 mc crystal frequency standard.



Avion's flexibility and ingenuity, coupled with extensive experience in Electronics, Mechanics and Optics can better serve you.

Investigate the career opportunities in our expanding organization.

AVION

INSTRUMENT CORP.

SUBSIDIARY OF Q C F INDUSTRIES, INC.

299 Highway No. 17, Paramus, N.J.

Want more information? Use post card on last page.

FIRST MK 4 MOD 0 EQUIVALENT SIZE 11 PRECISION INDUCTION RESOLVER!

Available Immediately!



SIZE 11—Mark 4 Mod 0 Electrical Equivalent, Winding Compensated

Frame Size: 1.062"

Functional Error less than 0.1%

Perpendicularity: less than ± 5 minutes



SIZE 15—Mark 4 Mod 0 Equivalent with accuracies and phase shift better than specified!

SIZE 23—Exceptionally high functional accuracy—better than .05%. Perpendicularity better than ± 3 minutes.

ALSO AVAILABLE—All American Electronic SIZE 11, 15 and 23 Resolvers may be obtained with: HIGH IMPEDANCE NETWORK COMPENSATION, PARTIAL OR COMPLETE WINDING COMPENSATION, BROAD BAND, HIGH FREQUENCY RESPONSE.

Complete line of SERVO MOTORS, GEARED SERVO MOTORS, MOTOR TACHOMETERS, BRUSHLESS INDUCTION POTENTIOMETERS, MINIATURE SYNCHRONOUS MOTORS; low and high temperature models.

American Electronic Mfg., Inc.

INSTRUMENT DIVISION OF



9503 W. JEFFERSON BLVD., CULVER CITY, CALIF.

Engineering Representatives in all Principal Industrial Areas

permit 50,000 sq ft of leased warehousing space to be relinquished.

Ground breaking is scheduled for August and occupancy is planned for shortly after the first of 1956.

Stromberg-Carlson Appoints Wilson



DONALD GREY WILSON, chairman and professor of the department of electrical engineering, University of Kansas, has been appointed assistant director of research at Stromberg-Carlson Co. In this new position, Dr. Wilson will be responsible for coordinating organization functions and activities, development of personnel, guidance in budgetary control, and the coordination of the public relations activities of the re-research organization at Stromberg-Carlson.

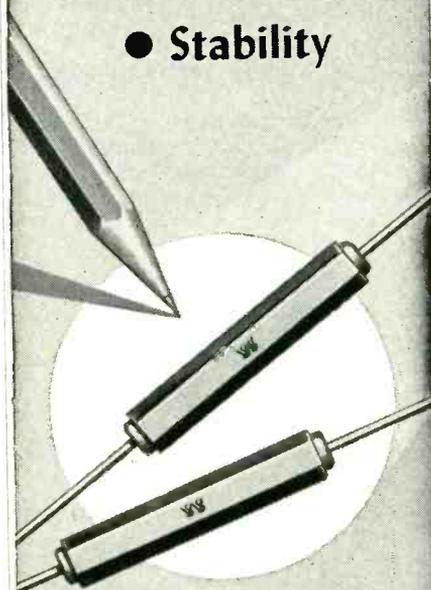
Prior to joining the department of electrical engineering at the University of Kansas in 1947, where he served as assistant professor, professor, and department chairman, he had broad experience in business and research at the Sealand Corp. automatic fire alarm division; instructor in electrical engineering at Rensselaer Polytechnic Institute and staff member at the MIT radiation laboratory.

Chicago Standard Changes Officers

WILLIAM J. SHEA, who has been chairman of the board and chief executive officer of Chicago Standard Transformer will assume the office of president due to ill health of president Larry S. Racine.

In Racine's absence, Donald Schwennesen, vice-president in

- Low noise level
- Precision
- Stability



SilWhite 65X
MOLDED RESISTORS

RATING—1 watt.

TEMPERATURE COEFFICIENT—From approx. $+0.1\%/^{\circ}\text{F}$ for 5000 ohm values to approx. $-0.2\%/^{\circ}\text{F}$ for 10 megohm values.

VOLTAGE COEFFICIENT—Rated at less than $0.02\%/ \text{Volt}$.

UPPER TEMP. LIMIT— 170°F for continuous operation.

NOISE LEVEL—Low noise level inherent, but at extra cost we can test and guarantee standard range resistors with "less noise than corresponds to a resistance change of 1 part in 1,000,000 for the complete audio frequency range."

VALUES

Standard Range—1000 ohms to 9 megohms.

Extra High Value Range—Up to 10,000,000 megohms.

BULLETIN 5409

has full details. Send for a copy. Attention Dept. R.



THE *SilWhite* INDUSTRIAL DIVISION
DENTAL MFG. CO.



10 EAST 40th ST.
NEW YORK 16, N. Y.

Western District Office • Times Building, Long Beach, Calif.

Want more information? Use post card on last page.

Want more information? Use post card on last page.

charge of engineering, will be vice-president in charge of sales and engineering.

Ray Gislason has been appointed vice-president in charge of all manufacturing plants of the company.

Bonfig Named CBS-Columbia President



HENRY C. BONFIG is president of CBS-Columbia, succeeding Seymour Mintz, resigned.

He is also a vice-president and director of CBS, the parent firm.

In 1935 he was named commercial vice-president of RCA Victor, a position he held until 1944.

In 1944 he was appointed vice-president and director of sales for Zenith Radio Corp.

He remained with Zenith until May, 1955 when he accepted the presidency of CBS-Columbia.

Burroughs Takes On More Space

BURROUGHS CORP. has acquired a one-story building in Detroit for production of classified electronic equipment. The building contains 104,000 sq ft of floor space and is located on a 23 acre site. The new operation is expected to employ nearly 1,000 persons.

New Computer Center Established

A NEW analogue computing center has been established by Dian Laboratories in New York, N. Y.

Dian is affiliated with the Mid-Century Instrumatic Corp. The computing services are available to government and industry on a rental basis. The firm is also en-

THE NEW WAY TO MARK EQUIPMENT....

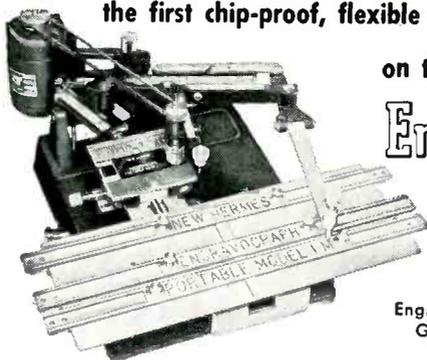
with

GRAVOflex

the first chip-proof, flexible engraving stock

on the versatile

Engravograph



Send for booklets:
Engravograph Booklet 1M-29
Gravoflex Booklet G-29

So simple to engrave Gravoflex. Lettering stands out permanently on contrasting background. No paint needed. 10,000 Engravographs used for engraving on metals and plastics. Only Engravograph has these patented features:

- Adjustable for 15 ratios.
- Self-centering holding vise.
- Automatic depth regulator.
- Adjustable copy holders.

NEW HERMES ENGRAVING MACHINE CORP.
13-19 UNIVERSITY PLACE, NEW YORK 3, N. Y.

shear it



bend it



form it



punch it

THE LARGEST STOCK ON THE EAST COAST

SCREWS BOLTS—NUTS

WASHERS RIVETS
FASTENING DEVICES

For Every
IMPORTANT
FASTENING

IN ALL METALS

- STEEL • BRASS
- EVERDUR • MONEL
- STAINLESS STEEL
- ALUMINUM
- NICKEL ALLOY STEEL
- NAVAL BRONZE



**SPECIALS
MANUFACTURED
TO BLUEPRINT
SPECIFICATIONS**



AUTHORIZED DISTRIBUTORS

**PARKER-KALON
PRODUCTS**

**SHAKEPROOF
PRODUCTS**

CATALOG ON REQUEST

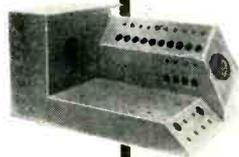
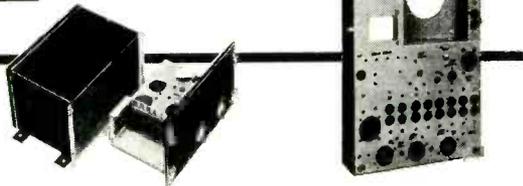
IMMEDIATE DELIVERY

KEYSTONE BOLT & NUT CORP.

ESTABLISHED 1922

131 Church St. N. Y. 7 Manufacturing Division Bristol, Conn. Teletype N. Y. 1-882

why you should use **BALTIC** custom built enclosures . . .



Your product in a BALTIC custom built housing has a luxury look. Individually designed to meet your specifications . . . and you can be assured of perfect fit and skilled craftsmanship.

All our products are interchangeable to assure speedy assembly on your production line. Each unit we turn out is accurately engineered to close tolerances and finished to perfection, reflecting our long years as specialists in solving sheet metal fabrication problems. Our large stock of standard and Whistler die combinations eliminates unnecessary tool charges and sends your unit cost way down.

Whether you need simple chassis or enclosures for the most complicated equipment, BALTIC will custom build it . . . in any metal, any size, any gauge, any finish, in large or small quantities. Complete facilities for finishing and shipping all under one roof.

BALTIC METAL PRODUCTS CO.

126 SUTTON ST. BROOKLYN 22, N. Y. • EVergreen 4-2300

gaged in the design of simulators, trainers and special-purpose computers.

Its staff is headed by Dr. Stanley Fifer, former head of the Navy Project Cyclone and member of the technical staff of Hughes Aircraft Co.

Gulton Appoints Two Engineers

SAMUEL HANISH has been appointed head of the underwater sound division of Gulton Mfg. Corp. of Metuchen, N. J.

George M. Hieber has been placed in charge of the development of electromechanical instruments for the firm. He previously handled field and development engineering.

Hanish joined the organization last year as a research engineer in its shock and vibration department, coming from Power Generators of Trenton, N. J., where he specialized in dynamic analysis in mechanical systems. He will be engaged in the evaluation and development of new transducer materials for underwater sound techniques, development of transducers for commercial underwater sound applications, and design of complete sonar systems and industrial control equipment.

Heiber, prior to joining the company, was a stress and instrumentation specialist with Grumman Aircraft.

Waddell Joins Giannini Division

BILL L. WADDELL has joined Datex division of G. M. Giannini & Co. as senior systems development engineer, charged with design and development of digital data handling systems. He formerly was with Northrop Aircraft and Librascope in computational analysis and systems development.

Canoga Expands Plant Facilities

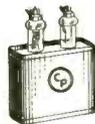
CANOGA CORP., manufacturers of radar systems, antennas and other devices, has acquired a 10,000 sq ft building, adjacent to the antenna range of its present facilities in Van Nuys, Calif. Overall invest-

PERFORMANCE AS RATED!



GLASSMIKE PLASTIC FILM CAPACITORS

"Pyrex" glass encased, plastic film dielectric, temperatures to 125°C. Insulation resistance to 10,000 meg x mfd. Types for DC and RF applications.



PLASTICON PLASTIC FILM DC CAPACITORS

Voltage ranges from 600V DC to 100KV DC or higher. Temperature characteristics to suit.

PULSE FORMING NETWORKS

Synthetic dielectrics for higher volt per mil loading and lower losses in capacitor dielectric. Stable performance at high temperatures. Ranges to 60KV. Designed to meet your requirements.

Original designers and manufacturers of Synthetic Dielectric Capacitors. We use plastic film dielectrics exclusively in our products. Where Size, Stability and Quality are essential, you can depend on Condenser Products.



HI-VOLT POWER SUPPLIES

Available from stock: 2KV, 5KV, 10KV, 15KV, 30KV, 50KV. Oil-filled construction for smaller, lighter, more flexible units. Separate accessible compartment for rectifier tubes in 50KV model. Also available in the 5KV, 10KV, 15KV, and 30KV power supplies.

ALL-PLASTIC MOLDED CAPACITORS

Mylar* Molded Capacitors pioneered by CP. Exceeds Jan C 91 electrical specifications. *DuPont trade name for Polyester Film.

May we help solve your problems? Write, on company letterhead, stating your position.

Condenser Products Company

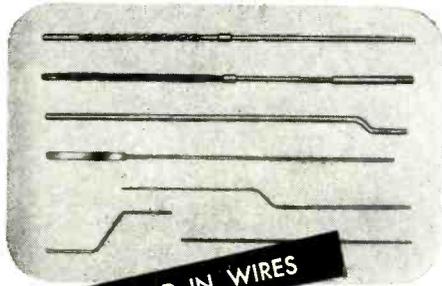
Div. of New Haven Clock & Watch Co.
140 HAMILTON ST., NEW HAVEN, CONN.

Specify



PRECISION QUALITY Components

OF TUNGSTEN,
MOLY, NICKEL CLAD WIRE,
ALLOYS, KOVAR



• DKE LEAD IN WIRES

Quality controlled throughout production with Tungsten hard glass leads produced under General Electric Timing Control. Each tungsten lead is microscopically inspected for flaws. DKE offers highest quality and LOW PRICES. Send drawings for quotations and let us prove the economy of our prices.



• DKE TUBE BASES

The Engineering Company can give you immediate delivery on following bases: 50 Watt, 3303B, 412 Industrial Base, Giant 7 Pin Bayonet, 4310 Four Pin Jumbo, Tetrode, Hydrogen Thyatron Bases in both Aluminum and Copper up to 6.50 dia, etc. All bases to JAN-1A/MIL-E-1B and subjected to weights and strength tests.

DKE HYDROGEN THYATRON TUBE BASES



CALL OR WRITE FOR QUOTATIONS
ON YOUR SPECIFIC REQUIREMENTS

THE **engineering** CO.
27 WRIGHT ST., NEWARK 5, N.J.

Want more information? Use post card on last page.
ELECTRONICS — September, 1955

ment for the land, building and equipment was around \$200,000.

The new addition, expected to increase production by 50 percent, will house the expanded electronic, microwave, and mechanical engineering departments.

The company anticipates the addition of another building of similar size in about a year.

Bogue Electric Elevates Gerlach

KEN R. GERLACH has been appointed executive vice-president of Bogue Electric Manufacturing Co., of Paterson, N. J. He was with the Sperry Gyroscope Co. with experience in the application of precision motor-generator equipment.

Prior to joining Sperry, Gerlach was associated with the Colonial Radio Co.

Mid-Century Names Chief Engineer

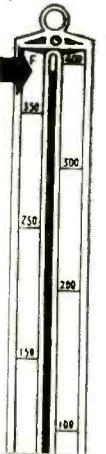


NELSON A. Merritt has been appointed chief engineer of the Mid-Century Instrumental Corp. of New York City.

The firm manufactures electronic precision analogue computers and computing equipment. Merritt will supervise the design of new products and will be in charge of engineering in connection with the manufacturing of all products.

He previously was head electronics engineer of the Electric Boat division of General Dynamics Corp. He was responsible for the

A new
standard
of insulation
performance



Resinite[®] VINYL GLASS

ELECTRICAL INSULATION
SLEEVING

A superior vinyl impregnated Fiberglas[®] insulation, Resinite Vinyl Glass sleeving offers dependable performance under extreme conditions.

- For operation from -50° to 395° F (20 hours)
- Maintains flexibility and dielectric strength after 1000 hrs at 300° F
- Withstands creasing, pounding, twisting and bending without loss of dielectric strength
- Excellent chemical and oil resistance
- Won't craze or crack
- Grades B-A-1, B-B-1 and B-C-1
- Sizes #24 to $\frac{3}{8}$ "
- Eleven colors
- Priced comparable to ordinary cotton or rayon base insulations

[®]Res. TM — Owens-Corning Fiberglas Corp.

Ask your Resinite representative or write for samples and performance data.

Resinite

RESIN INDUSTRIES, INC.

315 Olive St. • Box 1589 • Santa Barbara, Calif.

VINYL SLEEVING AND TUBING FOR THE AIRCRAFT,
ELECTRONICS AND PHARMACEUTICAL FIELDS

Want more information? Use post card on last page.

AMERICAN TELEVISION &
RADIO CO. ST. PAUL, MINN.

introduces the
new

ATR TV

*Full Door Console
Receiving Sets*

UNSURPASSED
IN BEAUTY

UNEQUALLED
IN PERFORMANCE

UNMATCHED IN
QUALITY
CONSTRUCTION

exclusive
profitable
dealer
franchises
now available

*designed
with the
Serviceman
in mind
... easy to
get at*



WRITE TODAY FOR COLORFUL
BROCHURE SHOWING THE
NEW LINE OF ATR TV SETS

ALSO MANUFACTURERS OF DC-AC INVERTERS,
"A" BATTERY ELIMINATORS, AUTO RADIO VIBRATORS

ATR AMERICAN TELEVISION & RADIO CO.
Quality Products Since 1931
SAINT PAUL 1, MINNESOTA-U.S.A.

Want more information? Use post card on last page.

nuclear reaction control systems on
the USS Nautilus, first atomic sub-
marine.

Edison Elects Vice-Presidents

DONALD W. COLLIER and Charles
Howe Goddard have been elected
vice-presidents of Thomas A.
Edison.

Dr. Collier will continue in his
present capacity as director of re-
search, a post he has held since
June, 1951.

Goddard will continue his activi-
ties as assistant manager of Edi-
son's Voicewriter Division. He
joined Edison in May of this year.
He was formerly with Sylvania
Electric Products for 11 years serv-
ing as marketing manager of the
lighting division.

Viking Instruments Selects Martin



VIKING Instruments of East Had-
dam, Conn. appointed Devereaux
Martin as vice-president and di-
rector of engineering. He will direct
development and research on the
company's line of electronic de-
vices and controls for industry.

He was formerly assistant to the
president of Electronics Corpora-
tion of America.

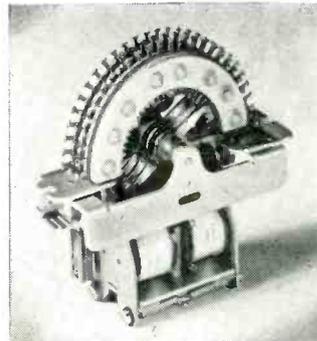
Brubaker Appoints Quality Manager

CHARLES R. WILSON, JR. has been
promoted to the position of man-
ager, quality control, at Brubaker
Electronics, of Los Angeles.

Wilson has, for the past four

TWO-WAY STEPPING SELECTOR

For Computing, Control, and
Indicator Systems



The flexibility of forward and reverse
stepping at the operator's choice, or by
automatic cycling, is now obtainable in a
compact unit—the G.E.C. two-way step-
ping selector. Each of these units can
replace several conventional one-way
stepping relays, thus adding efficiency
and versatility to circuit design.

The G.E.C. two-way stepping selector
operates in either direction at a speed of
approximately 65 steps per second on self-
interruption, and at speeds up to 20 steps
per second from external impulses. Positive
stepping action and freedom from over-
stepping are assured by driving the wiper
assembly on the forward stroke of the ap-
propriate armature.

The unit is designed for use with
standard 25-contact banks, up to three
levels. All selectors can be supplied
with bridging or non-bridging wipers, or
any desired combination of both. The
armature coils can be supplied for opera-
tion at 12, 24, 50, 110 or 220 volts d-c.
Bank contacts, wipers, and wiper brushes
are of nickel silver for maximum life.
The interrupter springs, designed for
easy adjustment, are fitted with platinum
contacts. The finish of the units makes
them suitable for either standard or
tropical use.

One-way stepping selectors with standard
25-point banks up to 8 levels, or 50-point
banks up to 5 levels, in either standard or
heavy-duty construction, are also available.

For bulletin and prices write: General
Electric Company, Limited, c/o IMTRA
CORPORATION (U. S. Agents), 58
Charles St., Cambridge, Massachusetts,
U. S. A.

Want more information? Use post card on last page.

September, 1955 — ELECTRONICS

years, served as plant superintendent for the firm. In his new position, he will report directly to the head of the manufacturing division.

Teletronics Names Assistant Chief Engineer

TELETRONICS Laboratory appointed Henry Schwiebert as assistant chief engineer of the company. He was formerly the assistant chief engineer of Wheeler Laboratories and prior to that held the position of project engineer with Hazeltine Electronics Corp.

Gruen Watch Fills Three Positions

GERALD C. Schutz was named as director of electronics of Gruen Watch and Adrian Jacobs and Erwin Kaestner as administrative staff assistant and technical staff assistant, respectively, to Arthur Hansen, executive vice-president.



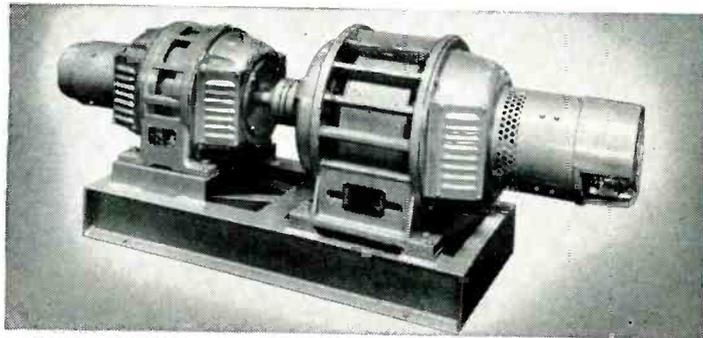
Gerald C. Schutz

Schutz was formerly associated with the Gibbs Manufacturing as director of electronics. During his five years with the firm, he was responsible for the initiation of a number of development programs in the airborne radar navigation and countermeasures field.

Jacobs was formerly production manager of Roller Smith Corp., manufacturers of electrical and electronic integrating and measuring instruments. From 1945 to 1954, he was with Bulova Watch as director of planning and sub-contracts.

Kaestner was formerly manager of manufacturing of the Roller

400 cycle High Frequency Power Supplies



This typical 400 cycle High Frequency Generator is available from 1 KVA to 100 KVA. Variable frequency power supplies can be designed with outputs as low as 3 cycles and as high as 2000 cycles.

Hertner also manufactures high frequency motor generators that can be either synchronous motor-drive, induction motor-drive, or direct current motor-drive.

Consult Hertner for your unusual power supply requirements.



THE HERTNER ELECTRIC COMPANY
12690 ELMWOOD AVE. • CLEVELAND 11, OHIO

MOTORS • MOTOR GENERATORS • GENERATOR SETS

A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION



BE Sure with CORNISH Electronic WIRES and CABLES

MICROPHONE CABLES

Designed for low capacitance, high insulation resistance, low attenuation—in plastic or rubber insulation to stand severe service

T-V LEAD-IN CABLES

Furnished only in pure virgin polyethylene to insure best electrical properties and long life under severe operating conditions

T-V LEAD-IN CABLES

Made hollow, of pure virgin polyethylene, for maximum efficiency in receiving Ultra High Frequency signals

INTERCOMMUNICATION CABLES

These quality cables are made in various constructions, utilizing plastic insulation for both conductors and jacket

SHIELDED INTERCOMMUNICATION

When installation conditions dictate, shielded cables are recommended. Made with internal or external shield—2 and 3 conductors

"MADE BY ENGINEERS FOR ENGINEERS"

CORNISH WIRE COMPANY, INC.
50 Church Street New York 7, N. Y.

**ELIMINATE REJECTS!
MINIMIZE BREAKAGE!**

use *Bird* jewel assemblies

Why chance rejects and breakage that add to production costs when you can eliminate these time-wasting "headaches" with Bird complete jewel assemblies — ready to install in your equipment. Bird's many years of precision production mean jewel bearings of the highest quality. These jewels are set according to your specifications by skilled craftsmen, in less time, for less money, and eliminate special set-ups in your plant.

Why not bring us your jewel problems — you specify — Bird will supply assemblies that fit your product and schedule. Our engineering staff is at your service for all your jewel bearing problems.

For information on jewel assemblies write for Bulletin 15.
Over 40 years of serving industry with Quality jewel bearings

Richard H. Bird & Co., Inc.
Sapphire and glass jewels • Precision glass grinding • Ferrite precision products • Sapphire stylus
1 Spruce Street, Waltham 54, Mass.

Smith Corporation. Prior to his joining Roller Smith he was chief projects engineer for Bulova Watch on all ordnance projects.

Hermetic Appoints Chief Sales Engineer

HERMETIC SEAL Products Co. of Newark, N. J. appointed A. Neumann as chief sales engineer. He will supervise customer relations, design development and all engineering activities.

Before joining Hermetic, Neumann was associated with IT&T as a process engineer.

Previously, he was development engineer for the Kincaid Manufacturing Co. of New York City.

Mica Fabricators Elect Officers

S. A. MONTAGUE, proprietor of Spruce Pine Mica Co., N. C., was reelected president of Mica Fabricators Association for a second term of one year. Peter J. Yannello of Reliance Mica Co., Brooklyn, N. Y. and John V. Faraci of American Mica Insulation Co., Manassquan, N. J., were elected vice-presidents for the coming year.

Hornickel Selected As Calmag Vice-President

H. C. HORNICKEL has been appointed vice-president and chief engineer of California Magnetic Control Corp., North Hollywood manufacturer of electronic components.

Fischer & Porter Names Four Vice-Presidents

FISCHER & PORTER CO., manufacturers of complete process instrumentation, has promoted four managers to vice-presidents in charge of their respective divisions, bringing the number of vice-presidents to six.

Those named are: Robert A. Stern, vice-president of the data reduction & automation division; Louis H. Aricson, vice-president of the international division; Nathaniel Brewer, vice-president of research; and Edward J. Querner,

New low-cost
DIGITAL VOLTMETER

SADIC DIGITAL VOLTMETER (TYPE 33-110) is CEC's newest unit for low-voltage analog-to-digital conversion. It offers true economy plus high accuracy. Output includes illuminated numerical display (above) and decimal-coded contact closures. Suitable for bench use or rack mounting (two units fit side by side in 19" rack) the 33-110 is useful for both laboratory indication and as a building block for automatic data-processing systems.

SPECIFICATIONS

- ... digital range 000 to 999 (1000 steps)
- ... accuracy 1/10th % of full scale
- ... sensitivity 10 millivolts provides full-scale output
- ... balance time 0.8 second, max.
- ... power source 105-115 volts a-c

Send for Bulletin CEC 3009-X3

Consolidated Engineering Corporation

300 North Sierra Madre Villa, Pasadena 15, California

Sales and Service Offices Located in: Albuquerque, Atlanta, Boston, Buffalo, Chicago, Dallas, Detroit, New York, Pasadena, Philadelphia, San Francisco, Seattle, Washington, D. C.

vice-president of manufacturing. The other vice-presidents are Seymour Blechman, vice-president of sales, and Jack C. Boonschaft, vice-president of engineering.

Packard-Bell Fills Manufacturing Post

THEODORE G. EDDY has been named manufacturing manager of the technical products division of Packard-Bell Co. of Los Angeles. The division is chiefly engaged in research and production in electronics and color television.

Before coming to Packard-Bell, Eddy spent five years as an associate with Robert Heller & Assoc., a Cleveland engineering firm, and three years as a field engineer for Albert Ramond Assoc. of Chicago.

Three Firms Join RTCA

THREE NEW members have been elected by the Radio Technical Commission for Aeronautics, increasing the RTCA Assembly membership to 120 organizations concerned with aeronautical telecommunication.

The new members are Flight Safety of Flushing, N. Y.; F-R Machine Works of Woodside, N. Y. and Western Union Telegraph Co. of New York City.

North American Promotes Moore and Ashby

JOHN R. MOORE and Dr. Robert M. Ashby have been appointed to the positions of director and assistant director, respectively, of North American's Aviation's electro-mechanical engineering department.

Moore, who has been assistant director of the department since 1953, joined the company in 1948 as a group leader in the aerophysics laboratory. Prior to that he had been with GE and has served as an associate professor of mechanics and director of the dynamical control laboratory at Washington University.

Dr. Ashby, who replaces Moore as assistant director, came to North American in 1949 from the Naval Research Laboratory Field Station in Boston where he was associate director. During World War II he



Giannini LOW PRESSURE TRANSMITTERS

Giannini low pressure transmitters utilize a precision potentiometer element to translate pressure signals into proportional electrical signals (20-50 volts), requiring little or no amplification.



MODEL 45176

Models are available with single or multiple outputs, and can be linear with airspeed, altitude, pressure, or to natural or empirical functions.

Ranges from ± 0.5 psi., diff. to 0-150 psi., (abs., diff., gage), under normal environmental conditions, or extreme conditions of high acceleration, severe shock or vibration. Write for complete engineering information.



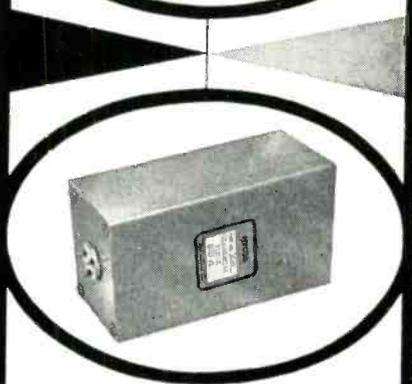
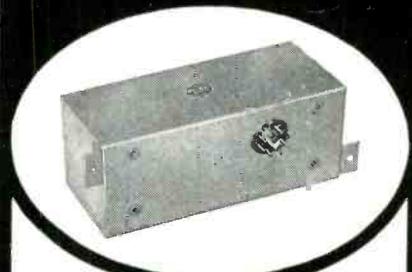
MODEL 45177

G. M. GIANNINI & CO., INC.
AIRBORNE INSTRUMENT DIVISION
PASADENA 1, CALIFORNIA

Giannini

Want more information? Use post card on last page.
ELECTRONICS — September, 1955

HYCOR TELEMETERING FILTERS



Features...

- HYCOR telemetering filters have excellent characteristics due to the use of high "Q" toroid inductor elements. The filters may be used in low level circuits with negligible hum pickup resulting.
- In addition, only the finest capacitors are employed to assure stability.
- Available in standard RDB frequencies.

GENERAL SPECIFICATIONS Impedance 500/500

TYPE	BANDWIDTH	ATTENUATION	FREQUENCY RANGE
1500	$\pm 7\frac{1}{2}\%$	-3 db or less	400 cps to 14.5 kc
	$\pm 20\%$	-30 db or more	
4300	$\pm 7\frac{1}{2}\%$	-3 db or less	400 cps to 960 cps 1300 cps to 14.5 kc
	$\pm 20\%$	-40 db or more	
4000	$\pm 7\frac{1}{2}\%$	-3 db or less	400 cps to 960 cps 1300 cps to 14.5 kc
	$\pm 15\%$	-45 db or more	
	$\pm 15\%$	-3 db or less	22 kc to 70 kc
	$\pm 28\%$	-45 db or more	

Other frequencies and impedances available on request.

Representatives in
Principal Cities

HYCOR
Company Inc.

Subsidiary of International Resistance Company
11423 VANOWEN STREET
NORTH HOLLYWOOD 1, CALIF.

Want more information? Use post card on last page.

PLASTECK TRANSLITE PANELS

EARN THEIR WINGS IN A TESTING LABORATORY

In recent exhaustive laboratory tests, Plasteck panels subjected to a 150 hour Fadeometer test with competitive panels, surpassed and exceeded required specifications (MIL-P-7788) emerging with no appreciable contrast value change. Thus you are assured of research-developed edge-lighted panels for immediate delivery or for future stock piling.

Our Research and Development engineers are engaged in an untiring effort to develop methods for day and night illumination of instruments and controls in today's military and commercial aircraft. Plasteck provides the industry with a legible panel of high contrast, either laminated or coated to meet your specifications of design.

KNOBS · DIALS



Standard knobs and dials are available in a wide range of sizes and types; specials are made to meet your precise specifications.



3 PLANTS EQUIPPED TO
TAKE CARE OF YOUR PANEL NEEDS

Plasteck, Inc.

300-4 S. McKenna Poteau, Okla.
TWX: Poteau 492

California Plasteck, Inc.

225 E. Fourth L. A., Calif.
TWX: L. A. 1111

Plasteck Eastern, Inc.

200 E. Washington Hoboken, N. J.

Our engineers and representatives are ready to consult with you at all times. Or write Dept. EL for complete literature on our edge-lighted panels, knobs and dials.

"FIRST IN EDGELIGHTING"

Want more information? Use post card on last page.

was a staff member of the Radiation Laboratory of MIT. Prior to his appointment to his new position he was chief of the company's flight and fire control section.

Moore succeeds Dr. Niels E. Edlefsen who has been director of the department since 1951, and has resigned to accept a position as vice-president of another organization.

General Cable Expands

GENERAL CABLE CORP. has entered into a contract for the acquisition of General Insulated Wire Works of Providence, Rhode Island.

C. J. Craig, president of General Insulated, will be appointed a vice-president of General Cable, with principal responsibility for the Providence operation. The newly-acquired plant occupies approximately 100,000 sq ft and employs about 300 people.

General Cable also will construct a new plant in Monticello, Ill. for making paper covered telephone cable. It will occupy some 50,000 sq ft. Formation of a new company to manufacture a complete line of telephone wires and cables in Canada was also announced by the firm. The new company, Telecables and Wires Ltd., will be owned jointly by General Cable, Canada Wire and Cable and the British firm of Telegraph Construction and Maintenance Company Ltd. General Cable will have a substantial minority interest.

New Printed Circuit Company Formed

EATON ASSOCIATES, a new company, has been organized to manufacture printed circuits and printed circuit assemblies. The new concern, located in Modus, Conn., is already in production.

J. O. Eaton, who was formerly with Eaton Manufacturing Co. of Cleveland, Ohio and Warren Wire Company of Pownel, Vermont, is the principal shareholder in the company. Associated with him in the enterprise are Daniel Dewey of Essex, Conn.; Samuel Pear of Modus; Frank E. Taplin of Williams-

How to whip your relay problems!

Just call **ADVANCE...**
we're ready and
willing to make the
relays you need.

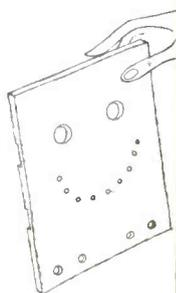


CONTACTS,
for example

Say the word and we'll whip up the sizes... switch from fine silver to tungsten, palladium, silver-cadmium oxide, gold contacts, or... you name it!

INSULATION

Laminated phenolic, silicone glass, ceramic steatite, linen-base bakelite, or... you name it!



ANYTHING SPECIAL...

ADVANCE will engineer, develop and produce the custom relays you need in minimum time. Call ADVANCE for action.

For ELECTRONIC USES

We build a vast variety of sensitive, reliable relays...create superior new designs quickly. You'll find our quality control is now the tightest in the industry.

Write—and let us solve your relay problems



ADVANCE ELECTRIC AND RELAY CO.

An Elgin National Watch Company Affiliate
2435-A NORTH NAOMI STREET
BURBANK, CALIFORNIA

Want more information? Use post card on last page.

town, Mass.; A. E. Griffin of Winsted, Conn., and H. D. Randall of Westerly, R. I.

ECA Promotes Senior Physicist

JAY TOL THOMAS has been appointed assistant to the president of Electronics Corporation of America.

Dr. Thomas, who has been serving as senior physicist with ECA, held a similar position for three years with Baird Associates of Boston, and previously worked on process control devices for the chemical industry at the DuPont Experiment Station, Wilmington, Del. In World War II he conducted radar research with the Naval Research Laboratory in Washington, D. C.

Dage Television Names Howland

JOHN R. HOWLAND has been named general sales manager of the Dage television division of Thompson Products.

He will supervise the sale of Dage color television systems and black-and-white television equipment. He formerly headed product research and commercial sales for the electronic division of Stewart-Warner.

Prior to that he was for 11 years assistant to the president of Zenith Radio.

Underwood Plans Plant Expansion

UNDERWOOD Corporation is planning an expansion program including construction of an industrial park containing a new manufacturing plant.

A one-year option has been taken by the firm on a 420-acre tract of land located in Hartford, Conn. If purchased, the area will cost \$250,000.

Ransom Research Begins Operations

DAVID H. RANSOM, former president of Mag-Electric Products of Hawthorne, Calif., has established an electronics development and manufacturing firm, under the name

Make a **GM** PORTABLE D'ARSONVAL

GALVANOMETER

the Heart of Your Instrument



FOR MEASURING HEMOGLOBIN content of blood samples, the Fisher Scientific Co. of Pittsburgh uses a Model 100 G-M Galvanometer in its popular Electro-Hemometer (at left). Whatever your own particular instrument field, you can achieve this same self-contained portability, ruggedness and high sensitivity with G-M Galvanometers. Compare catalog on request.

GM LABORATORIES·INC.

4336 NORTH KNOX AVE., CHICAGO 41

Reliance Mica Co., Inc.

MICA SPECIALTIES



RADIO and TV TUBE SPACERS



CAPACITOR FILMS



HEAT RESISTANCE WASHERS

Reliance are specialists in the fabrication of Mica parts. For 27 years, they have met industry's specifications for critical tolerance and quality control. Our years of experience meeting close tolerance work can help you whenever you are faced with tight specifications and our quality control will meet the increasing rigid specifications of today's design

QUALITY MICAS MAKE QUALITY TUBES

Is your application of Mica correct?

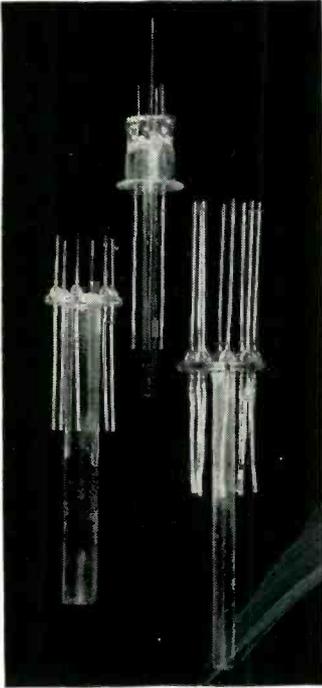
Consult us for help in obtaining the proper use of Mica in your products.

RELIANCE MICA CO., INC.

341-351 39th St.

Brooklyn 32, N. Y.

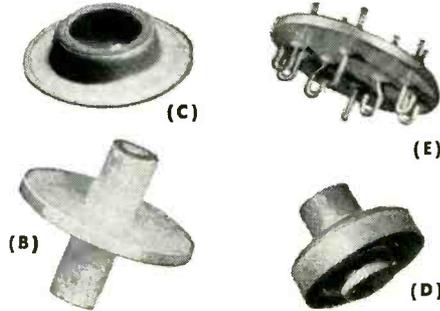
TUBE COMPONENTS AND HERMETIC SEALS



(A)

- (A) Molded Button Stems
- (B) Powdered Glass Molding
- (C) Metal-to-glass Window Seals
- (D) Clear Glass-to-metal Terminals
- (E) Chemical-oxide bonded glass-to-metal seals

We are also equipped for custom glass operations, both hand & machine. Complete facilities available for sealing & evacuation. Write now for immediate quotations on any quantity.



(B)

(C)

(E)

(D)

Over a Quarter Century of Sealing Experience

SCIENTIFIC ELECTRONIC LABS

866 Bergen St.

Newark 8, N. J.

Bigelow 8-6553

Ransom Research in San Pedro, Calif. Production is underway in the new firm.

Prior to becoming president of Mag-Electric Products, Ransom was director of research and development at Bogue Electric Manufacturing Co., an engineering executive at IT&T and a development engineer at Curtiss-Wright Corp. His work has been in development field of magnetic amplifiers, microwave radio relay systems and telephone switching systems.

Corning Sets Up Parts Department

A NEW department, the components department, has been established in the electrical products division of Corning Glass Works. It will be headed by Forrest E. Behm, formerly manager of pressware plant in Corning.

He will be responsible for the manufacture and sale of various types of glass components.

Mehm joined CGW in 1946 as assistant production superintendent in "A" Factory and later served as production superintendent at pressware plant. He has been manager there since 1953.

Potter Instrument Expands Facilities

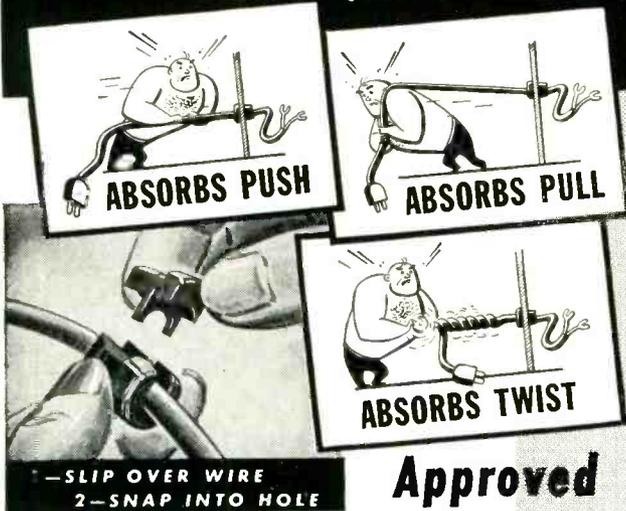
POTTER Instrument Co. of Great Neck, N. Y. has expanded production facilities with a new 15,000 sq ft building. The new plant is to be used for expanded production of the firm's magnistors and large data handling systems.

Chemical Firm Studies Selenium Ore

KAWECKI CHEMICAL Co. of Boyertown, Pa., is studying the feasibility of a native selenium ore processing plant in the Lysite area near Shoshoni, Wyo. Selenium is obtained in the U. S. mostly as a by-product from copper processing mills and from flues in refining and smelting plants.

Deposits in the Lysite area contain less than a half pound of selen-

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 13 New Jersey



Send wire sizes for free samples and specifications.

THE HEYMAN ORGANIZATION WITH 25 YEARS STAMPING EXPERIENCE HAS MODERN PRESS CAPACITY FOR OVER 2,000,000 FINISHED STAMPINGS PER DAY.

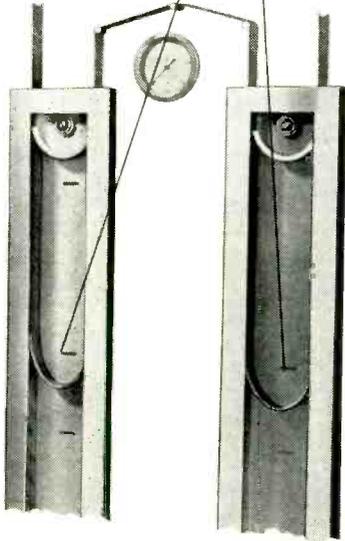
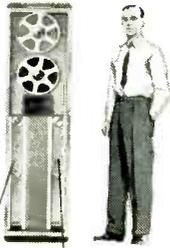
ASK FOR BULLETIN 33



DataReader

Model 546

A transport unit for high-speed searching, reading and recording of data on magnetic tape.



Vacuum column tape control

Vacuum method of sensing provides servo control of the reel drive motors, resulting in a highly sensitive tape feed control. Only a short length of tape need be accelerated to bring the tape to full speed. Exceptionally rapid acceleration and minimum tape strain are realized, since no mechanical system inertia need be overcome.

PERFORMANCE:

RAPID START—STOP—REVERSE—from stop to full speed in 6 milliseconds.

HIGH TAPE SPEED—optional single speed of 30, 40, 50, 60 or 75 in./sec.

TWO-DIRECTION SEARCH—either direction, automatically at full speed.

REMOTE OPERATION—forward, reverse, stop, rewind and selection of reading and writing.

END-OF-TAPE SENSING—stops automatically at either end of tape.

RAPID REWIND—2400 ft. of 1/2" or 3/4" tape in 3 minutes.

FOR FURTHER INFORMATION WRITE
ElectroData Corporation
Component Sales Division
460 No. Sierra Madre Villa
Pasadena 15, Calif.

ElectroData

An Affiliate of
CONSOLIDATED ENGINEERING CORPORATION
OF PASADENA, CALIFORNIA

ElectroData Corporation maintains a nationwide sales and service organization.

Want more information? Use post card on last page.

ELECTRONICS — September, 1955

PLANTS AND PEOPLE

(continued)

ium to a ton of rock.

Preliminary meetings have been held by Dr. Henry Fisk, chairman of the Natural Resources Research Institute at the University of Wyoming; Henry C. Kawecki, president, and Henry E. Sivik, research engineer for the chemical firm.

Cinch Buys Printed Circuit Company

CINCH Manufacturing Corp. of Chicago has purchased Graphik-Circuits of Pasadena, Calif., printed circuit producer.

The firm will be operated as a division of Cinch.

Cinch produces printed circuit sockets and terminals, and these can now be furnished installed in the printed circuit boards.

Harry R. Gillespie, Jr., who was administrative engineer for Cinch, is in charge of this operation.

Electrical Facilities Changes Name to Knopp

ELECTRICAL Facilities of Oakland, Calif., manufacturers of precision transformers, testing equipment and rectifiers, has changed its name to Knopp Inc.

The change was made for the purpose of having the product name and the manufacturer's identity similar.

Hermetic Seal Acquires Glass Solder

HERMETIC SEAL Manufacturing Co. of Newark, N. J. has acquired the Glass Solder Engineering Co. of Pasadena, Calif. as their west coast division.

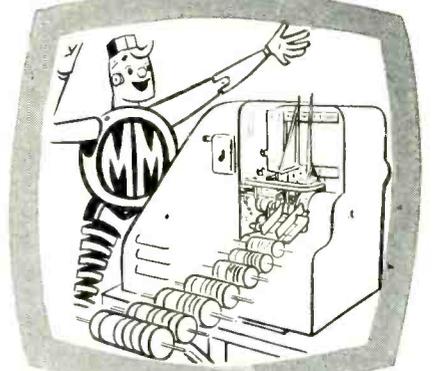
H. J. Wittmeyer, vice-president and general manager of Glass Solder, will continue in that capacity.

Electra Manufacturing Moves To New Plant

FIFTY PERCENT more space is provided in the new plant in Independence, Kansas of Electra Manufacturing Co., manufacturer of deposited carbon resistors.

The plant replaces engineering

making a MARKED IMPROVEMENT in COLOR CODING products



Industry's color-coding needs range from simultaneous application of up to six bands on wire lead electrical components to color banding drill chucks in the tool business. Meeting these needs are Markem machines (like the 69A shown), type and ink—which do the job faster, better and at lower cost than tedious hand methods ever could. When size, shape or material of your product, part or package poses a marking problem, get the benefits of Markem's 44 years of experience. Write or call Markem Machine Co., Keene 5, New Hampshire.



Want more information? Use post card on last page.

Closely Regulated D-C Power Source of Permanent Stability

For mobile or
stationary use



STAVOLT® POWER RECTIFIERS

- Greatly simplified circuit with fast responding magnetic control of highest reliability.
- No warm-up time, no hunting or drifting.
- Lighter weight, more compact, rugged and field proven. Encapsulated components.
- 11 standard models up to 1500 amps. Meets Spec. MIL-E-7894.

Write for interesting information
on STAVOLT rectifiers.

McCOLPIN-CHRISTIE CORP.

3410 W. 67th Street, Los Angeles 43, California
Specialists in Rectifier Manufacturing for 26 Years

PLANTS AND PEOPLE

(continued)

and production facilities which were located at Atchison, Kansas and Kansas City, Missouri.

Feedback Controls Names Vice-President

WILLIAM M. PEASE has joined the staff of Feedback Controls, of Alexandria, Va., as vice-president and general manager. He was formerly the director of the servomechanisms laboratory at M.I.T. and more recently general manager of the electronics division of Ultrasonics.

Rust Industrial Opens New Plant

RUST INDUSTRIAL Co., manufacturers of remote control units for radio station transmitters, has opened a new 11,000 sq ft plant in Manchester, N. H. The firm, established six years ago, can now double its production capacity to meet demand. Provisions have been made for further expansion in the near future.

Hoffman Acquires National Fabricated Products

HOFFMAN Electronics Corp. has purchased all the outstanding shares of National Fabricated Products, Chicago electronic component manufacturer.

National Semiconductor Products, located in Evanston, Ill., is a subsidiary of National.

Maurice E. Paradise, president and founder of National Fabricated Products, will continue in his former capacity under a long-term contract with Hoffman Electronics. The only change presently contemplated in the operation of the company will be the addition of a department of application engineering to develop maximum usage of the semiconductor products.

Gordon Completes Plant Addition

CLAUD S. GORDON Co. of Chicago completed an addition to its plant at Richmond, Ill. According to the



when the heat's on . . .

... you can really depend on Star THERMOLAIN® refractory porcelain for exceptional performance in any electrical heating device you manufacture. And for good reason! Star THERMOLAIN offers good mechanical strength plus excellent thermal shock resistance . . . a combination that means long, trouble-free heating-element life and user satisfaction. Want the facts? Standard refractory shapes, plus sizes, weights and engineering data are shown on our new technical data sheet. Write for a free copy today.

Star Porcelain Company,
42 Muirhead Ave.,
Trenton 9, N.J.



STAR
porcelain company



SPADE BOLTS



Specialists in designing and manufacturing of all-purpose fasteners and wire forms. Tooled to produce over 1000 styles in any screw size, material, finish, quantity, to your specifications.

Serving Industry for Thirty-five Years
— OTHER PRODUCTS —

Simplex
WIRE STRIPPERS & CUTTERS

• TOOLS • DIES • STAMPINGS
Bulletins on complete line upon request

WENCO MANUFACTURING CO.
1133 W. Hubbard St., Chicago 22, Ill., U.S.A.

Want more information? Use post card on last page.

September, 1955 — ELECTRONICS

Want more information? Use post card on last page.

company, the addition will double manufacturing facilities at the plant where Serv-Rite thermocouple wire, pyrometers, and pyrometer and thermocouple accessories are produced.

Eastern Engineering Established In New Plant

EASTERN ENGINEERING ASSOC. has been established in a new 11,000 sq ft plant in Alexandria, Va. for designing, engineering and manufacturing printed electronic wiring and circuits. Facilities for research development and manufacturing of diversified electronic equipment are included.

Chem-Etched Circuits Firm Organized

CHEM-ETCH'D CIRCUITS, of Garrett, Ind. has been formed to design, develop and manufacture etched circuits by the photo-engraving method. George C. Weiss is president of the newly formed organization. Other officers include Kenneth L. Grimes, vice-president; Bernard H. Barnett, secretary-treasurer; Kenneth L. Smith, sales manager and James E. Wolfkiel, Sr., manager of research and development. Production is already under way on specially designed equipment automatically producing multiple-unit sheets.

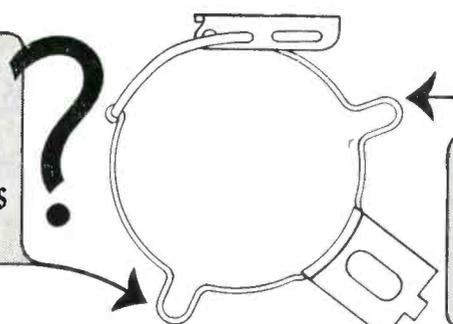
Lenkurt Builds New Canadian Plant

CONSTRUCTION of a new \$200,000 factory and office building in Burnaby near Vancouver, British Columbia, has been planned by the Lenkurt Electric Co. of Canada, subsidiary of Lenkurt Electric in San Carlos, Calif.

Construction began in June and should be completed in time for all operations to move there early in 1956 from the present plant in Vancouver.

The new building will have a total of 15,000 sq ft of space, more than twice as much space as the present

WHAT CLAMP TO USE WHERE TOLERANCES ARE LARGE



AUGAT'S NEW TWO TENSION LOOP CLAMPS

Augat two-tension loop clamps are the long-sought answer for uses where tube base tolerances vary up to .040. The bands of these sturdy clamps are made of Beryllium copper, heat treated to retain original tension and nickel plated to withstand a 96 hour salt spray test with no adverse effect.

The remaining parts of Augat's two-tension loop clamps are made of 18% nickel silver.

Write today for catalog and samples.

AUGAT BROS. INC.
31 PERRY AVENUE • ATTLEBORO, MASS.

When you need a

Non-Stock Pot ask



PRODUCTS CORPORATION

Manufacturers of
Ultra High Precision Potentiometers

**2041 COLORADO AVE.
SANTA MONICA, CALIF.**

TUNGSTEN FILAMENTS

Wire Leads

Heater Coils

Starter Coils

Resistor Coils

Electronic Coils

Projection Coils

Metallizing Coils

Cathode Ray Coils

Fluorescent Coils

Incandescent Coils

SINGLE
STRAND
STRANDED
CABLE

from

.0005"

to

.250"

New automatic machinery increases production, assures higher uniform quality at considerably lower costs! If you use filaments or stranded cable, ask for samples and quotations.

MICRO-Wire STRANDING COMPANY

131 Park Place

Passaic 1, N. J.

PLANTS AND PEOPLE

(continued)

factory. Two thirds of the space will be for production, the rest for offices.

Lear Promotes Two Officers

ANDREW F. HAIDUCK, formerly vice-president, was elected executive vice-president in charge of manufacturing of Lear. Chester D. Sefenberg, formerly treasurer, was elected vice-president and treasurer. All other officers of the firm were reelected.

Masco Elects New Officers

THE MARK SIMPSON Manufacturing Co., (Masco) appointed the following new officers:

Miryam Simpson, president; Mark Simpson, vice-president & secretary; Bernard Zisman, vice-president & treasurer; George Watson, vice-president, distributor sales division; Philip S. Optner, vice-president, mfg. division and Ralph Aasen, vice-president of engineering.

Ports Selected As Vice-President

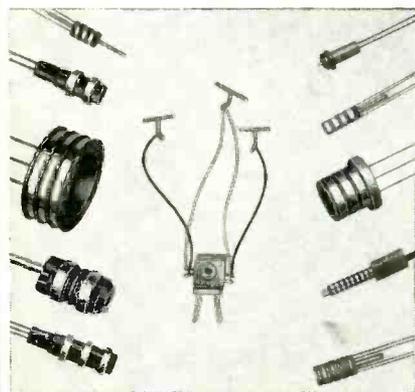
DELMER C. PORTS, chief engineer of Jansky & Bailey, has been elected vice-president of the firm.

Ports is chairman of the IRE Professional Group on Antennas and Propagation. He has been with the company since 1936.

Leach Changes Executives, Sells Jeffries

C. R. HARMON has resigned as president of Leach Corp. K. F. Julin, executive vice-president, has been appointed to act as general manager, and Harmon, who has been instrumental in the initial stages of the company's successful operation, will continue in a consulting and advisory capacity.

Jeffries Transformer, formerly a member of the Leach family, was



Miniature and Sub-Miniature
SLIP RING ASSEMBLIES
BRUSH BLOCK ASSEMBLIES
COMMUTATORS

and other
Electro-Mechanical Components

PRECISION MADE
TO YOUR OWN SPECIFICATIONS

Precision molded products with exacting tolerances in precious and non-precious solid metals of all alloys. All types of Thermo-Plastic and Thermo-Setting materials.

Slip Ring Assemblies fabricated or one-piece precision molded to your specifications in Nylon, Kel-F, Mineral filled Mellamine, Phenolic, and other materials. Rings and leads spot welded or brazed together for positive electrical circuit.

Our Swiss methods and techniques are geared to meet exacting requirements. We invite your inquiries.

COLLECTRON CORPORATION

MUrray Hill 2-8473 • 216 East 45th Street • New York 17, N. Y.



Lean on us for HEAT TREATING SERVICES

Ultramodern facilities and equipment*, fast service, unmatched experience, and rigid adherence to specifications make it your best move to lean on us for these services.

Brazing, annealing, and hardening of:

1. Stainless Steels
2. And Now, Tool Steels
3. Up to 5" width strips of stainless steel or high and low carbon steels.

Cycle annealing of Laminations, Silicons, Irons

Phone, write, or wire for information
Sample processing free



SARGEANT & Wilbur
HEAT TREATING CORP.

170 YORK AVENUE • PAWTUCKET • R. I.

* U. S. Air Force Certified

sold recently to Zinsco Electrical Products.

Leach plans further acquisitions of compatible companies in the future.

Underwood Corporation Changes Officers



L. C. Stowell

L. C. STOWELL was elected as chairman of the board and Fred M. Farwell as president of Underwood Corp.

Phillip D. Wagoner, who has been president and then chairman of the board since 1918 continues as a director, a member of the finance committee and chairman of the executive committee.

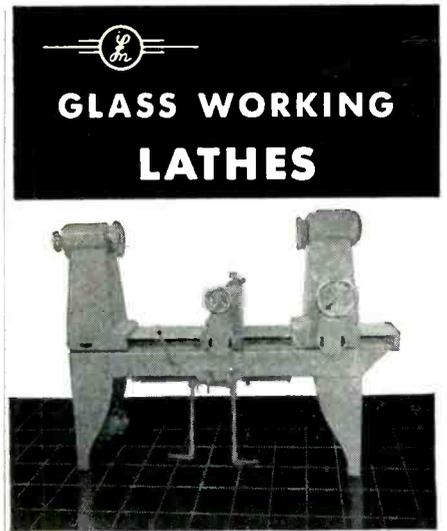
After 17 years with Dictaphone Corp. where he became president in 1927, L. C. Stowell joined Underwood as executive vice-president in 1936, becoming president in 1945.

Farwell was executive vice-president and a director of S. C. Johnson & Son, of Racine, Wisconsin.

Long Island Plant Bought By Superior

SUPERIOR TUBE CO., has acquired a majority interest in Johnson & Hoffman Manufacturing Corp. of Mineola, Long Island, New York, manufacturers of precision stamping and deep-drawn parts, primarily for the electronics industry.

Jay H. Johnson, president, and Eugene J. Hoffman, vice-president,



MODEL ME

\$3135.00 f.o.b. Grass Valley, Calif.

Especially useful for handling large television Bulbs

GENERAL SPECIFICATIONS

Maximum length overall	84"
Maximum width overall	27"
Maximum length, spindle nose to spindle nose	47"
Height, floor to spindle	52 5/8"
Radial clearance above apron	21 1/4"
Spindle hole diameter	3 7/8"
Approximate shipping weight	1800 lbs.
Net weight	1600 lbs.

STANDARD EQUIPMENT

- Two face plates
- One collet draw-in bar
- Hand carburetion control
- Foot pedal control of air or nitrogen supply and oxygen-gas volume
- Main air valve controlling air in either or both spindles
- Standard spindle speeds approx. 30-40-60 RPM. (With Adjusto Spede 17 1/2-175 RPM.)
- 1/2 h.p. motor, 220 volt, 3-phase

DO YOU KNOW?

That a first class glassblowing job requires accurate alignment of rotational axes between the headstock and footstock?

That variable spindle speed gives another dimension to your technique?

That simple chucking attachments supply versatility for wide varieties of applications?

That special chucking for your industrial procedures, or laboratory practices are available?

That Litton jet-mix fires are universally used in glassblowing to prevent reducing conditions?

That Litton Lathes have been the standard of the vacuum tube industry for 22 years, and have been constantly improved?

That you can get these precision tools at reasonable cost, in eight sizes, with swing from 8" to 42", and working length from 20" to 75 1/2"?

Let us send you complete specifications and prices on our line of equipment and tools for the Vacuum Tube industry and for general research and development laboratory use.

3238



Want more information? Use post card on last page.

Almo RADIO CO
IS YOUR EXCLUSIVE DISTRIBUTOR IN THIS AREA FOR ...

WARD-LEONARD

ACRO-MU
SWITCHES

CARTER
MOTORS

STACKPOLE

SUPER STOCKING DIST. FOR NATIONAL CO.

REFER YOUR ORDER DIRECTLY TO ALMO FOR PROMPT DELIVERY

FREE NEW INDUSTRIAL CATALOG UPON REQUEST

Almo RADIO CO.
509 ARCH ST., PHILA., PA.
BRANCHES: NORRISTOWN, PA., CAMDEN, N.J., ATLANTIC CITY, N.J., WILMINGTON, DEL., SALISBURY, MD.

EXPORT ORDERS FILLED PROMPTLY
CABLE ADDRESS: ALRAD-PHILA.

Want more information? Use post card on last page.

Aerohm

Precision wire-wound Potentiometers



"Lo-TORK" POT LT 7/8

For minimum-torque uses in computer, servo, and selsyn service. Stainless-steel precision ball bearings. Maximum torque is 0.01 inch-ounce. Dissipates one watt at 80°C. Resistances—100 to 100,000 ohms. Weight is only 1/2 ounce. Ganging to six decks; internal clamps hold 7/8" diameter. Standard linearity 0.5%; on special order 0.25%; toroidal winding allows winding angles to 360°; standard 354°.



AP 1 1/8-S

AP 1/2-S

RT 7/8-S

MICRO-MINIATURE and MINIATURE

Series AP 1/2-S—2 watts continuous at 80°C; resistances 10 to 20,000 ohms, 5% tolerance standard; diameter 1/2", depth 3/8", weight 1/4 ounce; sealed well enough for potting.

Series RT 7/8-S—3 watts continuous at 80°C; resistances 10 to 100,000 ohms; diameter 7/8", depth 3/8", weight 1/2 oz.; standard linearity 2%.

Series AP 1 1/8-S—4 watts continuous at 80°C; resistances 10 to 150,000 ohms; diameter 1 1/8", depth 1/2", wt. less than 3/4 oz.; standard linearity 1%.

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



Write for copy
of our new
catalog.

WATERS MANUFACTURING, Inc.

Waltham 54, Massachusetts

APPLICATION ENGINEERING OFFICES IN PRINCIPAL CITIES

Want more information? Use post card on last page.

PLANTS AND PEOPLE

(continued)

will continue in direct charge of Johnson & Hoffman's operations.

Consolidated Engineering Appoints Computer Chief



GLYN A. NEFF has been appointed project chief for data processing systems of the systems division of Consolidated Engineering Corp.

In his new post, he will be concerned primarily with data processing systems as they are used in design and testing of atomic reactors, jet engines and guided missiles.

Neff was transferred from the company's engineering division, where he played a role in development of MillisADIC, a high-speed electronic data processing unit that converts electrical measurements of physical phenomena into numerical form.

Prior to joining the company four years ago, he was engaged in airborne receiver development as an engineer with Collins Radio Co.

Insulated Circuits Moves To New Plant

INSULATED CIRCUITS has broken ground for a new plant in West Caldwell, N. J. The plant has been designed for automatic production. Each phase of circuit, switch or assembly will be manufactured under dust free, humidified and temperature controlled conditions. The new plant will contain approximately 32,000 sq ft of working area. Facilities for prototype, research and development will be segregated

MOLYBDENUM

PURE and THORIATED TUNGSTEN

For ELECTRONIC APPLICATION

RIBBONS

STRIPS

FORMED PIECES

Your special metals
rolled to thin sizes
- close tolerances

H. CROSS CO.

15 BEEKMAN ST., N. Y. 38, N. Y.
WOrth 2-2044 and COrtlandt 7-0470

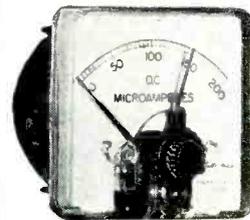
METER-RELAYS

For Sensitive and Accurate Control

RANGES:

0/20 Ua. to
0/50 A.
0/5 Mv. to
0/500 V.

The trip point
is adjustable to
any point on
the scale arc.



These meter-relays are sensitive to changes of as little as 1%. One contact is carried on moving pointer. The other is on a semi-fixed pointer. When two pointers meet contacts close and lock. Holding coil is wound directly over moving coil. Reset can be manual or automatic. Spring action in contacts kicks them apart forcefully.

Three sizes of clear plastic case models, 2 1/2, 3 1/4 and 4 1/2 inches (all rectangular). Two ruggedized and sealed models, 2 1/2 and 3 1/2 inches (round metal cases). Contact arrangements: High Limit Single, Low Limit Single or Double (both high and low). Contact rating is 5 to 25 milliamperes D.C.

Suggested circuits for meter-relays and complete specifications including prices are covered in new 16-page Bulletin G-6, which you can get by writing Assembly Products, Inc., Chesterland 4 Ohio.

Booth A-150, Instrument Show, Sept. 12-16, Los Angeles
Want more information? Use post card on last page.

September, 1955 — ELECTRONICS

from regular production. The move from the present location at Belleville, N. J. to the new location has been planned to cause a minimum loss of production time.

Audio & Video Elects Two

R. E. HADADY has been elected to vice-president of Audio & Video Products in charge of field engineering. James U. Lemke was elected vice-president and chief engineer for A-V Manufacturing Corp., a division of Audio & Video. Hadady will direct national sales and field engineering activities. Before joining A-V, he was manager of the customer engineering division of Davies Laboratories.

Lemke will supervise all research and development operations of A-V Manufacturing.

Gaunt Joins Lockheed Research

RICHARD P. GAUNT has joined the Lockheed missile systems division as a member of the research staff. He has been associated with the CalTech Jet Propulsion Laboratory as senior research engineer in charge of a missile systems group.

He has designed special-purpose analog computers and differential analyzers.

Polarad Forms Auto Specialty Division

POLARD ELECTRONICS CORP. has formed a new division to manufacture and merchandise automotive and bicycle specialties.

The move is the first step in a diversification program to utilize to the fullest the firm's engineering and production facilities.

Louis Stark, from the automotive specialties field, has joined Polarad to act as general manager of the new division.

Consolidated Diesel Establishes Subsidiary

CONSOLIDATED Diesel Electric Corp. has formed a subsidiary, Consolidated Avionics Corp. Harry R.

FOR MARKING...



**PLASTIC • METAL
GLASS • PAPER
RUBBER • CERAMIC
CARDBOARD**

*in such products as
Resistors, capacitors,
valves, tubes, labels,
sleeves, spark plugs, car-
tons, etc., etc.*

**THESE PRODUCTS
AND MANY OTHERS
OF ALMOST ANY
MATERIAL AND SHAPE
CAN BE IMPRINTED**

ON THE

REJAFIX MARKING MACHINE

Why not send us samples of your products? They will be test-printed and returned to you for your examination!

- REJAFIX HAND-OPERATED MODELS FOR SMALL RUNS. FULLY AUTOMATIC MODELS FOR MASS PRODUCTION.

EST. 1922

POPPER & SONS INC. 300 FOURTH AVENUE
NEW YORK 10, N. Y.

here's what **DIE CAST**

GRC ZINC ALLOY
THREADED

FASTENINGS

mean to you...

**in terms of a better product, in
terms of a more economical product!**

Gries' unique techniques make possible closer tolerances, cleaner threads, greater dependability, durability, die-cast uniformity. Mass production means lower costs!



NEW BULLETIN AVAILABLE!

Fact-packed—shows how Gries ingenuity and money-saving methods can solve your fastenings problems.

Send today for your
copy, prices and samples.



GRIES REPRODUCER CORP.

151 Beechwood Ave. • New Rochelle, N. Y.
Phone: NEw Rochelle 3-8600



*World's
Foremost
Producers of
Small
Die Castings*

Transistor Power Supply



Constant Voltage Constant Current Double Dual DC Outputs

The Model 210, has four independent regulated outputs of constant voltage and constant current for powering all types of transistors and transistor devices. Other uses include current and voltage biasing, instrument calibration, electro-chemical applications. This supply is designed for laboratory experimentation, factory testing or incorporation into equipment.

FEATURES

- Four Independent Outputs—Constant Current and Constant Voltage, Positive or Negative
- Line Voltage Regulator
- Electronic Constant Current Regulation
- Low Ripple Content
- Each Output Continuously Variable
- Vernier Ranges for Constant Voltage Output
- Fully Metered—Automatic Meter Range Switching

Specifications

Constant Voltage	Continuously Variable
(a) Output No. 1, pos. or neg.	0-1V, 0-10V, 0-100V
(b) Output No. 2, pos. or neg.	0-100V
Ripple	0.01%
Line Regulation	Less than $\pm 1.0\%$ change for input 95 to 125 VAC
DC Current (max.)	Either output, 100 MA max. Adjustable, 2 to 30 MA
Constant Current	Constant with-in $\pm 1.0\%$ for output 0 to 150V
Current Regulation	Less than 0.05%
Ripple	Less than 0.05%
Line Regulation	Less than $\pm 2.0\%$ change for input 105 to 125 VAC
Size	19"x8-3/4"x9"
	Rack & Bench Mounting

Price \$315 FOB NUTLEY, N. J.
Used by Leading Laboratories and Factories
For additional information Write for Bulletin E-2
Sales Engineers in all Areas

ELECTRONIC RESEARCH ASSOCIATES, INC.



67 East Centre Street Nutley, New Jersey

Glixon, formerly of the Servo Corporation of America has been appointed president. The subsidiary will engage in the manufacture and development of servos, digital data reduction and electronic instrumentation. Glixon holds a research fellowship at New York University.

Bristol Engineering Promotes Snyder

MERLE E. SNYDER has been appointed manager of the electronics division of Bristol Engineering Corp.

Snyder joined Bristol in 1950 and assisted in forming what is now the electronics division. He was previously associated with Kellogg Switchboard and Supply.

National Research Names Minault

S. SYDNEY MINAULT has been appointed general manager of the equipment division of National Research Corp. in Cambridge, Mass.

He has previously served as production manager and later vice-president and general manager of Tracerlab; chief product engineer, camera plant manager and later chief engineer of AnSCO; methods supervisor and later manufacturing engineering superintendent of Sperry Gyroscope.

Eimac Elevates Howes, Culbertson

GORDON HOWES has been appointed administrative assistant to the general manager of Eitel-McCullough, manufacturer of Eimac electron-power tubes.

Robert Culbertson will succeed Howes as director of factory engineering.

Howes began his career with the company in 1935, only a few months after the firm was founded. In 1941, he laid out plans for the firm's Salt Lake City, Utah, plant and remained there as plant manager until 1943. On his return to San Bruno, he organized the factory engineering department and remained its di-

IT SAYS THAT 2 OUT OF 3 ELECTRONIC ENGINEERS USE BURGESS BATTERIES

BURGESS DESIGN AND ENGINEERING SERVICES CAN SOLVE YOUR PROBLEM!

For more than forty years, Burgess has offered to Electronic Engineers design and engineering facilities to meet any dry battery need. Burgess welcomes the opportunity to assist in solving your problems. Burgess popularity is based on uniform performance and consistent high quality that have earned and held the respect of Engineers everywhere. Your local distributor carries a complete stock of Burgess Industrial Batteries.

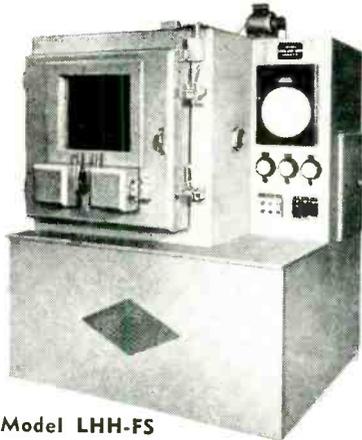
FOR YOUR CONVENIENCE!

Burgess offers, at no charge, an engineering manual listing the complete line of Burgess Batteries, a handy check sheet for new battery specifications and the new Transistor catalog folder. Ask your distributor or write Burgess Battery Company for your free copies today.



BURGESS BATTERIES
BURGESS BATTERY COMPANY
FREEPORT, ILLINOIS

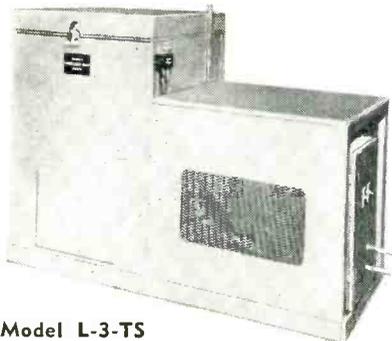
TEST CHAMBERS



Model LHH-FS

Low-High Temperature Chamber with Controlled Humidity

Supplied in sizes from 2 to 100 cu. ft. net working space, these chambers operate to -100° F at rapid reduction rate and provide controlled humidity through a range of 35 to 175 $^{\circ}$ F at 20 to 95% r.h. Full controls available.



Model L-3-TS

Chest Type Low-Temperature Cabinet

Available in sizes from 2 to 30 cu. ft. net working space. Optional controls furnished to customer specifications. Temperature range to -100° F. Capacity for rapid temperature reduction.

Equipment available to meet U. S. Govt. specs for environmental testing. Electronic or pneumatic recording or indicating control systems. Walk-in rooms, temperature baths and custom chambers manufactured to specifications. Optional finishes in hammertone, aluminum or stainless steel. Rounded corners standard on all equipment.

WALK-IN ROOMS TEMPERATURE BATHS

Manufacturers of Environmental Test Equipment Since 1941
MEMBER of Environmental Equipment Institute



55 Washington Avenue
Carlstadt, New Jersey
GEneva 8-1500

Want more information? Use post card on last page.

ELECTRONICS — September, 1955

PLANTS AND PEOPLE

(continued)



Gordon Howes



Robert Culbertson

rector until his recent promotion.

Culbertson joined the Eimac staff in 1952 as a laboratory chemist. He was appointed chief factory chemist and for the past year has served as assistant to the director of factory engineering, in charge of factory chemistry.

IRC Acquires EMEC

INTERNATIONAL Resistance Company, through one of its California subsidiaries, has purchased EMEC, of Seattle, Washington. EMEC manufactures magnetic clutches for electronic and electrical applications.

Miller Buys Vidaire Stock

GEORGE MILLER, president of Vidaire Electronics of Lynbrook, N. Y., has purchased all outstanding shares in the corporation. Joseph DeRosa is no longer connected with company.



356K Multimeter Kit \$12.90
Wired \$14.90
1000 ohms/volt

425K 5" Scope
Kit \$44.95
Wired \$79.95

470K 7" Push-Pull Scope
KIT \$79.95. WIRED \$129.50.

YOU BUILD

EICO

KITS
IN ONE
EVENING-
but they
last a lifetime...
and you
save 50%

38 Kits and 42 Instruments —
the Industry's most complete
line of MATCHED
TEST INSTRUMENTS

1/2 - million EICO Instruments are now in use the world over! That's the proof of EICO's leadership in Value.

For latest precision engineering, finest components, smart professional appearance, lifetime performance and rock-bottom economy — see and compare the EICO line at your Jobber before you buy any higher-priced equipment! You'll agree with over 100,000 others that only EICO Kits and Instruments give you the industry's greatest values at lowest cost.



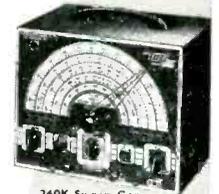
221K VTVM Kit \$25.95
Wired \$39.95



565K Multimeter Kit \$24.95
Wired \$29.95
20,000 ohms/volt



377K
Sine & Square Wave Audio Gen.
Kit \$31.95. Wired \$49.95



360K Sweep Gen.
Kit \$34.95. Wired \$49.95



1050K Battery Elim.
Kit \$29.95. Wired \$38.95



025K Tube Tester
Kit \$34.95
Wired \$49.95

Write NOW for FREE latest Catalog E-9



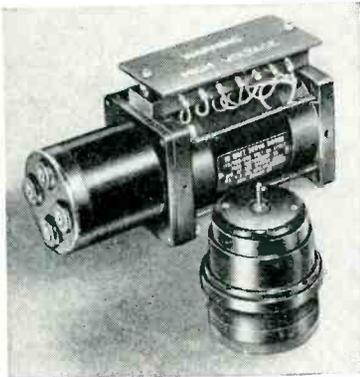
ELECTRONIC INSTRUMENT CO., Inc.
84 Withers Street, Brooklyn 11, N. Y.

Want more information? Use post card on last page.

PRECISION

A-C Rate Generators

and
single-shaft
servo packages
from FORD INSTRUMENT



- offered in 60cy and 400cy models
- available temperature compensated for wide ambient range
- extremely stable, linear units with high voltage output

Ford Instrument's a-c rate generators are designed for any use which requires a high degree of accuracy in the linear translation of rotational motion into voltage. They are especially valuable in servo systems to stabilize responses, and can be provided in convenient single-shaft packages with a wide variety of precision servo motors.

FREE — fully illustrated data bulletin gives specifications and performance information. Please address Dept. EL



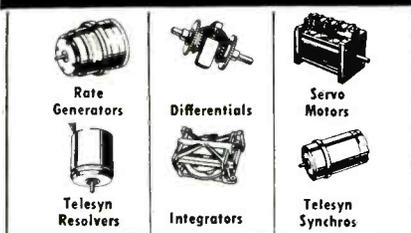
59



FORD INSTRUMENT COMPANY

Division of Sperry Rand Corporation
31-10 Thomson Ave.
Long Island City 1, N. Y.

Ford Instrument's standard components



Want more information? Use post card on last page.

380

New Books

Transistors: Theory and Applications

BY A. COBLENZ AND H. L. OWENS. *McGraw-Hill Book Co., New York, 1955, 313 p., \$6.00.*

THE AUTHORS of this book have struck the mark on which they took aim. The result is a bull's-eye in presenting the basic facts about transistors to the intelligent novice. The book is of great help to the electronic technician engaged in transistor work and serves as a valuable tool to the engineer who is first entering this fascinating field. The engineer working in the field of transistors should have this book on his reference shelf to help him keep his two feet on the ground.

This book is based on a series of lectures given by the authors at Evans Signal Laboratory and Coles Signal Laboratory while they were members of the Signal Corps Engineering Laboratories Staff. The lectures were expanded into a series of articles appearing in *ELECTRONICS* magazine from March, 1953 until January, 1954. The book adds many other useful chapters.

Format

The book is divided into five general sections: the physics of transistors, the nature of transistor phenomena, the characteristics of the transistor in circuits, the manufacture of transistors and special topics.

Chapters 1 through 5 discuss the basic physical facts of solid state physics in such a manner that energy gaps and potential barriers are readily understood on the basis of electron theory and quantum theory. Both these subjects are adequately discussed to provide the foundation for the theory of transistors.

Chapters 6 through 9 inclusive discuss the theory of operation of point-contact transistors, junction transistors, tetrode transistors, $p-n$ hook transistors and phototransistors. The authors cover the various characteristics of the various transistors and how the manufacture results in variations of these characteristics. Typical values are given for the various types and



Dependable • Precision Wire Forming and Stamping Specialists

Precision Parts to meet your Production and Engineering needs. From .002" dia. to .125" dia. Radio tube parts—Stampings—Drawings. Modern facilities, high-production equipment.

Send sketch or print
for quotation.



MANUFACTURING CO., Inc.
81-A Hudson Street
Newark 3, New Jersey

Want more information? Use post card on last page.

September, 1955 — ELECTRONICS

comparisons are made. In these chapters the equivalent circuit is developed and input resistance, output resistance and other characteristics derived. Characteristics as power gain, voltage gain and small signal parameters are covered in these chapters.

Transistor Circuits

Chapters 10 through 12 inclusive, treat the transistor in the circuit. Amplifiers of the grounded emitter, grounded collector and grounded base types are examined, characteristics compared and advantages stated. A handy chart is included covering the characteristics of the three basic amplifiers. A special chapter is devoted to switching applications. The cascading of various types of amplifiers and their coupling problems is further discussed in another chapter.

The manufacture of germanium and silicon transistors is fully covered in chapters 13 and 14. Types of sampling tests are covered in these chapters which also contain a comparison of silicon and germanium.

In chapter 15 the authors review suggestions as to new types of transistors such as the analog transistor, unipolar field-effect transistors, fieldistors and others. Appendix I lists the four-pole parameter transformation equations. Appendix II gives the generalized equations for transistors in cascade. Appendix III is extremely worth while. In it are contained sections of MIL-T-12679A which cover the standard definitions of the various characteristics.

All factors being considered this is a book worth having in a personal library. An excellent bibliography is given at the end of each chapter.—R. S. SHERRY, *The W. L. Maxson Corporation, New York, N. Y.*

Principles and Practice of Electrical Engineering

BY G. A. WALLACE. *McGraw-Hill Book Co., New York, 1955, 598 p., \$7.50.*

WRITTEN as a general course in electrical engineering for engineering students majoring in other fields,

NEW! RADIO FREQUENCY POWER METER

PM-20

Frequency Range .01 to 500 Megacycles.
(Can be calibrated at 60 cps.)

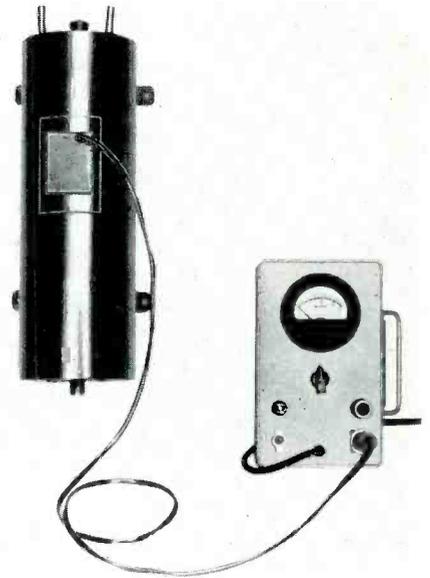
8 Full Meter Scales from 1½ to 6000 watts.

- Self-cooled up to 600 watts. Requires 30 gallons of water per hour up to 6000 watts.
- Accuracy $\pm 5\%$
- Input Impedance 52 ohms.
- Input Connector UG61/U.
- Meter Ranges: 0 to 1½, 0 to 6, 0 to 15, 0 to 60, 0 to 150, 0 to 650, 0 to 1500, 0 to 6000 watts.
- Input Power 115 volts 60 cps $\pm 10\%$ or 6 volts AC or DC.

WRITE TODAY FOR COMPLETE INFORMATION

ELECTRO IMPULSE Laboratory

208 RIVER STREET • RED BANK, N. J. • Phone: Red Bank 6-0404



YOKES

Industrial Camera
Yokes
Alignment Yokes
Image Orthicon
Yokes
Focus Coils Image
Orthicon
Terminal Board
Assemblies

COILS

Variable R.F.
Variable I.F.
Plate Coils
Oscillator Coils
Crystal Heater Units

COIL ASSEMBLIES

Impedance Coils
Peaking Coils
R.F. Chokes
Video Peaking Coils
Transmitter Coils

TELE COIL CO., Inc.

2733 Saunders St.

SAMUEL FELDMAN, Pres.

Camden 5, N. J.

Phone EMerson 5-7528

You
Are
Invited
to

Audiorama 1955

presented by

THE AUDIO FAIR

The largest aggregation of high-fidelity equipment ever displayed under one roof . . . presented by more than 125 manufacturers from all over the world. Their representatives will demonstrate the latest developments in the fast-moving audio field. At AUDIORAMA 1955, your questions will be answered personally and authoritatively. AUDIORAMA 1955 is for music-lovers, broadcast engineers, sound-on-film men, military and municipal agencies, industrial purchasing agents — for everybody interested in quality sound reproduction.

AUDIORAMA 1955 is presented by THE AUDIO FAIR
Harry N. Reizes, Director of Audio Fairs, 67 W. 44th St., N. Y.
An AUDIO FAIR-VIDEO FAIR, INC., Management Project

SPONSORED BY



NO ADMISSION
CHARGE

FOUR DAYS —
Oct. 13, 14, 15, 16

FOUR FLOORS —
5th, 6th, 7th, 8th

HOTEL NEW YORKER
New York City

Daily: 1 to 10 P.M.
Sun: 12 Noon to 6 P.M.



PHAZOR **PHASE METER**
Pat. Pend.

MODEL 200 A

PRICE \$349.50
F.O.B. NEW YORK

- HIGH ACCURACY
- MEASURES FROM 0 TO 360 DEGREES
- READINGS NOT AFFECTED BY NOISE AND HARMONICS
- PHASE SHIFTS OF THE ORDER OF .01° CAN BE MEASURED EMPLOYING SPECIAL CIRCUIT TECHNIQUES
- MEASURES IN-PHASE AND QUADRATURE COMPONENTS SEPARATELY

For further information contact your nearest representative or write for brochure

INDUSTRIAL TEST EQUIPMENT CO.
55 E. 11th ST. · NEW YORK 3 · GR. 3-4684

Manufacturers of:

- PHASE METERS
- NULL DETECTORS
- IMPEDANCE COMPARATORS
- POWER OSCILLATORS
- VACUUM TUBE VOLTMETERS
- FREQUENCY STANDARDS
- AUTOMATIC HI-POT

Other Electronic Test Equipment

NEW BOOKS

(continued)

this book reviews basic electrical physics, explains the generation, transmission and use of electrical power and treats the operating principles of generators, motors, transformers, transmission lines, meters, illumination and electronic devices.

Electronic Devices

Chapter 41 deals with the operation of thermionic tubes and photoelectric cells. The chapter starts out by describing the operation of the thermionic triode and introduces the student to static characteristic curves, tube factors and dynamic characteristics. Circuits are given for R-C and transformer-coupled amplifiers, the push-pull output stage, stabilized amplifiers and oscillators. Also treated are tetrodes, pentodes and thyratrons.

The book concludes with sections dealing with phototubes and other light-sensitive cells, a description of the cathode-ray oscilloscope and a basic electronic timing circuit.—
J. M. C.

Modern Physics for the Engineer

EDITED BY L. N. RIDENOUR. McGraw-Hill Book Co., New York, 1954, 499 p, \$7.50.

AS SOON as a man calls himself a "scientist" something happens to him. He seems to become cloistered in exalted realms and be much too good for the average of his fellows. In particular, he achieves a compulsion to look down his nose at the lowly engineer. It is in this happy spirit that Dr. Weller writes the introduction to this book. It would be difficult indeed to achieve an introduction more calculated to make even a research engineer sigh: "The damn physicists again" and toss the book in a corner.

Scope of the Book

But he would be very wrong to do so. For here in one volume is a group of lucid, comprehensive articles on many of the fields of modern physics. Even a hasty survey of them cannot fail to add breadth to an engineer's viewpoint. Starting with Relativity and the Foundations of Mechanics, there are articles on Atomic Structure,

Redesign for AUTOMATIC PRODUCTION

Any electric or electronic device can be redesigned for automatic manufacture—usually by the convenient means of some types of printed circuits. This redesign, however, is contingent upon the review of the entire process and materials flow.

Only a few electrical components have been redesigned for automation but all of them lend themselves to this important transformation. Redesign is only possible by analysis of the functions involved and reconstitution in terms of structures which are amenable to mechanization. This is our function.

Our experience and facilities are exclusively directed toward the simultaneous redesign of products and processes for automatic manufacture.

Since redesign for automatic manufacture has so many variables, we must know your problems before offering intelligent information. Please write:

AUTOMATIC PRODUCTION RESEARCH

195 South Columbus Ave., Mount Vernon, N. Y. Mount Vernon 4-7011

WE CARRY IN STOCK ALL SIZES, ALL SHAPES, ALL ALNICO GRADES

When you need them—
as you need them . . .

HIGH ENERGY, PRECISION
ALNICO PERMANENT **MAGNETS**

Experimental or
production
quantities

Catalog upon request

PERMAG
ENGINEERING
PRECISION CUTTING
PRECISION GRINDING
MAGNETIZING

24 HOUR DELIVERY

PERMAG CORP., 210 TAAFFE PLACE, BROOKLYN 5, N. Y. — Phone: MAin 2-0114

Physics of the Solid State, Magnetism, Microwave Spectroscopy, Nuclear Structure and Transmutation, Electronuclear Machines, the Actinide Elements and Nuclear Power, Elementary Particles, Astrophysics, High Pressure Phenomena with Applications to Geophysics, The Earth Beneath the Sea, Thunderstorms and Lightning Strokes, Transient Phenomena in Supersonic Flow, Electrons and Waves, Semiconductor Electronics, Communication Theory and the Transmission of Information, and Computing Machines and the Processing of Information.

Quite a list. And most of the articles are written to and for the intelligent engineer. In general they start with a qualitative description of the problem and how it has been tackled, proceeding into the quantitative analysis with what mathematics may be necessary, and ending with a statement of the present day position. These are articles from which the busy engineer can extract just as much as he needs and has time for. In some cases a hasty skimming will suffice, for background information only, while in other articles a careful understanding will be found desirable. Each individual can fit the pattern to his own desires.

It is difficult to choose the better articles but the chapters which appealed most to this reviewer were those on Atomic Structure, Physics of the Solid State, and High Pressure Phenomena. Doubtless others will have other preferences.

What's Missing

It would be quite interesting to know how the list of subjects was chosen. There is nothing on such varied topics as Low Temperature Phenomena, Optics, Sound, Thermodynamics and Electromagnetic Propagation, to mention a few. Can it be that no interesting work is going on in those fields?

Furthermore, in a book on Modern Physics these topics would seem to be much more congruous than dissertations on the applications of vacuum tubes and digital computing machines. To me Communication Theory would seem to belong to the mathematician and Computing Machines and the

Processing of Information to the engineer. It does not seem accidental that the ancestors of the present computing machines, both analog and digital, were nurtured in engineering schools and by engineers. Nor does it seem odd that order was brought into information theory by mathematicians. If the physicists find use for them that is fine, but it does not seem to make them a part of modern physics.

To show how dangerous this inclusion is, the author is trapped into discussions of "diddling" the information fed into the Univac on election night, the alarm of the mushroom growers on the disappearance of the horse and other gems of social (?) significance.

If you scrape the two crusts off this pie, you will find the filling juicy and palatable. — KNOX MCILWAIN, *Hazeltine Electronics Corp., Little Neck, L. I.*

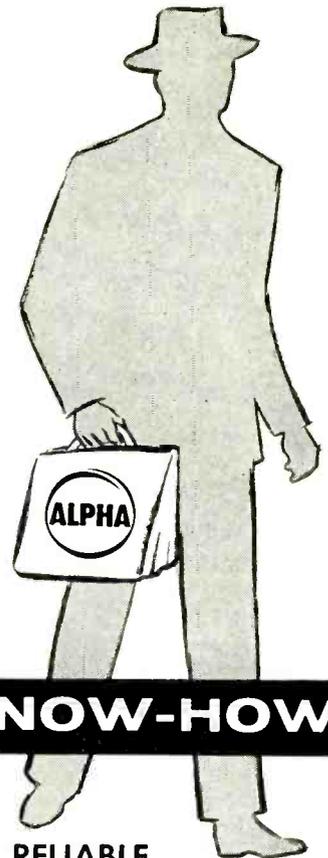
The Theory and Practice of Telegraphic Transmission

BY R. ROQUET. *Editions Eyrolles, Paris, France, 1954, 252 p., 2,750 francs.*

THE FULL TITLE of this book, published in the French language, is "Théorie et Technique de la Transmission Télégraphique; Tome 1: Théorie, Avec Extension à la Transmission de l'Information."

The growing importance, in modern telecommunication, of pulse techniques and information theory has developed in many countries a lively interest in the transmission of unit signals. One had hoped that a definitive work on "The Pulse" would sometime emerge from the country whose administration of posts and telegraphs, in the tradition of Baudot, had had the subject under scrutiny for more years than had any other. This book is it.

Written by the chief engineer of the French Post Office telecommunication academic extension department, and particularly slanted to the use of students preparing themselves for examinations leading to professional advancement, this work brings together the elements necessary for serious study



KNOW-HOW

FOR RELIABLE ASSISTANCE WITH SOLDER AND FLUX PROBLEMS...

SEE THE **ALPHA** MEN

highly trained field SPECIALISTS ALWAYS available in YOUR TERRITORY to give you QUALIFIED ASSISTANCE.

ALPHA METALS, INC.

59 Water St.,

Jersey City, N. J.



QUALITY CONTROLLED PRODUCTS BY SPECIALISTS in Solders, Fluxes, Tin & Lead Products FOR OVER 50 YEARS.

SOLDER
ROSIN
SOLDER

the manufacturers of

CEN-TRI-CORE
ENERGIZED OR PLASTIC
ROSIN-FILLED
SOLDER

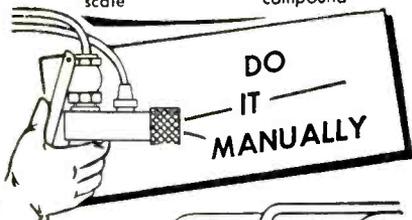
non-corrosive solder that is guaranteed against rosin voids or skips

Want more information? Use post card on last page.

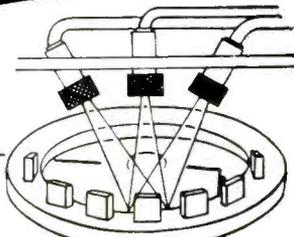
which of these
**CLEANING
PROBLEMS**
are yours?

CHECK*

- | | |
|--|--|
| <input type="checkbox"/> Insulating coatings | <input type="checkbox"/> Radio-active oxides |
| <input type="checkbox"/> Amorphous metal | <input type="checkbox"/> Dirt |
| <input type="checkbox"/> Discoloration | <input type="checkbox"/> Grease |
| <input type="checkbox"/> Lacquer | <input type="checkbox"/> Oil |
| <input type="checkbox"/> Plastic flash | <input type="checkbox"/> Rust |
| <input type="checkbox"/> Rubber flash | <input type="checkbox"/> Varnish |
| <input type="checkbox"/> Glass flash | <input type="checkbox"/> Paint |
| <input type="checkbox"/> Enamel flash | <input type="checkbox"/> Plate |
| <input type="checkbox"/> Imbedded metal | <input type="checkbox"/> Core sand |
| <input type="checkbox"/> Lead deposits | <input type="checkbox"/> Silicate coatings |
| <input type="checkbox"/> Carbon | <input type="checkbox"/> Excess solder |
| <input type="checkbox"/> Brazing flux | <input type="checkbox"/> Ceramic deposits |
| <input type="checkbox"/> Weld spatter | <input type="checkbox"/> Graphite |
| <input type="checkbox"/> Stains | <input type="checkbox"/> Slag |
| <input type="checkbox"/> Heat treat scale | <input type="checkbox"/> Polishing compound |



OR



WITH **PRESSURE BLAST
WET BLASTING**

**TWO
SPEED**

* This ad is your coupon. Check off your problem(s) and mail today for free illustrated literature... application data... case history information!

THE CRO-PLATE COMPANY INC.
747-A WINDSOR STREET
HARTFORD 5, CONNECTICUT

of the propagation of wavefronts on wires. It is one of the virtues of the European system of qualifying for advanced engineering status that tutorial compilations of this type are made available for widespread use, in contrast to the American system under which only the most ambitious students do their own digging in Malcomb, Milnor, Carson and Gilbert.

The adequate, mathematically basic exposition under review, clarified by 178 graphs and diagrams, is grounded in telegraphy and does not stray far from its precincts. While there is a studied attempt at generalization made throughout, and while portions of several chapters are devoted to communication systems responsive to multiple-level, quantized power increments, the work as a whole is tied to on-off, two-current or three-current wire transmission. In that field, it is impeccably thorough.

Carrier-current a-c modulation theory is well expounded, but one looks almost in vain for references to television, radar, computer and telemetering applications of the pulse; these, presumably, are reserved for a tome or tomes to come. Despite Volume One's subtitle: "Avec Extension a la Transmission de l'Information," Roquet is no Gallic counterfoil to Shannon and Wiener.

The Contents

The book is divided into three parts. The first defines transmission terms employed in telecommunication, and addresses itself to signals as conveyors of information, their propagation and their distortion in transmission. The author, whose high position in the European telegraphic consulting committee's standardization work is reflected in his meticulous definitions, has produced a superior pedagogical product in these initial chapters that might well be emulated in the United States.

In the second part, the author considers modulation: the production of electrical phenomena at the point of departure, transient phenomena on the line and demodulation at point of arrival. In the third part, selected concrete problems are introduced as a means of

SERVO MOTORS

from FORD INSTRUMENT for
**EXTREMELY LOW INERTIA AND
HIGH FREQUENCY RESPONSE**



- **STANDARD SERVO MOTORS** in nominal ratings of 10w, 5w, 2½w, 1½w and ½w
- **SPECIALS** to customer requirements.

Ford Instrument's high precision servos are available in high and low voltage models, in 60cy and 400cy designs, for a multitude of applications. With Ford's smooth iron, low-inertia rotors, they offer these advantages:

- Linear torque-voltage characteristics
- Linear torque-speed characteristics
- Withstand continuous stalling
- High torque efficiency

FREE—Fully illustrated data bulletin gives specifications and performance information. Address Dept. IL.



**FORD INSTRUMENT
COMPANY**

Division of Sperry Rand Corporation
31-10 Thomson Ave.
Long Island City 1, N. Y.

Ford Instrument's standard components



Rate Generators



Differentials



Servo Motors



Telesyn Resolvers



Integrators



Telesyn Synchros

Want more information? Use post card on last page.

September, 1955 — ELECTRONICS

indicating how theory may be extended to meet them.

Most of the information in this book is available to transmission engineers in the American and British technical press, but not in so convenient a compilation. The book should be useful to bilingual Canadians and to U. S. French-reading authors, teachers and graduate students; to librarians; to engineers active in communication standards work and to the growing number of American industrial and government technicians who participate in the C. C. I. activities of the International Telecommunications Union.

The only anachronistic feature of this paper-covered, offset-printed book, in approximately 8½" by 11" format, is its price, which, by some esoteric relationship of the corrugated franc and the neoprene dollar, translates into \$7.86.—I. S. COGGESHALL, *Western Union Telegraph Co., New York, N. Y.*

Thumbnail Reviews

Contract Termination Guide, Manufacture Department, Chamber of Commerce of the U. S., 1615 H St. NW, Washington 6, D. C., 60 p, 1954. \$1.00. A guide through the confusion and inconsistencies of government contract termination settlement.

Standards on Electrical Insulating Materials. ASTM, Philadelphia, Pa, 1955, 660 p, \$5.50 (paper). Updates specifications published in 1953 and includes revisions up to Feb. 3, 1955. Includes 60 testing methods, 17 specifications.

Numerical Methods. By Andrew D. Booth. Academic Press Inc., 1955, 195 p, \$6.00. Expounds basic principles of numerical analysis from the point of view of readers interested in learning how to program automatic computers.

Wireless and Electrical Trader Year Book: Radio, Television and Electrical Appliances 1955. Trader Publishing Co. Ltd., London, England, 1955, 304 p, 12/6. Information on British radio-tv sets, receiving and c-r tubes and the radio-tv servicing business. Of interest to overseas buyers wishing to contact British sources of supply.

Basic Electronics. By Van Valkenburgh, Nooger and Neville, Inc. John F. Rider Publisher, Inc., New York, 1955, 560 p (five volumes, paper), \$9.00. Home study course without correspondence question and answer service. Covers components, basic circuits, receivers, transmitters and antenna systems. Very elementary.

Need special transformers fast?

You can get them from us, engineered to your specifications and produced faster than you may think possible.

Our staff of design engineers have long experience in communications. They know how to design around special problems of size, weight, high voltage or temperature; and they understand over-all circuit requirements. They can design what you need.

And our manufacturing and inspection facilities can put the engineers' design into quality-controlled production in a remarkably short time.

When you have a transformer problem, call on

CALEDONIA

ELECTRONICS AND TRANSFORMER CORPORATION

Dept. E-9, Caledonia, N. Y.

SEALING
DIPPING
POTTING
IMPREGNATING



INSULATING
FUNGUSPROOFING
MOISTUREPROOFING
HEAT CONDUCTING

WAXES BIWAX COMPOUNDS

Developed and produced for manufacturers of electronic components and other electrical units.

Specifications and samples available on request.

Information relative to your problem or application will enable us to make suggestions and recommendations.

BIWAX CORPORATION

3445 HOWARD STREET
SKOKIE, ILLINOIS

McGraw-Hill Mailing Lists Will Help You

for Results



Mc GRAW-HILL
DIRECT MAIL LIST SERVICE

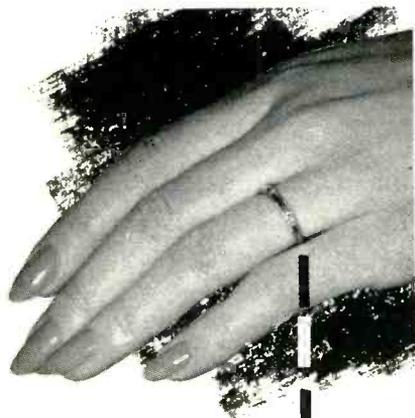
- Merchandise your advertising
- Conduct surveys
- Get inquiries and leads for your salesmen
- Pin-point geographical or functional groups
- Sell Direct
- Build up weak territories
- Aid Dealer relations

Direct Mail is a necessary supplement to a well rounded Business Paper advertising program.

Most progressive companies allocate a portion of their ad budgets to this second medium at the same time as they concentrate on the best business publications.

600,000 of the top buying influences in the fields covered by the McGraw-Hill publications make up our 150 mailing lists. Pick Your prospects out of our Industrial Direct Mail catalogue.

Write for your free copy of our Industrial Direct Mail catalogue with complete information.



A WINDING MACHINE FOR TINY TOROIDS

Tiny toroids — 14 OF THEM — produced on a Boesch Model SM Subminiature Coil Winding Machine are shown fitted inside a SIZE FIVE WEDDING RING.

Consider the importance of this comparison! By producing space and weight-saving subminiature toroids, the Boesch Model SM helps you design subminiaturized equipment.

For coils down to 5/64 ID, wire sizes as fine as #50, IT'S THE BOESCH MODEL SM Toroidal Winding Machine. Some-what larger coils can be wound with wire as heavy as #36.



14K. gold wedding ring courtesy of Shreve, Crump & Low Company, Boston, Massachusetts

Send us your specifications and a core sample. We will show you what our machines can do.

NOW — no licensing, no royalties required in the sale and use of BOESCH Machines.



Want more information? Use post card on last page.

Backtalk

Those Early Days

DEAR SIRs:

FRANK ALEXANDER'S "About Whistlers" (*Backtalk*, p 380, Aug. *ELECTRONICS*), also rings a loud bell in the far recesses of my memory.

In 1918, while researching on r-f detection phenomena for E. J. Simon, Inc., radio contractors, in New York City, I was working with a Marconi magnetic detector, used by the British Marconi Wireless Telegraph Co. for some years prior to 1910 for spark signal detection, but hardly even known of by present day radio engineers.

In it an endless, round belt of insulated fine, soft, iron wires moved slowly through a glass tube carrying a layer of copper wire, and through which the r-f signal current passed. Around this a narrow, many turn secondary coil spool was located at its mid point.

Two U-shaped permanent magnets, with like poles adjacent and at the middle of the coils, sprayed a magnetic field along the iron wire belt, moved by a clock work drive at a speed of about 4 inches per second. The secondary coil was normally connected to a head phone. The r-f currents in the small inner coil annul the hysteresis of the iron and create an induced a-f current in the secondary winding and telephone.

With this magnetic detector I used a three-stage audio amplifier between the secondary and the head phones.

When the band was in motion, a strong and steady hissing noise was heard in the phones which, I deduced, was set up by the 180 degree turning of the molecular magnets in the iron as they passed through the reversed magnetic field at the coil center. I thought this very interesting and demonstrated it to a number of my associates, among whom were, E. J. Simon, Oscar Roos, Ben Liebowitz, Frank Hinners, Joe Freed, Larry Lesh, and possibly Lester Jones if he was there that early.

While nothing ever came of these experiments, the concept of molecular magnets in the soft iron, twisting end-wise on their axes to pro-

FIVE STAR ELECTRICAL COMPONENTS



COILS

Wound to Your Specifications



SOLENOIDS

Light and Miniature Types



RELAYS

Power and Sensitive Types



Send for catalog sheets describing these items in detail. Prompt quotations will be furnished on receipt of your complete specifications and requirements.

THE FIVE STAR COMPANY

10 WEST MAIN STREET
PLANTSVILLE, CONN.



Measurements Corporation
MODEL 80

STANDARD SIGNAL GENERATOR

2 Mc. to 400 Mc.

Individually Calibrated Direct-Reading Dial

FREQUENCY ACCURACY: $\pm 0.5\%$

OUTPUT VOLTAGE: 0.1 to 100,000 microvolts.

OUTPUT IMPEDANCE: 50 ohms.

MODULATION: Amplitude modulation 0 to 30%. Internal modulation 400 and 1000 cycles. Provision for external pulse and amplitude modulation.

POWER SUPPLY: 117 volts, 50/60 cycles. 70 watts.

MEASUREMENTS CORPORATION

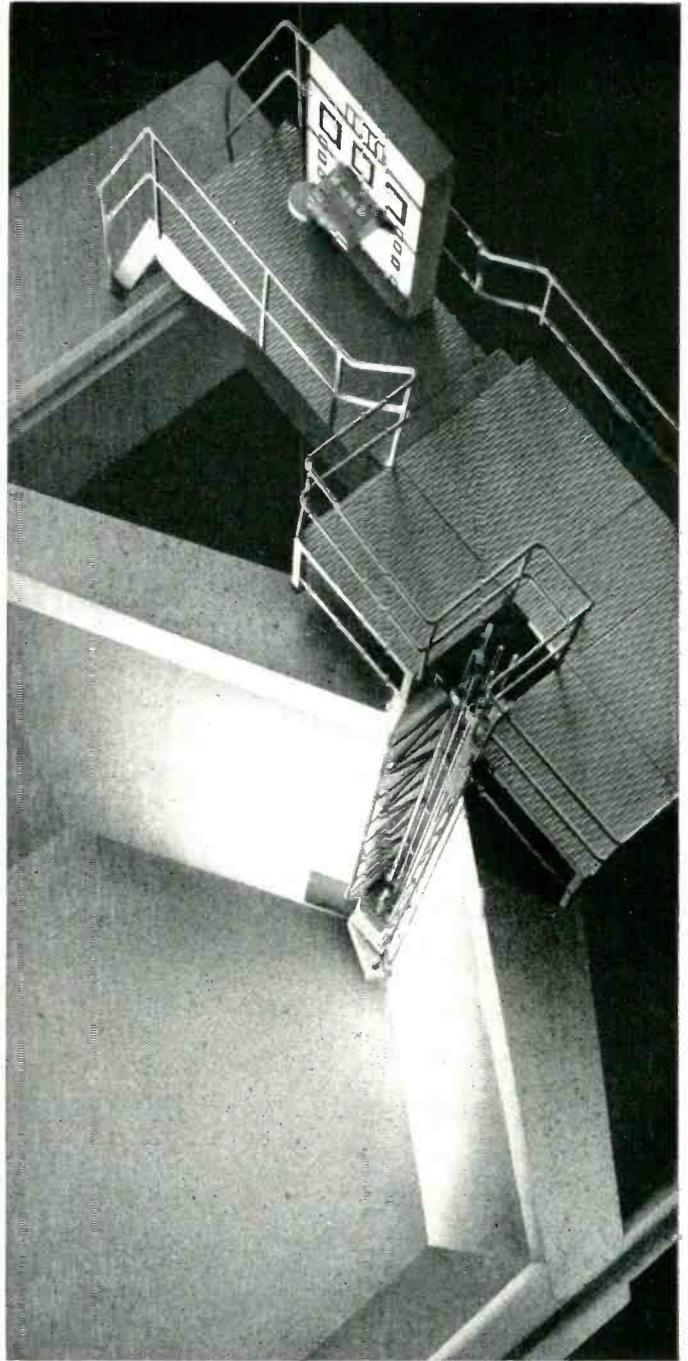
BOONTON



NEW JERSEY

Want more information? Use post card on last page.

From
miniature battery
to
massive
atomic reactor...



Storing electrical power in small packages, or helping to make atomic power practical... each demands advanced technology. And these are but two of the *hundreds* of complex tasks the AMF organization performs every day.

The highly specialized yet widely diversified activities of some 35 engineering and production

facilities provide AMF with a wealth of experience that covers nearly every field of industry. And it is immediately available to *you*.

Call upon AMF with your problem. See for yourself why this all-around experience in answering the needs of government and industry alike has made AMF the "can do" company.

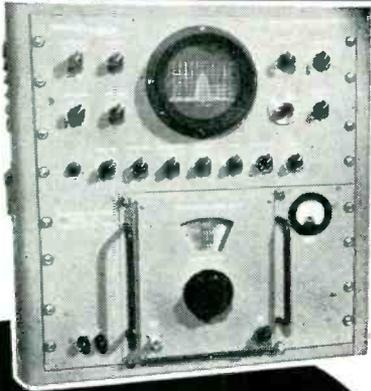
AMF HAS EXPERIENCE YOU CAN USE!



AMERICAN MACHINE & FOUNDRY COMPANY, Defense Products Group, 1101 N. Royal Street, Alexandria, Virginia
Executive Offices—AMF Building • 261 Madison Avenue, New York 16, N. Y.

NEW

PANORAMIC SPECTRUM ANALYZER SPA-1



now 50 mc
to 4000 mc

WITH TWO TUNING HEADS

Check these outstanding features:

- Low noise input, less than 0.5 microvolts across 50 ohms, for high usable sensitivity
- 10 MC maximum sweepwidth, continuously reducible to 0 MC
- Continuously variable differential markers, ± 50 kc to ± 5 mc
- Continuously variable resolution (I.F. bandwidth 9 kc to 100 kc)
- 1 cps to 60 cps sweep rate, continuously variable with single control.
- DC coupled video amplifier for analysis of CW signals.
- Three selectable amplitude scales, 40 db log, 20 db linear and square law.
- Low frequency swept oscillator provides high inherent stability.
- Excellent construction and design make the equipment unparalleled for minimum down time.
- Optional bezels and CRTs for visual examination or camera use.
- Low cost.

Tuning Heads

RF-2 50 mc - 250 mc
RF-3 220-mc - 4000 mc in five ranges

Inquiries invited on Panoramic Spectrum Analyzers for special problems. Write today for descriptive literature.



- Makers of
- Panadapter
 - Analyzer
 - Panoramic Sonic Analyzer
 - Panoramic Ultrasonic Analyzer

10 South Second Avenue, Mount Vernon, N. Y.
MOUNT VERNON 4-3970

Want more information? Use post card on last page.

BACK TALK

(continued)

duce the hissing noise, has stuck strongly in my memory.

During this same investigation, I plotted (and still have) characteristic voltage-current curves of many kinds of electrolytic and contact detectors. These curves look surprisingly like those of our modern transistors and I believe that the electrolytic types might well deserve further scrutiny in this light, especially with an insulated grid electrode for controlling the current flow. I might also add that my first patent #1,104,065 of July 21, 1914, and filed Oct. 5, 1910 covers broadly the original "cat whisker" detector, so much used in the earliest days of radio broadcasting, and so suggestive of modern transistors.

B. F. MIESSNER
President

Miessner Inventions, Inc.
Morristown, N. J.

EDITOR'S NOTE: Recent letters in *Backtalk* have related a number of anecdotes of the early days of the art and industry (perhaps more art then and industry now).

Although the name of this department was coined to cover letters back from readers it seems most appropriate to cover also subjects away back in history.

Height-Finding Radar



Radar technicians of Royal Canadian Air Force who have manned the northern radar fence installations are here shown taking further instructions from General Electric engineers on use of the new MPS-14 mobile height-finder radar that can detect planes three times as far as previous units. The equipment was developed in collaboration with Rome Air Development Center

TRANSIT CASES

FOR ELECTRONIC EQUIPMENT

MIL SPECS
OR
COMMERCIAL
REQUIREMENTS



USING
SANDWICH MATERIAL
AND
MOLDED FIBERGLAS

PRODUCTS

- Artic Shelters • Reflector Panels
- Weather Shields • Specialized Products

CUSTOM DESIGNED
AND MANUFACTURED

GUARANTEED →

Skycrane Inc.
PORT JERVIS, NEW YORK



INCREASED INSULATION BETTER CONNECTIONS

JONES BARRIER Terminal Strips

Leakage path is increased—direct shorts from frayed terminal wires prevented by bakelite barriers placed between terminals. Binder head brass, nickel plated. Insulation, molded bakelite.



No. 2-142



No. 2-142-1/4 W

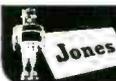


No. 2-142-Y

Shown: Screw Terminals—Screw and Solder Terminals—Screw Terminal above, Panel with Solder Terminal below. For every need.

Six series meet every requirement: No. 140, 5-40 screws; No. 141, 6-32 screws; No. 142, 8-32 screws; No. 150, 10-32 screws; No. 151, 12-32 screws; No. 152, 1/4-28 screws.

Catalog No. 20 lists complete line. Send for your copy.



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

Want more information? Use post card on last page.

September, 1955 — ELECTRONICS

PROFESSIONAL SERVICES

Consulting—Patents—Design—Development—Measurement

in

Radio, Audio, Industrial Electronic Appliances

AIRPAX PRODUCTS CO.

Development Division
Specialists in the
Design and Manufacture of
UNUSUAL TRANSFORMERS AND RELAYS

Middle River Baltimore 20, Md.

ELECTRONIC RESEARCH ASSOCIATES, INC.

"TRANSISTORIZE" YOUR PRODUCT!
Complete Service in consulting, research, develop-
ment, and production on Transistor circuitry, prod-
ucts and instrumentation.

67 East Centre Street Nutley, N. J.
Nutley 2-5410

PICKARD & BURNS, INC.

Consulting Electronic Engineers

Analysis and Evaluation
of Radio Systems
Research, Development and Production
of Special Electronic Equipment
240 Highland Ave. Needham 94, Mass.

ANALYSIS INSTRUMENT CO.

Consultants on Magnetic Problems

Magnetic Materials Tested
Special Magnetic Devices Designed
Magnetizing & Testing Equipment Supplied
P. O. Box 7 Pequanock, New Jersey

ERCO RADIO LABORATORIES, INC.

Radio Communications Equipment

Engineering - Design - Development - Production
Our 27th Year in Air to Ground
Communications and Radio Beacons
Garden City • Long Island • New York

ALBERT PREISMAN

Consulting Engineer

Television, Pulse Techniques, Video
Amplifiers, Phasing Networks,
Industrial Appliances
Affiliated with
MANAGEMENT-TRAINING ASSOCIATES
3224 - 16th St., N. Y. Washington 10, D. C.

H. O. BIXBY ASSOCIATES

Consultants to the Electronic Industry

SURVEYS—PROMOTIONS—LIAISON
PERSONNEL PLACEMENT—TECHNOLOGY
238 Main St. Cambridge 12, Mass.
ELiot 4-8404

HANSON-GORRILL-BRIAN INC.

Product & Mfg. Development

ELECTRICAL - ELECTRONIC
HYDRAULIC - MECHANICAL
One Continental Hill Glen Cove, N. Y.
Glen Cove 4-7300

KARL F. ROSS

*Registered Patent Agent
(U. S. and Canada)*

Specializing in electronic patent matters
305 Broadway, New York 7, N. Y. WOrth 2-3449

THOMAS H. BRIGGS & ASSOCIATES

Electronics Consultants

Electron Tubes - Automation - Product Surveys
Tube Materials & Reliability - Servo-mechanisms
Engineering and production facilities.
Box 185 RD-2 Norristown, Penn. Tel. No. 8-7671

THE KULJIAN CORPORATION

*ELECTRONICS DIVISION
Consulting Electronic Engineers*

Research, Development, Production of
Automatic Controls — Special Instrumentation
1200 No. Broad St., Philadelphia 21, Pa.
Stevenson 2-9000

THE TECHNICAL MATERIAL CORPORATION

Communications Consultants

Systems Engineering
General Offices and Laboratory
700 Penimore Rd., Mamaroneck, N. Y.

CROSBY LABORATORIES, INC.

Murray G. Crosby & Staff

Radio - Electronic
Research Development & Manufacturing
Communication, FM & TV
Robbins Lane, Hicksville, N. Y.
Hicksville 3-3191

Measurements Corporation

Research & Manufacturing Engineers

HARRY W. HOGG MARTIAL A. HONNELL
JOHN M. VAN BUREN
Specialists in the Design and
Development of Electronic Test Instruments
Boonton, New Jersey

TELECHROME, INC.

Electronic Design Specialists

COLOR TELEVISION EQUIPMENT

Flying Spot Scanners, Color Synthesizers, Keyers,
Monitors, Oscilloscopes and Related Apparatus
J. R. Poukin-Curman, Pres. & Ch. Engr.
88 Metrick Rd. Amityville, L. I., N. Y.

DELAWARE PRODUCTS CO.

Analog Voltage to Digital Conversion
Digital Voltage Recording Systems

Design-Development-Manufacturing

300 Broadway Camden 3, N. J.

MERCURY ELECTRONIC COMPANY

Power Supplies

Electronic • Magnetic • Static

Red Bank New Jersey

WALSH ENGINEERING CO.

Design and Prototypes
of Electronic Apparatus

in which Transformers and Magnetic Components
are especially important factors in Performance,
Size, Weight and/or Cost

34 DeHart Place Elizabeth, N. J.
Elizabeth 2-7600

EDGERTON, GERMESHAUSEN & GRIER, INC.

Consulting Engineers

Stroboscopy — Transient Oscillography
Photoelectricity — Pulse Techniques — Timing
High Speed and Electronic Flash Photography
Telemetering - Industrial Television Applications
160 Brookline Avenue Boston 15, Mass.

NEW ROCHELLE TOOL CORP.

FOR CERTIFICATION OF INDUCTION
AND DIELECTRIC HEATING EQUIPMENT
IN ACCORDANCE WITH F. C. C. RULINGS

Mobile Test Unit Available Entire U. S.

320 Main St. New Rochelle, New York
Phone NE 2-5555

WHEELER LABORATORIES, INC.

Radio and Electronics

Consulting — Research — Development

R-F Circuits — Lines — Antennas

Microwave Components — Test Equipment

Harold A. Wheeler and Engineering Staff
Great Neck, N. Y. HUnter 2-7876

Eldico of New York, Inc.

Pioneers of Television Interference Elimination from
Transmitters, Induction Heaters, Diathermy and etc.

Donald J. S. Merten & Engineering Staff

72 E. Second St. Mineola, L. I., N. Y.
Pioneer 6-5212

NIAGARA ELECTRON LABORATORIES

CONSULTATION - DESIGN - CONSTRUCTION
MFG. THE THERMOCAP RELAY

Specializing in solution of problems of electronic
and electro-physical instrumentation for the re-
search or analytical laboratory. Industrial plant
problems also invited.

Andover, New York Cable Address: NIATRONLAB

YARDNEY LABORATORIES

Research-Design-Development

Electro-Chemical Generators of Energy

40-46 Leonard Street Worth 6-3100
New York 13, N. Y.

he's working for you



THIS FELLOW IS TRAINED IN YOUR BUSINESS. His main duty is to travel the country — and world — penetrating the plants, laboratories and management councils . . . reporting back to you every significant innovation in technology, selling tactics, management strategy. He functions as your all-seeing, all-hearing, all-reporting business communications system.

THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine — the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it" — "they" being all the industry's front line of innovators and improvers — and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you — giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.



McGraw-Hill PUBLICATIONS

MANUFACTURER'S REPRESENTATIVES

As a service to readers, ELECTRONICS presents the advertisements for some of the leading manufacturer's representatives in the electronics industry. These firms are qualified to help the Manufacturer with his distribution problems; the Buyer with his product needs.

S. BOSWORTH & CO.

Engineering Sales Representatives

PRECISION ELECTRONIC INSTRUMENTATION
COMPUTERS—CONTROLS

Industrials—Aircraft—Government—Universities
In Metropolitan New York and Adjoining Areas
214 Old Country Road, Hicksville, L. I., New York
Hicksville 4-2232

PAUL HAYDEN Associates

ENGINEERING

WAREHOUSING

Calling on **JOBBER'S**
INDUSTRIALS
AUDIO SPECIALISTS

P. O. Box 331, EAST POINT, GA.
Telephone (Atlanta): FAirfax 9046
BRANCH OFFICES AT
Burlington, N. C. • Birmingham, Ala. • Mt. Dora, Fla.



SAMUEL K. MACDONALD, INC.

Manufacturers representatives over 25 years
1531 SPRUCE STREET, PHILA. 2, PA.

Territory: Pennsylvania • New Jersey
Delaware • Maryland
Virginia • West Virginia
District of Columbia

Other Offices:
Pittsburgh
Baltimore
Washington, D.C.



McGraw-Hill Mailing Lists Will Help You

- Merchandise your advertising
- Conduct surveys
- Get inquiries and leads for your salesmen
- Pin-point geographical or functional groups
- Sell direct
- Build up weak territories
- Aid dealer relations

Direct Mail is a necessary supplement to a well rounded Business Paper advertising program.

Most progressive companies allocate a portion of their ad budgets to this second medium at the same time as they concentrate on the best business publications.

600,000 of the top buying influences in the fields covered by the McGraw-Hill publications make up our 150 mailing lists. Pick YOUR prospects out of our Industrial Direct Mail catalogue.

Write for your free copy of our Industrial Direct Mail catalogue. With complete information.

CONTACTS

FOR THE FIELD OF ELECTRONICS

Complete Service FOR SMALL PARTS

- TOOLS
 - STAMPINGS
 - ASSEMBLIES
 - SOLDERING
 - PLATING
 - PORCELAIN ENAMELING
 - BRIGHT ANNEALING
- Established 29 Years.

ORBER MANUFACTURING CO.
DUNNELL LANE PAWTUCKET, R. I.

One inexpensive modern device...

can frequently help speed up operation and maintenance or production.

One product advertised in the "Contacts" Section may be the answer to your problem... a real money-saver.

To be informed—and reminded—on modern aids to economical operation, maintenance and production, check "Contacts" advertising regularly... every issue.

PLASTIC CUSTOM MOLDING

- Styrene
- Lucite
- NYLON
- Butyrate
- Acetate
- Vinylite
- Polyethylene

Highly integrated organization with newest equipment for automatic injection molding your plastic parts, products or packaging from planning stage to finished product. Equipped to produce low cost prototype single cavity molds. Inquiries invited.

TELL PRODUCTS Corp.

A Division of Tell Mfg. Co., Inc.
520 Cary St., Orange, N. J.

• PLATING • Precision

Industrial
GOLD and SILVER
of all Description
GOVERNMENT CERTIFIED

GARREPY PLATERS INC.

11-19 Bartlett St., Worcester, Mass.
PLeasant 3-6472

\$175
f.o.b.



SHORTED TURN INDICATOR

FOR UNMOUNTED COILS
SENSITIVE, RUGGED, NON-SHOCKING

Kartron LEhigh 9-4606
Huntington Beach, Calif.



SAUERISEN CEMENTS

for FASTER ASSEMBLY ON
Radio Tubes

Leading electrical manufacturers use Sauerisen Cements for assembling, sealing and insulating.

Send unassembled parts or sketch for technical advice.

Write for Catalog

Sauerisen Cement Company • Pittsburgh 15, Pa.

World's Only Recorder of its Kind WALKIE — RECORDALL 8 LB SELF-POWERED BATTERY RECORDER

- AUTOMATIC RECORDING UP TO 4 HOURS.
 - PICKS UP WITHIN 50 FT. RADIUS.
 - LIGHTEST — 8 LBS.
 - VOICE ACTIVATED "SELF-START-STOP"
- Permanent, unalterable, indexed recording at only 3c per hr. Records in closed briefcase with hidden mike —conferences, lectures, dictation, 2-way phone—while walking, riding, flying.
- MILES REPRODUCER CO., INC.
812 Broadway, N.Y. 3, N.Y. Dept. E

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.



**Positions Vacant
Positions Wanted
Part Time Work**

**Civil Service Opportunities
Selling Opportunities Wanted
Selling Opportunities Offered**

**Employment Agencies
Employment Services
Labor Bureaus**

DISPLAYED

The advertising rate is \$21.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured 7/8" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

RATES

\$2.10 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Box Numbers—counts as 1 line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Not subject to Agency Commission.

UNDISPLAYED

Send NEW ADS to ELECTRONICS, 330 W. 22nd St., N. Y. 36, N. Y., for October issue closing September 1st

PROGRESSIVE ENGINEERS LOOK WEST

Qualified Electronic and Electro-Mechanical engineers find happy association with a Western electronics pioneer and leader.

*design
development
production*

Commercial and military projects. Radar, DME, Communications, Noise, Test Equipment including color T.V. —Many others with real interest & challenge. Relocation expenses—excellent working conditions—Central location. Scheduled reviews & advances. Fine insurance plan. Move should not disturb urgent military projects.

Send complete resume, income history & requirements to engineering employment mgr.

Hoffman LABORATORIES, INC.

(A SUBSIDIARY OF HOFFMAN RADIO CORP.)

3761 SO. HILL ST.

LOS ANGELES 7, CALIF.

DRAKE PERSONNEL

National Placement Center for
**EXECUTIVE AND
TECHNICAL PERSONNEL**

**General and Plant Managers
Plant Superintendents—Foremen
Accounting—Staff Personnel
Engineers: Design—Production
Sales Managers—Engineers**

Please outline briefly your experience or personnel needs to:

John Cope
220 S. State St., Chicago 4, Ill.
HARRISON 7-8600

"PHYSICIST"

\$6600-7200

Heavy math, little chemistry. Supervise small testing lab. Knowledge of instrumentation necessary. Several other good openings.

Contact BOB POORE

O'SHEA EMPLOYMENT SYSTEM

"America's Largest"
64 E. Jackson, Chicago, Ill. Tel. WAbash 2-1884

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

Electronic Design Engineers

Two unusual openings which provide opportunity to gain varied experience in a small laboratory in which each man contributes to the projects of others, and maintains full responsibility for his own.

Work is in development and design of electronic test equipment over the frequency range of 100 kilocycles to 2000 megacycles. It requires a minimum of 5 years experience in design and development of electronic equipment, with facility in the use of precision test equipment.

The professional advantages are many . . . the future assured . . . in working with a universally known and respected organization, producing equipment essential to the electronic progress of America. Living conditions are excellent, in the lakeland region of northern New Jersey—only 50 minutes from New York City.

Please send resumes, including salary requirements, to W. C. Moore, Engineering Manager. Convenient interviews will be arranged in New York for qualified applicants.

BOONTON RADIO

Boonton



CORPORATION

New Jersey

★ MANUFACTURERS

Let us handle technical sales representation of your products

★ INVENTORS

We will share the cost of protecting your invention if accepted for commercialization

We Specialize in Electronics, Nucleonics, Instrumentation, Servomechanisms & Cybernetics.

R. W. HODGSON CO.

Technical Sales Representation & Research & Development Engineering

3406 W. Washington Blvd. Los Angeles 18, Calif.
REpublic 2-2651

CHIEF ELECTRONICS ENGR. \$12-15,000—NO FEE

Handle overall technical and administrative functions of large research organization. Must have top references and know complete function of a research, design and development organization.

CONTACT J. J. COOPER
O'SHEA EMPLOYMENT SYSTEM
"AMERICA'S LARGEST"

64 E. Jackson, Chicago, Ill. Tel.—WAbash 2-1884

MANUFACTURERS REPRESENTATIVE

Long established highly successful sales organization seeks additional electronic components. Coverage New York State.

RA-6878, Electronics
330 W. 42 St., New York 36, N. Y.

POSITIONS VACANT

A medium-sized southern New England manufacturer of technical papers used by the electronics industry has a challenging position for an electrical engineer under 35. Some selling or administrative experience is desirable. He must have a strong persuasive personality and be capable of working with both technical and nontechnical people. Salary open. Include resume of personal history, education, and experience with introductory letter to box P-7081, Electronics.

Faculty Position, teaching, research (Solid State Physics) salary, rank, dependent upon qualifications. Graduate Assistantships (Teaching, research, or combination—Solid State Physics) leading toward MS. Out-of-State tuition waived. \$1600-1800 for 12 months. Z. V. Harvalik, Physics Dept., University of Arkansas, Fayetteville, Ark.

Assistant Professor of Electrical Engineering. University of North Dakota, Grand Forks, North Dakota. Duties: teaching electronic and communications courses to undergraduate students. An advanced degree plus some teaching or industrial experience preferred. Submit resume of education and experience to Head, Electrical Engineering Dept.

POSITIONS WANTED

Component Parts Engineer specialized in small electronics parts with a practical reliability philosophy for missile environments. Fifteen years experience in aircraft and missile electronics. Desires a responsible position where evaluation and test methods can be of value. PW-7311, Electronics.

Chief Engineer, cathode ray tubes, heavy on design, factory processing, screening and aluminizing. Cost and production conscious. Desire top level position. Willing to do consultant work on a limited time basis. PW-7389, Electronics.

SELLING OPPORTUNITY WANTED

Manufacturers Representative covering Middle Atlantic area, with three years experience as radio engineer and four years experience in sales and administration with large company and one year as manufacturers representative, desires to take on additional lines. RA-7277, Electronics.

OVER 500
EXPERIENCED ENGINEERS AND SCIENTISTS*
CHOSE DESIGN AND DEVELOPMENT CAREERS
WITH RCA DURING THE LAST YEAR!

You, too, can find your future, in one of these fields:

- SYSTEMS ENGINEERING
- ELECTRONIC DATA PROCESSING
- GUIDED MISSILE ELECTRONICS
- AVIATION ELECTRONICS
- ELECTRON TUBES

*Plus hundreds of recent engineering graduates, field service engineers, and other categories of engineers.

FIELDS OF ENGINEERING ACTIVITY	TYPE OF DEGREE AND YEARS OF EXPERIENCE PREFERRED											
	Electrical Engineers			Mechanical Engineers			Physical Science			Chemistry Ceramics Glass Technology Metallurgy		
	1-2	2-3	4+	1-2	2-3	4+	1-2	2-3	4+	1-2	2-3	4+
SYSTEMS <i>(Integration of theory, equipments, and environment to create and optimize major electronic concepts.)</i>												
AIRBORNE FIRE CONTROL			W							W		
DIGITAL DATA HANDLING DEVICES			C			C				C		
MISSILE AND RADAR			M			M				M		
INERTIAL NAVIGATION			M			M				M		
COMMUNICATIONS			C I							C I		
DESIGN • DEVELOPMENT												
COLOR TV TUBES —Electron Optics—Instrumental Analysis—Solid States (Phosphors, High Temperature Phenomena, Photo Sensitive Materials and Glass to Metal Sealing)	L	L	L	L	L	L	L	L	L	L	L	L
RECEIVING TUBES —Circuitry—Life Test and Rating—Tube Testing—Thermionic Emission	H	H	H		H	H		H	H		H	H
SEMI-CONDUCTORS —Transistors—Semi-Conductor Devices	H	H	H				H	H	H			
MICROWAVE TUBES —Tube Development and Manufacture (Traveling Wave—Backward Wave)		H	H		H	H		H	H		H	H
GAS, POWER AND PHOTO TUBES —Photo Sensitive Devices—Glass to Metal Sealing	L	L	L	L	L	L	L	L	L	L	L	L
AVIATION ELECTRONICS —Radar—Computers—Servo Mechanisms—Shock and Vibration—Circuitry—Remote Control—Heat Transfer—Sub-Miniaturization—Automatic Flight—Design for Automation—Transistorization	C X	C F X	C F X	C X	C F X	C F X	C X	C F X	C F X	C F X		
RADAR —Circuitry—Antenna Design—Servo Systems—Gear Trains—Intricate Mechanisms—Fire Control	C X	C F X	C F X	C X	C F X	C F X	C X	C F X	C F X	C F X		
COMPUTERS —Systems—Advanced Development—Circuitry—Assembly Design—Mechanisms—Programming	C	C F X	C F X	C	C F	C F X	C	C F	C F	C F		
COMMUNICATIONS —Microwave—Aviation—Specialized Military Systems	C	C F	C F		C F	C F		C F	C F	C F		
RADIO SYSTEMS —HF-VHF—Microwave—Propagation Analysis—Telephone, Telegraph Terminal Equipment		I F	I F		I F	I F		I F	I F			
MISSILE GUIDANCE —Systems Planning and Design—Radar—Fire Control—Shock Problems—Servo Mechanisms		M F	M F		M F	M F		M F	M F			
COMPONENTS —Transformers—Coils—TV Deflection Yokes (Color or Monochrome)—Resistors	C	Z C X	Z C X	C	Z C	Z C	C	Z C	Z C		Z	Z
MACHINE DESIGN Mech. and Elec.—Automatic or Semi-Automatic Machines		L	L		L	L		L	L			

Location Code: C—Camden, N.J. F—Florida H—Harrison, N.J. I—International Div. L—Lancaster, Pa. M—Moorestown, N.J. W—Waltham, Mass. X—Los Angeles, Calif. Z—Findlay, Ohio

Modern benefits program . . . Liberal relocation assistance.

Please send resume of education and experience, with location preferred, to:

Mr. John R. Weld, Employment Manager
 Dept. A-15J, Radio Corporation of America
 30 Rockefeller Plaza, New York 20, N. Y.



RADIO CORPORATION of AMERICA

Copyright 1955 Radio Corporation of America

CHOOSE A CAREER OF

Achievement
WITH

Admiral

OPPORTUNITIES that offer stability and an assured future. You will work with the most modern electronic equipment and a staff of engineers who are leaders in the field.

To qualify, you must have had previous experience in design and development of communications equipment. Men selected will be given intermediate or advanced level assignments in either a TV, radio or government equipment lab. Positions available for engineers with the following backgrounds:

★ **TEST EQUIPMENT**

Design of electronic test equipment and associated circuits for TV receivers and government electronic equipment.

★ **UHF COMMUNICATIONS**

Applied development and design of military communications apparatus for both transmitters and receivers.

★ **RADAR INDICATOR SYSTEMS**

Development and design to include fire control equipment in the microwave region.

★ **TELEVISION SYSTEMS AND COMPONENTS**

HV Transformers, coils, amplifiers, deflection yokes and tuners as applied to color and monochrome TV

★ **RESEARCH AND DEVELOPMENT**

Engineers with ability to apply fundamental principles of engineering to solving original problems of more than average technical difficulty related to communications projects.

To aid our engineers in their progress, Admiral also provides financial support for advanced education as well as other liberal employee benefits. You will have the opportunity to qualify for excellent salaries commensurate with your ability and experience.

Please forward complete resume to Mr. W. A. Wecker, Personnel Division

Admiral Corporation

3800 W. Cortland St.
Chicago 47, Illinois

ENGINEERS

**ELECTRONIC
and
MECHANICAL**

The Radio and Television Department of General Electric, situated in beautiful Electronics Park, is expanding its staff of development and product design engineers.

Those graduate engineers who qualify for current openings will find excellent opportunities for professional development through association with the outstanding engineers and scientists concentrating on research, development and design in all branches of the electronics industry.

Electronics Park is headquarters for the Electronics Division of GE, including the Electronics Laboratory, Radio and Television Department, Semiconductor Products, Communications Equipment, Broadcast Equipment, Cathode Ray Tube Department, Components Department and Government Equipment Department.

Salary scales for engineers are strictly competitive, and based on individual ability and experience. And, in addition to its comprehensive system of benefits, General Electric is noted for its stability.

Current openings include:

**ELECTRONICS ENGINEERS
ENGINEERING SUPERVISORS
MECHANICAL ENGINEERS**

VHF and UHF Head-End Design
Audio and High-Fidelity Products
Advanced Development
Deflection Component Design
Deflection Systems
Color Television
Transistor Circuits
Metal-forming and Plastics

Please send complete resume to:
MR. JAMES STARK

GENERAL  ELECTRIC

Electronics Park,
Syracuse, N. Y.

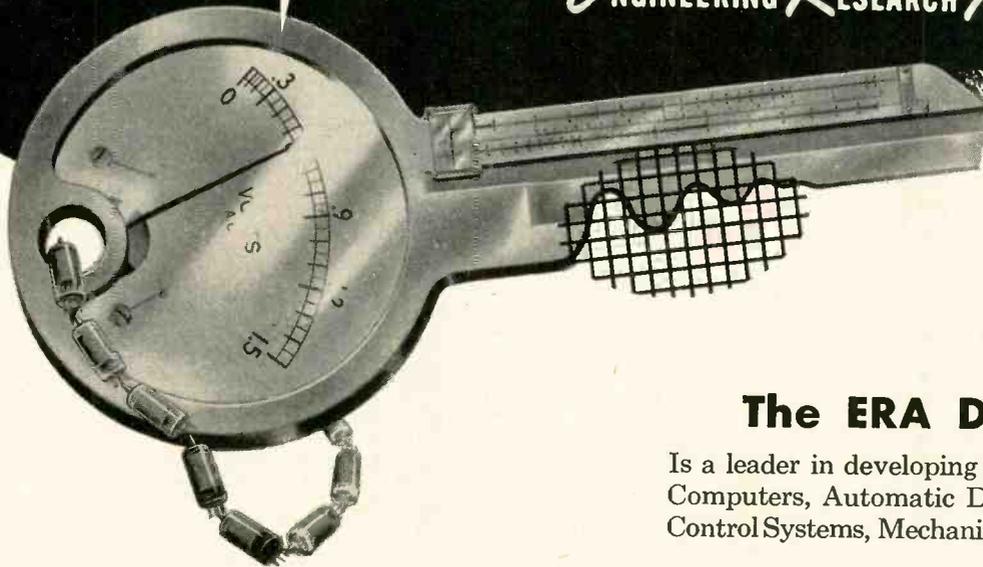
the Key
to your
future...

ELECTRONIC **ENGINEERS** MECHANICAL

opportunities better than ever at

Remington Rand

ENGINEERING RESEARCH ASSOCIATES DIVISION



The ERA Division

Is a leader in developing Electronic Digital Computers, Automatic Data-Handling and Control Systems, Mechanisms, and Weapons.

Everything you want in a job—

Stimulating Work

Most of our engineers are having the time of their lives doing creative research and development on important new applications in mechanical and electronic engineering. Men work as project teams, and each man learns all aspects of his project. Pulse circuits, magnetic cores, transistors, printed wiring, miniaturization, and precise mechanisms are used in designing computers, automatic data-handling and control systems, mechanisms, and special weapons. Other excellent engineering jobs are available in production, testing, specifications, quality control, contract administration, and technical writing.

Advancement

ERA plans to *triple* its staff. Opportunities for promotion are sure to come rapidly for years.

Good Pay from the Start

We offer the highest starting salary possible considering your qualifications for the job. Experience need not be in computers.

Good Living

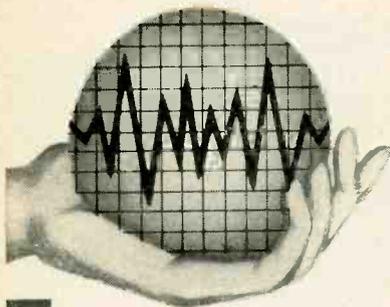
Most ERA engineers own their homes. Within 15 minutes they can drive to work, to downtown shopping, or to the country. The University of Minnesota offers evening courses and Big Ten sports. Minneapolis Symphony concerts are a vital force in the community. Minnesota's forests are dotted with 10,000 cool lakes, many nearby. Hunting, fishing, swimming, and boating are excellent. You will enjoy living in Minnesota's vacation land.

Send an outline of your training and experience to Dept. 54:

Remington Rand
DIVISION OF **SPERRY RAND** CORPORATION

ENGINEERING RESEARCH ASSOCIATES DIVISION

1902 W. Minnehaha Avenue
Saint Paul W4, Minnesota



ENGINEERS

How Realistic Are You About Your Future In Electronics?

As the electronics industry grows from \$9 billion to \$20 billion in the next 10 years, will you be growing with it?

In answering, consider the extent to which your personal progress is dependent on the progress of the company you are with... and the following facts about Sylvania:

- Sylvania has expanded to 45 plants and 16 laboratories in 11 states
- In 6 years, the electronics industry grew 24%; Sylvania grew 32%
- Since 1949, Sylvania has doubled its engineering staff and tripled its sales

Sylvania's success story is the story of its creative engineers. These men of talent are given wide latitude to experiment... every facility to test original designs... and are rapidly advanced in the company as is shown by the fact that the average age of high level officials at Sylvania is only 45.

If you are realistic about your future, look into the opportunity now open to join Sylvania... and be high in your profession 10 years from now.

WALTHAM Engineering

Majors in E.E., M.E., Math, Physics. Research & Development experience in —

- Countermeasures
- Systems Analysis
- Transistor Applications
- Noise Studies
- Antenna Res. & Dev.
- Systems Development
- Mechanical Design
- Miniaturization
- Digital Computer Circuits & Systems
- Circuit Design
- Shock & Vibration
- Technical Writing
- Missile Analysis

Missile Systems Laboratory

- Radar Research & Development
- Missile Guidance & Ground Equipment Analysis
- Systems Evaluation Operations Research

BUFFALO Engineering

Majors in E.E., M.E., or Physics. Experience in Product Design and Advanced Development in —

- Circuit Design
- Systems Development
- Pulse Techniques
- F.M. Techniques
- Equipment Specifications
- Components
- Microwave Applications
- Servo Mechanisms
- Subminiaturization
- Mechanical Design
- Shock & Vibration
- Heat Transfer

**INTERVIEW & RELOCATION
EXPENSES
WILL BE PAID BY SYLVANIA**

Sylvania provides financial support for advanced education as well as liberal insurance, pension and medical programs.

Please forward resume to: Professional Placement Supervisor

SYLVANIA ELECTRIC PRODUCTS INC.

Thomas A. Tierney
100 First St.
Waltham, Mass.

Randall A. Kenyon
175 Great Arrow Ave.
Buffalo 7, N. Y.



Your inquiries will be answered within 2 weeks

UNIVERSITY of MICHIGAN ENGINEERS and SCIENTISTS

Unusual opportunities for outstanding and experienced men are available at the University of Michigan's Willow Run Research Center. Research Engineers and Physicists with advanced degrees and/or experience in the fields of:

- DIGITAL COMPUTER • LOGICAL DESIGN • INFRARED • ACOUSTICS • DIGITAL COMPUTER PROGRAMMING • ELECTROMAGNETIC THEORY • COMMUNICATIONS CIRCUIT DESIGN • COMPONENT DEVELOPMENT • RADAR • OPTICS ENGINEERING • SYSTEMS DESIGN

Salary commensurate with training and experience. Excellent working conditions. Liberal vacation policy along with other fringe benefits. Unusual opportunity to carry on University graduate studies while working full time. Moving expenses paid. U. S. Citizenship required.

Write, giving details of education and experience, to

A. J. Procassini
University of Michigan
Willow Run Research Center,
Ypsilanti, Michigan



ENGINEERS:

Take it from
RALPH S. HAWKINS,
B.S.E.E., Cornell
University '39

**No
frustrations
at National**

Mr. Hawkins started with National in 1940 testing equipment and writing instruction books. He advanced to Project Engineer on teletype and facsimile equipment development, then to chief engineer of the Communications Receiver Department, and most recently became Staff Engineer. One reason for his steady and rapid progress is the combination of diversified opportunities and the cooperation of superiors that exists at National. It's a combination, says Mr. Hawkins, that makes an engineer's association with National a pleasant and profitable one.

Opportunities at National Now for...

**PROJECT ENGINEERS
SENIOR ENGINEERS**

SEND YOUR RESUME TODAY TO Mr. John A. Bigelow



NATIONAL COMPANY, INC.

58 Sherman St.

Malden, Mass.

Bendix OFFERS

3 SENIOR ENGINEERING JOBS WELL WORTH LOOKING INTO...

SYSTEMS PROJECT ENGINEER

6-10 years experience in missile or radar electronic system development. Ability to direct systems engineering at the project level.

Senior Engineer - TEST EQUIPMENT DESIGN

7-10 years experience in development and design of electronic test equipment for complete systems involving microwave and pulse techniques, adaptation of commercial instruments to special applications, preparation of proposals and the actual product design of electronic and electro-mechanical devices. Familiarity with problems of maintenance helpful. Supervisory experience and ability required.

Senior Engineer MECHANICAL DESIGN

6-10 years experience in missile or aircraft electronic package design. Familiarity with vibration and other environmental problems essential.

Here are three especially attractive job opportunities for engineers who want to get on the ground floor in the important, interesting, and challenging phase of a new industry—guided missiles.

Qualified men are given real job responsibilities with Bendix and grow with the development of what is not only the nation's most important weapon system, but a project that will undoubtedly lead to new and im-

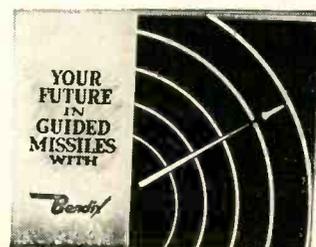
portant long-range commercial application.

At Bendix you will be associated with top missile authorities and have at your command unexcelled engineering and manufacturing facilities. Salaries for these top jobs and other opportunities are open for discussion. Write today to: Mr. W. L. Webb, General Manager, Missile Section, Bendix Products Division, Bendix Aviation Corporation, 401 North Bendix Drive, South Bend, Ind.

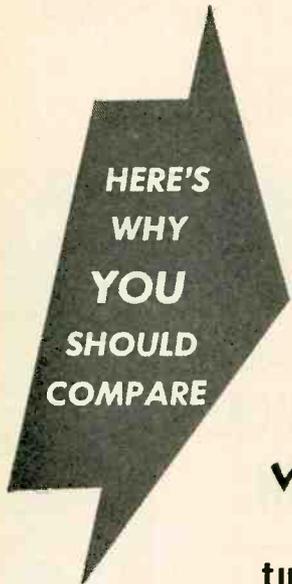
23 OTHER ENGINEERING POSITIONS!

Bendix also offers unusual job opportunities for assistant engineers, junior engineers, and technicians, as well as a score of other assignments. A 30-page book describing in

detail every phase of our guided missile operation will be sent to you on request. If you are interested in guided missiles, this book is bound to interest you. Write for it today.



LET'S FACE IT...



there are thousands of engineering positions open today...*but*—

CROSLEY

DIVISION



✓ New engineering groups being established offering unusual opportunities *NOW*... "on the ground floor."

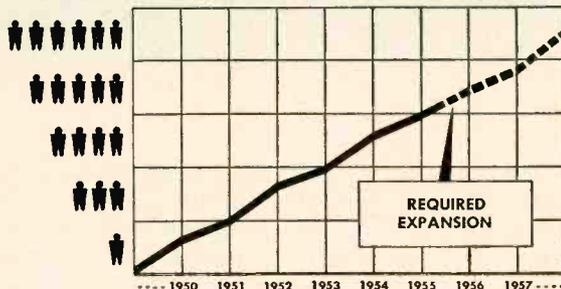
✓ Greater advancement opportunities assured by the continued expansion of this young, vibrant engineering organization.

PRESENT REQUIREMENTS*

Electronics and Mechanical Engineers, Physicists and Mathematicians:

- Advanced Research
- Research
- Project
- Advanced Design
- Senior Design
- Design
- Junior

CROSLEY ENGINEERING GROWTH IN PERSONNEL



SOME OF THE FIELDS OF INTEREST TO CROSLEY:

Radar — Servo-mechanisms — Fire Control — Digital Circuitry — Navigation — Communications — Countermeasures — Missile Guidance — Microwave Design — Telemetry

SUBSTANTIAL BENEFITS AVAILABLE TO YOU:

Excellent salaries, fully equipped modern laboratories, paid vacations and holidays, subsidized university educational program, group insurance program for you and your family, retirement plan and adequate housing in desirable residential areas.

Investigate these opportunities by sending resume to:

*U. S. Citizenship required

DIRECTOR OF ENGINEERING
Government Products — Crosley Division,
AVCO Manufacturing Corporation
Cincinnati 15, Ohio

ELECTRONIC ENGINEERS

Research & Development
Physicists - Engineers
(SENIORS)

Experienced in research and development of various radar systems including: beacons, missile guidance and counter measures. Advanced training in applied mathematics, noise theory and probability analysis desirable. EE degree or equivalent required.

FIELD ENGINEERS

(SENIORS)

Local & Field Assignments

Must have EE degree, with 3-5 years experience in one of the following:

- Flight Simulators
- Radar & Sonar Trainers
- Fire Control Radar
- Electronic installation and maintenance.

• EQUIPMENT ENGINEERS

3-5 years experience with at least 3 years in circuit packaging. EE degree with mechanical background.

• APPLICATION ENGINEERS

5-10 years experience on coil and transformer development.

Salary and advancement commensurate with ability; liberal vacation, sick leave, 9 paid holidays, group life, sickness and accident insurance plans, and a worthwhile pension system.

STAVID

Engineering, Inc.

U. S. Highway 22, Watchung, P. O.
Plainfield, N. J.—Plainfield 7-1600

WANTED ELECTRONIC ENGINEERS

Experienced in
Power Supply Design
for Military Applications

One of the country's oldest and largest manufacturers of electronic equipment requires the services of several competent electronic engineers familiar with military specifications and requirements for power supplies. Working environment and surroundings are congenial and stimulating. The company plant is situated in Long Island City.

Our employees are aware of this advertisement. Please furnish written resume and state salary required.

P-7114, Electronics
330 W. 42 St., New York 36, N. Y.

EXPAND YOUR HORIZON!

ELECTRONIC ENGINEERS
ELECTRONIC PHYSICISTS

*Bendix Radio has new,
exceptional opportunities for advancement
while working on:*

RADAR
MISSILE GUIDANCE
AIRBORNE COMMUNICATIONS
MOBILE COMMUNICATIONS
AUTO RADIO

Expand the horizon of your future with Bendix Radio—a leader & pioneer in the electronics field, one that has the knowledge, strength and resources to stay out front during the competitive days ahead! Your part is EASY! Wire, phone, write . . . or send us a post card. Simply state your name, address and phone number, your education and experience. We'll carry the ball from there! All replies held in strictest confidence, and we guarantee speedy action!

Address: Mr. L. H. Noggle
Dept. J
Bendix Radio
Baltimore 4, Md.
Phone: VAlley 3-2200

Bendix Radio

DIVISION OF
BENDIX AVIATION
CORPORATION

Baltimore 4, Maryland

UNIVAC

The FIRST Name

in Complete Electronic Computing Systems

As the UNIVAC takes its place in more and more industries, the REMINGTON RAND DIVISION has greatly expanded its research and development work in order to continue its leadership in electronic computing equipment.

There are many positions recently opened at all levels in all phases of research, design, developments, and application of computing and allied equipment. Even though your training and experience may not be connected with computers, we are willing in many cases to provide the necessary training. Individual cases can be evaluated during interview.

- System Studies
- Logical Design
- New Components
- Solid State Physics
- Semi-conductors
- Magnetic Materials
- Storage Techniques
- Circuit Design
- Pulse Techniques
- Input-Output Devices
- Product Design
- Test Equipment Design
- Computer Development and Design
- High Speed Electro-Mechanical Devices
- System Test and Maintenance

The rapidly expanding engineering program has created many permanent positions paying excellent salaries. These positions offer personal challenge as well as outstanding opportunities for professional development. The possibilities for graduate study in this area are excellent and the company has a liberal plan for reimbursement of tuition expenses. Other company benefits include retirement and group insurance.

Replies Kept Strictly Confidential

FOR INTERVIEW, WRITE TO

Remington Rand

Division of

SPERRY RAND CORPORATION

2300 West Allegheny Ave. Philadelphia 29, Pa.

ELECTRONIC ENGINEERS!

• Big opportunities
• await you at
• Bendix York!

To the Engineer who is a recent college graduate, as well as to those with experience in all phases of advanced design, Bendix York offers opportunities outstanding in its field. As a young and expanding division, Bendix York provides fascinating and challenging assignments. Good salaries, all employee benefits, ideal living conditions in a beautiful suburban area are yours.

• Send resume of Education and Experience to: Mr. L. D. Smith, Employment Supervisor

Bendix

AVIATION CORPORATION

YORK DIVISION

Phone: York 5521 York, Penna.

ELECTRONIC TUBE DIVISION OF WESTINGHOUSE ELECTRIC CORPORATION IN ELMIRA, NEW YORK

OPPORTUNITIES IN TUBE DESIGN, DEVELOPMENT & APPLICATION.

MICROWAVE TUBE DESIGN

MANUFACTURING EQUIP. DESIGN - ELECTRICAL & MECHANICAL

MANUFACTURING ENGINEERING

INDUSTRIAL ENGINEERING

FOR MFG. COST CONTROL

OPPORTUNITIES FOR BETTER LIVING & PROFESSIONAL IMPROVEMENT



Interviews your area, or expenses paid for Elmira interviews send resume to:
R. M. Garrett
Westinghouse Elec. Corp.
P.O. Box 284, Elmira, N.Y.

Burroughs means Business

TO *Qualified*

ENGINEERS & PHYSICISTS

ELECTRICAL ENGINEERS

. . . circuit designers to develop new circuit techniques and/or apply them to advanced systems development that will lead to product design.

MECHANICAL ENGINEERS

. . . mechanism and electronic packaging design and development to meet Government and commercial customer acceptance.

PHYSICISTS

. . . solid state components, with application directed towards electronic devices.

LOGICAL DESIGNERS; Senior

. . . for system design involving inter-connection of basic logical elements to effect arithmetic and logical function of data processing equipment.

THE ABOVE OPENINGS

— are in the fields of Communications, Data Handling, Electronic, or Electro-Mechanical Business Machines . . . including such specifics as High Speed Mechanisms, Paper Handling Devices, Magnetic-Tape Transport Mechanisms, Magnetic-Drum or Tape Applications, Radar, Telemetry, Guided Missiles, Process Control Instrumentation, Digital and Analog Computers, Transistors and Magnetic Amplifiers, Servo Mechanisms and Electronic Packaging Design.

Yes . . . **It Really Pays To Work Where The Best In Everything Is Available To YOU & YOUR FAMILY!**

HERE at Burroughs new Research Center, where highly specialized commercial and government development work is in progress, ENGINEERS and PHYSICISTS who find a special interest in our current openings will discover the opportunity they seek to exercise their keenest creative talents in the field of data handling equipment as well as in the equally challenging allied interests of electronics, automation and instrumentation.

In addition to OPPORTUNITY and RECOGNITION . . . Burroughs offers cooperative educational aid . . . liberal pension plan and all the usual health and hospitalization benefits for you and your family . . . delightfully suburban community life for you and your children, only thirty minutes from Philadelphia.

Paid travel expenses for interview at our NEW Research Center . . . moving and locating expenses.

Write D. A. BOWDOIN, Personnel Section

Burroughs

RESEARCH CENTER
PAOLI, PA., ON PHILADELPHIA'S MAIN LINE

ELECTRONICS

AT CHANCE VOUGHT

Chance Vought Aircraft is continuing to expand its activities in the area of Electronics Systems utilization. Already a recognized leader in the development of surface to surface missiles, Chance Vought is currently undertaking the development of practical electronic systems to further the potential functions of the Regulus Missile projects and the supersonic XF8U-1 Day Fighter. Exceptional opportunities are available in the following fields:

- **SERVOMECHANISMS** . . . Design, develop and test of Stabilization Control Systems. Analysis and design of Inertial Guidance Systems.
- **RADIATION** . . . Aircraft antenna design and development. Model studies. Wave guide component design. Radome measurements and qualifications.
- **LABORATORIES & DESIGN** . . . Packing design of assemblies for manufacturing. Test analysis and definition of components for the environments.
- **INSTRUMENTATION** . . . Systems planning and installation; transducer design and transistor application to telemetering equipment.
- **SYSTEMS** . . . Coordinate installation, modification, acceptance tests of radar fire control, navigation and communication systems.
- **GUIDANCE** . . . Radar, beacon, computer design for missiles and surface and sub-surface vessel application.
- **RELIABILITY** . . . Test and analyze environmental effects on aircraft components and systems; define reliability criteria.

THE SCOPE of the comprehensive electronics design programs under way at Chance Vought assures the qualified engineer of the opportunity for recognition of his unique abilities and superior performance.

These outstanding career opportunities now exist at all levels in electronics research, design and development.

Engineers interested in a personal interview for discussion of these openings should contact:

SUPERVISOR — ENGINEERING PERSONNEL



P. O. BOX 5907 — DALLAS, TEXAS

DESIGNERS AND BUILDERS OF HIGH PERFORMANCE MILITARY AIRCRAFT SINCE 1917

quality control
SYSTEMS ENGINEERING
component design
ENVIRONMENTAL ENGINEERING
coordination
RESEARCH ADMINISTRATION
production engineering
DEVELOPMENT packaging

Regardless of which is your ultimate objective the broad practical experience you get in FIELD ENGINEERING will supplement your theoretical training, prepare you to meet the challenge of the future and put you years ahead!

RAYTHEON FIELD ENGINEERING

is diversified. Radar, Sonar, Guided Missiles, Computers, Microwave and other specialized equipments offer an outstanding opportunity to qualified men to earn excellent salaries while working among authorities in these fields. Your performance regulates your progress. Liberal insurance and retirement plans. Generous travel allowances and other benefits. Grow with a growing organization. Write now:

RAYTHEON MFG. CO.
Government Service Department
100 River Street
Waltham 54, Massachusetts

RECEIVER ENGINEERS

With Experience in VHF and UHF Frequencies

Career Opportunities
With Old Established
Central Connecticut Firm
Interesting Projects
Top Salaries
Suburban Living

Replies Held in Strict Confidence
Wire or Phone Collect
Personnel Mgr. SHERWOOD 7-2741

**THE ALLEN D. CARDWELL
ELECTRONICS PRODUCTIONS
CORPORATION**

Plainville, Connecticut

SENIOR ELECTRONICS ENGINEERS

EE degree or equivalent experience. Background in communications and navigation desirable. Permanent positions in design and development. Citizenship required. Position at Rochester, New York. Excellent living and recreational conditions in this area.

ADDRESS:

Chief Electronics Engineer
STROMBERG-CARLSON COMPANY
ROCHESTER 3, NEW YORK

ENGINEERS

LONG-RANGE
CONTINUING
OPPORTUNITY

FOR
ELECTRICAL
AND
MECHANICAL

ENGINEERS

AT

Bendix

OPENINGS EXIST FOR . . .

LIQUID PROPELLANT

ROCKET CONTROLS

ENGINEER

Mechanical or electrical engineer to supervise the research and development of liquid propellant rocket controls, systems design, component design, development and testing.

CONTROL ENGINEER

Requiring an engineering degree in electrical engineering or math and physics, plus at least three years of experience in design analysis of feedback control systems. Should be familiar with frequency response methods as applied to feedback control synthesis. Analog computer and simulator experience highly desirable. Activity is in the field of aircraft and missile power plant controls including gas turbine, ram jet, and rocket types. Controls are largely hydro-mechanical. The fuel metering research facility includes an analog computer and jet engine simulators.

MAGNETIC AMPLIFIER

SYSTEMS ENGINEER

Electrical engineer supervisory capacity on research and development of magnetic amplifier circuitry, control systems, and component design and testing, supervising other engineers and technicians.

The salary of these positions will be determined by your ability and experience.

Send detailed resume listing education, engineering experience, and salary requirement to:

Technical Employment Department S.B.

Bendix Products Division of
Bendix Aviation Corporation
401 North Bendix Drive
South Bend 20, Indiana

We guarantee you an immediate reply

TO THE FINE ENGINEERING MIND
SEEKING THE CHALLENGING PROJECTS IN



TEST EQUIPMENT

TEST EQUIPMENT ENGINEERS (Senior Electronic Engineers and Electronic Engineers) are urgently needed for design and development of test equipment for aircraft and missile application at Convair. Unusual career opportunities are here now for engineers qualified in these fields: *telemeter equipment; auto pilot; rocket propulsion; system engineering; electronic packaging and cabling; electrical, hydraulic and pneumatic power distribution; data reduction systems, radar beacon, remote control systems, specification writers, test procedures, component test, inertial guidance.*

CONVAIR offers you an imaginative, explorative, energetic engineering department to challenge your mind, your skills, and your abilities in solving the complex problems of vital, new, immediate and long-range programs. You will find salaries, facilities, engineering policies, educational opportunities and personal advantages excellent.

Generous travel allowances to engineers who are accepted. Write at once enclosing full resume to:

H. T. Brooks, Engineering Personnel, Dept. 909

CONVAIR

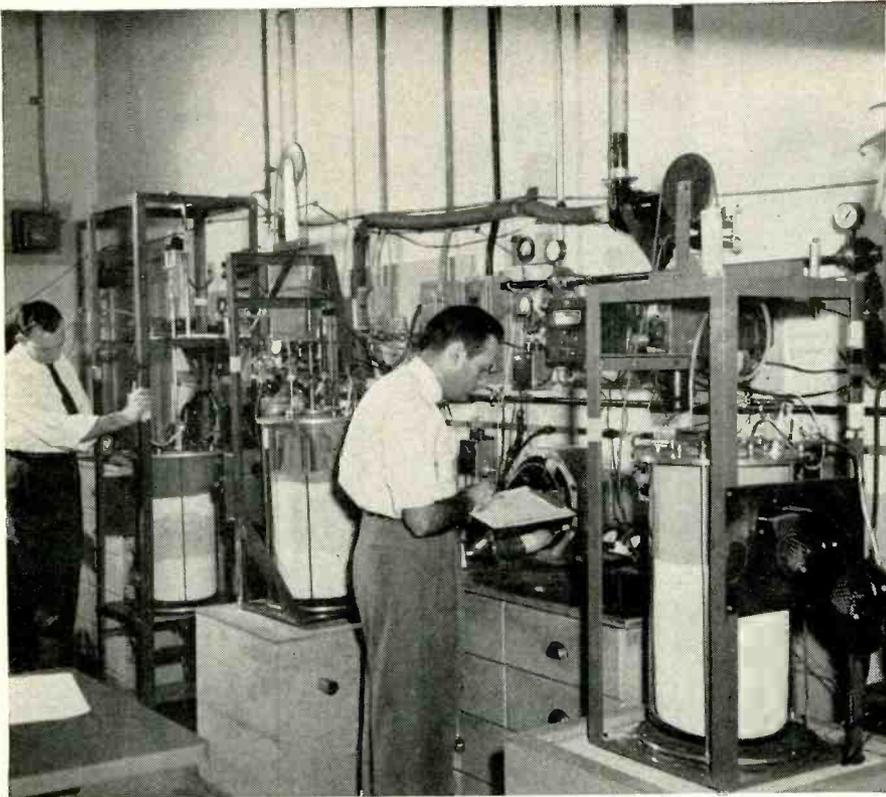
A Division of General Dynamics Corporation

3302 PACIFIC HIGHWAY

SAN DIEGO, CALIFORNIA

SMOG-FREE SAN DIEGO, lovely city on the coast of Southern California, offers you and your family a wonderful new way of life . . . a way of life judged by most as the Nation's finest for climate, natural beauty and easy (indoor-outdoor) living.

CHALLENGING CAREERS AT RAYTHEON



Checking on a process in one of Raytheon Research Division's "furnace" rooms. Single crystals of silicon (melting point near 1400°C) are grown in these furnaces.

Ready to move UP in electronics?

In Raytheon's extensive research program, a variety of special furnaces and equipment is used for the preparation, purification and study of semiconductor materials. This research is fundamental to the continuing pre-eminence of Raytheon in the field of transistors and diodes. Today there are more Raytheon transistors in use than all other makes combined.

When you join Raytheon you work in an atmosphere of progress. University graduate study is encouraged through a tuition refund plan. Openings now for engineers, scientists in many areas including:

- microwave tubes • special purpose tubes • guided missiles
- transistors • diodes • receiving tubes • TV receivers • radar
- metallurgy • ceramics • communications • cathode ray tubes
- sonar • servomechanisms • solid state physics • field engineering

Join a team where performance pays off. Please address inquiries to L. B. Landall, Professional Personnel Section.



RAYTHEON MANUFACTURING COMPANY
 190 Willow St., Waltham 54, Mass.
 Plants also located in California and Illinois

ELECTRONIC ENGINEERS

Technical Operations, Inc., is looking for an electronic engineer with three to five years of experience, capable of supplying original ideas in the fields of transistor circuitry and operations research instrumentation. Join an expanding research and development organization located in suburban Boston. Please send complete resume and requirements to:

R. R. SMYTH

Technical Operations, Inc.

6 Schouler Court Arlington 74, Mass.

Electronic Organs Engineering — Sales

Challenging opportunities are available in both of the above departments. Send resume.

ALLEN ORGAN COMPANY

MACUNGIE PENNSYLVANIA

ELECTRICAL ENGINEERS

To work on engineering problems in development of new Regulated AC and DC supplies, transistors, semi-conductor circuitry and magnetic amplifiers. BEE, or BS with physics or math major, plus some allied experience.

SORENSEN & COMPANY, INC.

375 Fairfield Avenue Stamford, Conn.

OPPORTUNITY Research and Development Engineer

Experienced in the design and development of resistance elements for the electronic industry. Excellent opportunity to join forces with an aggressive organization. An established medium size company located in Cleveland, Ohio. State qualification, salary desired, present status and references.

P-7461, Electronics
 330 W. 42nd St., New York 36, N. Y.



Since 1931

an integrated combination of men and machines . . .

ELECTRONIC ENGINEERS INTERESTED IN COMPUTER DEVELOPMENT

By joining ERCO's progressive organization you can count on your talents being fully utilized on some of the most interesting projects in the computer field. Engineering management constantly stresses individual advancement and recognition.

Since ERCO produces what ERCO designs, for both military and commercial projects, your future will be marked only by the limits of your creative engineering talents.

We need engineers whose experience lies in these fields . . . Analog Computers, Computer Components, Radar, Servo-Mechanisms, Fire Control, Pulse Circuitry, or Systems Engineering

- YOU'LL BE DELIGHTED WITH**
- the fine housing and schools in suburban Washington, D. C.
 - our modern plant located in Riverdale, Md. just 9 miles from the nation's capitol.
 - ERCO's liberal company benefits

Send Resume to

ENGINEERING AND RESEARCH
 A DIVISION OF **QCF INDUSTRIES**
 INCORPORATED
RIVERDALE MARYLAND

COMPUTER ENGINEERS

Can you fill these key positions?



Link Aviation, Inc. needs top level electronics engineers

If you are experienced in computer engineering—and have the ability to direct others in important projects, then Link Aviation Inc. has a top level position for you in its expanding research and development program.

These permanent, key positions are for:

SENIOR DIGITAL COMPUTER ENGINEERS—Must be capable of supervising a small group of engineers designing special-purpose digital computers. Should have extensive knowledge of latest digital computer logic and circuit design techniques. Familiarity with transistor pulse circuits, magnetic functional elements, magnetic tape and drum read-write systems and analog digital conversion methods is highly desirable. The position will require complete responsibility for computer project from system design through prototype construction.

SENIOR ELECTRONICS ENGINEERS—Qualified to design complex feedback amplifiers, precision regulated power supplies, specialized electronic instruments and advanced systems which require unusual creative and analytical ability. Familiarity with vacuum-tube circuit design, transistor circuits, application of magnetic amplifiers, photo-conductor and photo-transistor circuitry is desirable. Should be capable of directing a small group of engineers engaged in systems and component design in the above fields.

Link's broad scope of activities—including design and development of flight and radar simulators, computer-actuated training devices, electronic instruments and special-purpose computers—presents engineers of executive calibre with an outstanding opportunity for personal advancement in a growing organization.

In addition to these advantages, Link offers an unusually attractive "fringe benefit" program including profit sharing, retirement and liberal vacation and holiday policies. Link is located in Binghamton near the heart of upstate New York's recreationland. Only 180 miles from New York City, Binghamton provides "hometown" comfort with big-city conveniences.



Write full details to Mr. John Hunt, Director of Research.



BINGHAMTON, NEW YORK

A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION



ENGINEERS and DESIGNERS NEEDED

for:

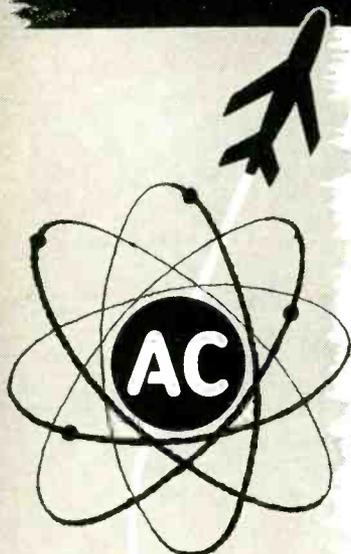
MISSILE GUIDANCE
SYSTEMS

BOMBING NAVIGATIONAL
COMPUTER SYSTEMS

NEW CIVIL AVIATION
PRODUCTS

JET AND TURBO-PROP
ENGINE CONTROLS

AIRBORNE FIRE
CONTROLS



GM CAREER OPPORTUNITIES IN

Systems Engineering and Analysis
Experimental Engineering
Development Engineering
Project Coordination

Design Engineering
Product Engineering
Product Evaluation
Field Engineering

AND WE ALSO NEED:

DESIGNERS • CHECKERS • LAYOUT MEN

Positions Are Permanent

Excellent Advancement Opportunities

Every inquiry treated confidentially and given
immediate attention and personal reply.

WRITE TODAY FOR EMPLOYMENT APPLICATION

Mr. Louis R. Berks
Supervisor of Employment

AC SPARK PLUG DIVISION
Precision Instrument Plant

GENERAL MOTORS CORPORATION
Milwaukee 2, Wisconsin

DEVELOPMENT ENGINEERS and PHYSICISTS

RADIO AND RADAR SYSTEM APPLICATIONS
TRANSISTORS AND MAGNETIC AMPLIFIERS
SERVOMECHANISMS AND ANALOGUE DEVICES
ELECTROMECHANICAL CONTROLS AND ACTUATORS

We are now staffing the new Electronics Laboratory of our Aeronautical Division in Anaheim, California. The selection of associates is based on consideration of their demonstrated abilities and interests in connection with our long-range laboratory plans. Careful attention to engineering and operational planning and to the selection of critical control problems assures opportunities for continuous professional development. The efforts of a relatively small but select staff are being applied on projects requiring engineering ingenuity essential to advancing the art of control in the aeronautical field.



Mr. Controls

Aeronautical Division
Robertshaw-Fulton
CONTROLS COMPANY

SANTA ANA FREEWAY AT EUCLID AVENUE
ANAHEIM, CALIFORNIA

Positions are available at all levels of laboratory work. Please direct inquiries to Vernon Vogel, Electronics Laboratory Director.

New Opportunities
at Barry in

SHOCK & VIBRATION CONTROL ENGINEERING

Barry, already leader in the field, is further expanding its staff, its facilities, its future. There are promising openings at your career level, beginners too, in each branch—

- Development Engineers
- Project Engineers
- Test Engineers
- Sales Engineers at headquarters office and Chicago branch

You'll find challenging opportunities, fine facilities for accomplishment, good living in suburban Boston plus company-sponsored educational opportunities at leading universities.

Send resume to Charles E. Crede, Chief Eng.

BARRY CONTROLS

Incorporated



Watertown 72,

Massachusetts

ELECTRONIC ENGINEERS

Must have 2-5 yrs. exp. in the design of IF, VHF and/or UHF broad band systems. Progressive firm, many benefits.

Phone or write

MR. G. W. FELLENDORF
Instruments for Industry, Inc.
Mineola, N. Y. Pioneer 2-5300

MENT OPPORTUNITIES

CIRCUIT DESIGNERS

TEST

MANUFACTURING

TELEPHONE

ELECTRICAL

ENGINEERS

TOOL AND MECHANICAL

DESIGNERS

EXPERIENCED IN ELECTRO
MECHANICAL PRODUCTS, FOR
USE IN COMMUNICATIONS,
AUTOMATION, AIR-BORNE
CONTROLS

Due to extensive expansion program,
North has immediate openings for Engi-
neers & Technicians.

Opportunity to work with some of
the industry's finest Engineers.

Headquarters in Galion. Small town
living, yet close to large municipalities.

Send resume to A. V. Ryon-
Director of Personnel

NORTH ELECTRIC COMPANY

Galion

Ohio

POSITION OPEN

LOS ALAMOS SCIENTIFIC LABORA-
TORY has an opening for a senior elec-
tronics designer of experimental elec-
tronics equipment, used in our Laboratory
testing program. Position involves travel
in conjunction with field tests for periods
of several months a year. Salary commensu-
rate with experience and ability. Perma-
nent position with excellent employee
benefits including 24 days annual vacation,
liberal sick leave, and excellent retirement
plan. For further information please send
resume of education and experience to
Department of Scientific Personnel.

Los Alamos Scientific Laboratory
of the
University of California
Los Alamos New Mexico

ENGINEERING OPPORTUNITIES

for you

CONVAIR-Pomona is en-
gineering, engineering and pro-
duction of electronic equipment and com-
munication systems. The Convair-Pomona
facility is one of the newest and largest
laboratories in the country. The
facility is in progress, backed by Convair's outsta-
nding record of achievement, offers excellent
opportunities for recent graduates and ex-
perienced engineers in the following fields:

**ELECTRONICS
DYNAMICS
AERODYNAMICS
THERMODYNAMICS
OPERATIONS RESEARCH
HYDRAULICS
MECHANICAL DESIGN
LABORATORY TEST ENGINEERING**

Generous travel allowance to engineers who
are accepted.

*For further information on Convair and its
fields of interest, write at once, enclosing a
complete resume to:
Employment Department 3-G

*ENGINEERING
BROCHURE
TO QUALIFIED
APPLICANTS



CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION
POMONA, CALIFORNIA

EMPLOYMENT OPPORTUNITIES



antenna used with new radar height-finder needs a platform all its own above the control center in the radome building erected in Arctic climates. Air pressure supports a rubberized glass fabric radome "balloon." Entrance to the radome is through an air lock chamber.

ENGINEERS • PHYSICISTS

Please send resume to:
Dept. 8-5-P—Technical Personnel

GENERAL ELECTRIC

ELECTRONICS PARK, SYRACUSE, N. Y.

What Opportunities in Electronics are on the Horizon at GENERAL ELECTRIC?

Advances in electronics are so rapid at General Electric that today's predictions appear tomorrow as equipment bearing the GE symbol.

The opportunities created by the scope and pace of the field are increased at General Electric by the facilities and range of professional advantages which GE engineers enjoy.

This means that GE electronics engineers have incentives, satisfactions and rewards that lead to accelerated personal development and advancement in the company.

Positions available in the following fields:

Advanced Development, Design, Field Service and Technical Writing in connection with:

MILITARY RADIO & RADAR • MULTIPLEX MICROWAVE MOBILE COMMUNICATION • SEMICONDUCTORS • ELECTRONIC COMPONENTS • TELEVISION, TUBES & ANTENNAS

Bachelor's or advanced degree in Electrical or Mechanical Engineering, physics, and experience in electronics industry necessary.

ENGINEERS

Find Out About GPL's INTEGRATED APPROACH

To Research Engineering

A continuous flow of stimulating and varied projects are laid before the staff of General Precision Laboratory, Incorporated.

Sometimes research and development engineers work together as a cooperative, specialized professional team. Often one or two devote all their energies to a long-range basic problem. All are engaged in challenging work which encourages them to broaden their interests beyond their immediate fields of concentration. There is particular opportunity for components application engineers of several types.

Your family will enjoy your career at GPL as much as you, for you'll make your home in beautiful Westchester, noted for its high standard of living. Only an hour away is New York City, with all its famous cultural and educational advantages.

General Precision Laboratory Inc.

A subsidiary of General Precision Equipment Corporation

63 Bedford Road
Pleasantville, New York

WHAT GOES ON IN THE GP LAB:

RESEARCH & DEVELOPMENT WORK IN:

Electronics

Television

Aircraft & Missile Guidance, Control, Simulation

Radar, Microwave, Ultrasonics

Systems Engineering: (aeronautical, naval, industrial)

Precision Mechanics, Ceramics, Optical Devices

Instruments, Servos, Controls: (hydraulic, pneumatic, magnetic, electronic)

Expenses will be paid for qualified applicants who come for interview. We regret we can consider only U.S. citizens. Please write complete details to Mr. Hollis F. Ware

Is YOUR FUTURE as promising as the ATOM'S?

If you're not satisfied with your own answer to this question, you should investigate the opportunities at TRACERLAB, foremost company in the field of NUCLEAR APPLICATIONS.

TRACERLAB needs . . .

NUCLEAR ENGINEERS
ELECTRONIC ENGINEERS
ELECTRICAL ENGINEERS
MECHANICAL ENGINEERS
PHYSICISTS

to work in research, development and applications of nuclear instrumentation. Openings are of a permanent and non-military nature, and offer outstanding opportunities for advancement. We would be pleased to have you consider the possibility of joining our successful and forward looking team.

Write in confidence to . . .

Tracerlab
130 HIGH ST., BOSTON 10, MASS.

MENT OPPORTUNITIES

ENGINEERS

for immediate placement

ENGINEERING AT NCR:

1. Immediate, permanent positions in Mechanical and Electrical Engineering Divisions.
2. Engineering project work in Adding Machines, Cash Registers, Accounting Machines, Computers, and related Data Processing Equipment in Dayton, Los Angeles, and Ithaca, New York.
3. Work involving design, development, and production engineering of mechanical, electronic, and electromechanical devices.
4. Some experience in development, design, and application of high-speed, light-weight mechanisms of the intermittent motion type is desirable, but not essential.
5. Ample training and indoctrination is available to all employees.

MECHANICAL ELECTRICAL ELECTRONIC MECHANICAL

AS AN NCR ENGINEER you will enjoy:

1. UNLIMITED OPPORTUNITY in an ever-expanding field of Business Engineering.
2. AN EXCELLENT SALARY and benefits of lifetime value for you.
3. A RECREATIONAL PROGRAM for the enjoyment of the entire family in a Country Club with 36 holes of golf, for outings with swimming, boating, and play for the children.
4. LIVING IN DAYTON... considered one of the cleanest and most attractive cities in the world with outstanding school facilities.
5. YOUR WORK AT NCR with its friendly atmosphere, with its employee morale at a very high level, and with people who, like yourself, have decided to build their professional future with NCR.

**ACT AT ONCE—Send resume of your education and experience to:
EMPLOYMENT DEPARTMENT TECHNICAL PROCUREMENT SECTION**

**THE NATIONAL CASH REGISTER COMPANY
DAYTON 9, OHIO**

**CORNELL AERONAUTICAL
LABORATORY, INC.
of Cornell University
is seeking**

ELECTRONIC ENGINEERS

for positions in all levels of experience above Junior Engineer

- Communications
- Dynamic Control Systems
- Aircraft Instrumentation
- Radar
- Computers
- Electrical Measurements
- Varied Electronic Circuits
- Servo-Mechanisms
- Missile Guidance
- Microwave

If you have a B.S. degree and experience, imagination and potential, we invite you to communicate with our Employment Manager

BOX 235 BUFFALO 21, N. Y.

Stability and Opportunity for ELECTRONIC ENGINEERS who want more room to grow

Top opportunities for achievement and recognition are open at FTL... key unit of the world-wide, American-owned IT&T System. FTL's long-range development program offers stability and security. Finest facilities—plus broad and generous employee benefits.

INTERESTING ASSIGNMENTS IN:

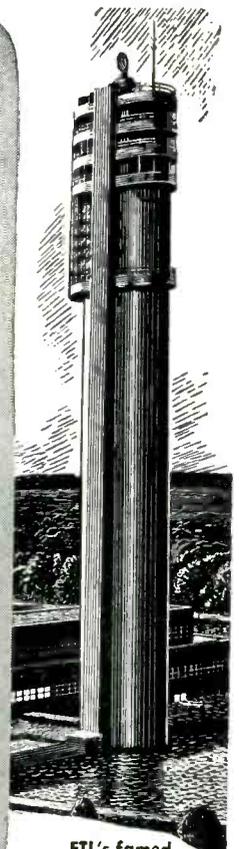
- Radio Communication Systems • Electron Tubes
- Microwave Components • Electronic Countermeasures
- Air Navigation Systems • Missile Guidance
- Transistors and other Semiconductor Devices
- Rectifiers • Computers • Antennas
- Telephone and Wire Transmission Systems



**SEND RESUME TO:
PERSONNEL MANAGER,
BOX EL-9**

Federal Telecommunication Laboratories

A Division of INTERNATIONAL
TELEPHONE AND TELEGRAPH CORPORATION
500 Washington Avenue, Nutley, N. J.



FTL's famed
Microwave Tower
—28 minutes
From N. Y. C.

EMPLOYMENT OPPORTUNITIES

UNITIES



has a future for **ELECTRONIC ENGINEERS**

in these specialized fields

MISSILES

Research, systems analysis, development, and design in guidance and control systems, systems component equipment, and systems operational test equipment.

TEST EQUIPMENT

Research, development, and design in Guided Missile operational test equipment systems and systems component equipment.

MICROWAVES

Systems analysis, development, and design in microwave circuitry and components for missile guidance systems, radar systems, and systems test equipment.

RADAR

Study, analysis, development, and design in highly advanced radar techniques, and electronic countermeasures.

ANTENNAS

Research, development, and design of airborne antennas in low-frequency, UHF, and microwave regions for missiles, radar, and countermeasures equipment.

PACKAGING

Encapsulation and subminiaturization design for reliability and producibility in missile guidance and control equipment systems, airborne radar systems, operational systems test equipment, closed-loop TV systems, etc.

Career-minded men with several years specialized experience, and preferably with advanced degrees, are invited to join our rapidly expanding programs in industrial and military electronics.

Address inquiries to:

Technical Employment Manager

**FARNSWORTH ELECTRONICS CO.,
Fort Wayne, Indiana**

A division of International Telephone and Telegraph Corp.

ELECTRONIC DEVELOPMENT ENGINEERS

CHALLENGING DESIGN & DEVELOPMENT POSITIONS FOR CREATIVE ENGINEERS

These positions are tailor-made for highly imaginative engineers who enjoy problems of more than ordinary difficulty—problems that require a maximum of individual electronic creativity. Men selected will be entrusted with the complete electronic or electro-mechanical design and development tasks (initial circuits, systems, components, or product design) entailed in carrying a prototype project from original conception to its completion.

REQUIREMENTS: Senior and Intermediate engineers with degrees and 4 to 8 years' experience; Junior engineers with degrees and 1 to 3 years' experience, capable of growing with our long-range, electronic design and development program in the following fields:

- (1) ANALOG COMPUTER
- (2) RADAR BEACONS
- (3) MAGNETIC AMPLIFIERS
- (4) ELECTRO-OPTICS
- (5) MISSILE SYSTEMS
- (6) SERVOS
- (7) FIRE CONTROL SYSTEMS

Interviews will be arranged at convenient locations.

Send Resume to:

**AVION DIVISION
OF ACF INDUSTRIES INCORPORATED**

Route 17, Paramus, N. J.

COlfax 1-4100

ENGINEERS

Research Engineers & Physicists

1. MICROWAVE PHYSICIST
For research project on application of ferrites at microwave frequencies and other microwave projects. PhD with experience.
2. INSTRUMENTATION ENGINEER
Electronic and mechanical experience for design of X-ray spectrographic instruments. BS or MS with 3-5 years engineering experience.
3. TUBE DESIGN ENGINEER
To head project on X-ray tube design. BS or MS with 3-5 years' tube design and development experience.

Ideal working conditions in suburban research laboratory. All retirement insurance and other fringe benefits.

Send resume to

PHILIPS LABORATORIES

Irvington-on-Hudson, N. Y.

N Y C: LO 2-8703 or Irvington 9-3100

ELECTRONICS
for MEDICAL RESEARCH

E.E. or Physics Major with work experience in electronic instrumentation. Interesting & challenging opportunity to develop equipment in connection with medical & biological research problems. Superior employee benefits & working conditions. Nationally known research organization located N.Y. area. Send detailed resume including salary requirements.

P-7342, Electronics
330 W. 42 St., New York 36, N. Y.

ENGINEERS

Creative Opportunities with Republic Aviation


 Research

Antenna Engineer

To conduct pattern studies, design prototype antennas and supervise flight tests of new antenna installations. College graduate in Physics, Math or E.E.

Electronic Instrumentation Engineer

Three to five years aircraft instrumentation experience required. Knowledge of transducers, amplifiers and recording equipment used in experimental research testing of hi-speed jet aircraft is essential. Knowledge of servo loop theory as applied to aircraft systems coupled with ability to properly instrument, record and analyze is desirable. Graduate with E. E. degree preferred.



REPUBLIC AVIATION

FARMINGDALE, LONG ISLAND, NEW YORK

NEW ALL-EXPENSE-PAID RELOC

For those living outside the New York City area, Republic offers an unusual plan which eliminates financial worries. This plan offers these 6 benefits: Interview expenses paid for qualified applicants; Tuition Refund Plan pays up to 2/3 of tuition fees; life, health and accident insurance—up to \$50,000—company-paid; plus hospital-surgical benefits for the family. And of course you'll live and work on fabulous Long Island, the playground of the east coast.

Please address complete resume, outlining details of your technical background, to:

Assistant Chief Engineer
Administration
Mr. R. L. Bortner

MENT OPPORTUNITIES

FUSILLI
COMMER
MILIT
EL

ENGINEERS

The APPLIED PHYSICS LABORATORY of THE JOHNS HOPKINS UNIVERSITY offers an exceptional opportunity for professional advancement in a well-established Laboratory with a reputation for the encouragement of individual responsibility and self-direction.

Our program of

GUIDED MISSILE RESEARCH and DEVELOPMENT

provides such an opportunity for men qualified in:

Design and Analysis of Pulse Circuits
Research and Development in Radar and Microwaves

Electronic Packaging

Development of Telemetry, Data Processing, and Special Switching Equipment

Magnetic Amplifier Design & Analysis

Development and Application of Printed Circuits

Servomechanisms and Control-System Analysis

Please send your resume to
Professional Staff Appointments

APPLIED PHYSICS LABORATORY
THE JOHNS HOPKINS UNIVERSITY
8621 Georgia Avenue
Silver Spring, Maryland

Electronics Engineers

expanding helicopter
field offers you
excellent opportunities

Both Junior and Senior electronics engineers are needed to work with those who design, test, and build rotary wing aircraft.

Challenging positions are open to men with experience or a good educational background in:

Radar

Flight Test Instrumentation

Strain Gage Circuitry

Oscillographic Data Recording Systems

Vibration and Temperature Measuring Systems

Work on Automatic Control Systems—

both test and development

Automatic Pilot and Blind Flying Instrumentation

Not only will your professional achievements be recognized, but you and your family will enjoy many personal benefits.

Apply in person or send complete resume to

R. L. Auten, Personnel Department

SIKORSKY AIRCRAFT

Bridgeport 1,

Connecticut

EMPLOYMENT OPPORTUNITIES

FOR OPPORTUNITIES

PHYSICISTS and MECHANICAL ENGINEERS
ELECTRICAL ENGINEERS and PHYSICAL CHEMISTS

Range of interesting, diversified, important projects—
with congenial associates and modern equipment and facilities—
prestige of affiliation with a leading company and steady advancement—
in a career here at GENERAL MOTORS.

Now open in RESEARCH, ADVANCE DEVELOPMENT and PRODUCT DESIGN

- SPECIAL AUTOMOBILE RADIO
- AERIAL RADIO, RADAR and ELECTRONIC EQUIPMENT
- ELECTRONIC COMPONENTS
- INTRICATE MECHANISMS such as tuners, telemetering, mechanical linkage, controls, etc.
- ACOUSTICS—loud speakers, etc.
- TRANSISTORS and other SEMICONDUCTORS—with leadership by a physicist with an outstanding record in this field.
- TRANSISTOR APPLICATIONS

Salary increases based on merit and initiative. Relocation expenses paid for those hired.
Vacations with pay, complete insurance and retirement programs.
Inquiries invited from recent and prospective graduates as well as experienced men with baccalaureate or advanced degrees in physics, electrical or mechanical engineering, chemistry, metallurgy.

All inquiries held in confidence and answered—Write or Apply to

Personnel Department DELCO RADIO DIVISION

GENERAL MOTORS CORPORATION

1446 South Home Ave.

Kokomo, Indiana

ELECTRONIC DESIGN ENGINEERS
capable of
ASSUMING RESPONSIBILITY

To perform basic design and direct experimental laboratory work in the development of new equipment.

The desire and ability to progress with an expanding engineering and production organization will yield ample opportunity for advancement.

The position affords excellent working conditions, modern equipment, and usual fringe benefits.

Salary will be commensurate with background and ability.

BELL SOUND SYSTEMS
Electronics Division of

THOMPSON PRODUCTS, Inc.
555 Marion Road, Columbus, Ohio

ELECTRONIC ENGINEERS

For responsible positions in small, expanding advanced development laboratory. Excellent opportunity for advancement. Experience in the following fields is especially important:

- Television (Flying-spot Scanners)
- Pulse Circuitry
- Digital Coding Systems
- Radar Tracking Equipment
- Electro-mechanical Equipment

Please submit resume, including salary required.

P-7305, Electronics
330 W. 42nd St., New York 36, N. Y.

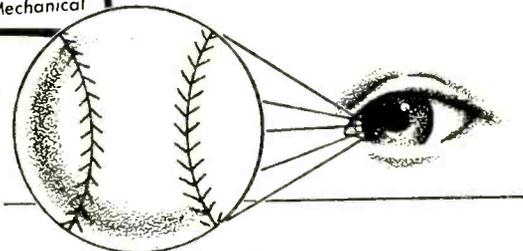
ELECTRONICS
ENGINEER
AIRCRAFT
CONTROL SYSTEMS

Permanent position available with established Connecticut manufacturer for experienced man with initiative and ability to assume responsibilities in development, design and application. This is a key position in an expanding operation. Send adequate resume. All replies confidential.

P-7278, Electronics
330 W. 42nd St., New York 36, N. Y.

ENGINEERS
DESIGNERS-DRAFTSMEN
Electronic Mechanical

Keep Your
Eye
on the
Ball



In your career, as in successful baseball, golf or tennis, it pays to keep your eye on the ball. Keep your eye on the advantages only a young, yet securely established company can offer. Melpar is young enough to welcome new ideas, to recognize and award achievement, yet big enough to offer stability and growth to those who look to the future.

Superb new laboratory facilities just completed this year; an engineering staff of the highest calibre; long-range military and industrial research programs; and an ideal family environment in pleasant Fairfax County in northern Virginia . . . these are just some of the many benefits you'll find as a member of the Melpar staff.

Keep your eye on a career with Melpar, leader in electronic research and development.

For personal interview send resume to
Technical Personnel Representative,



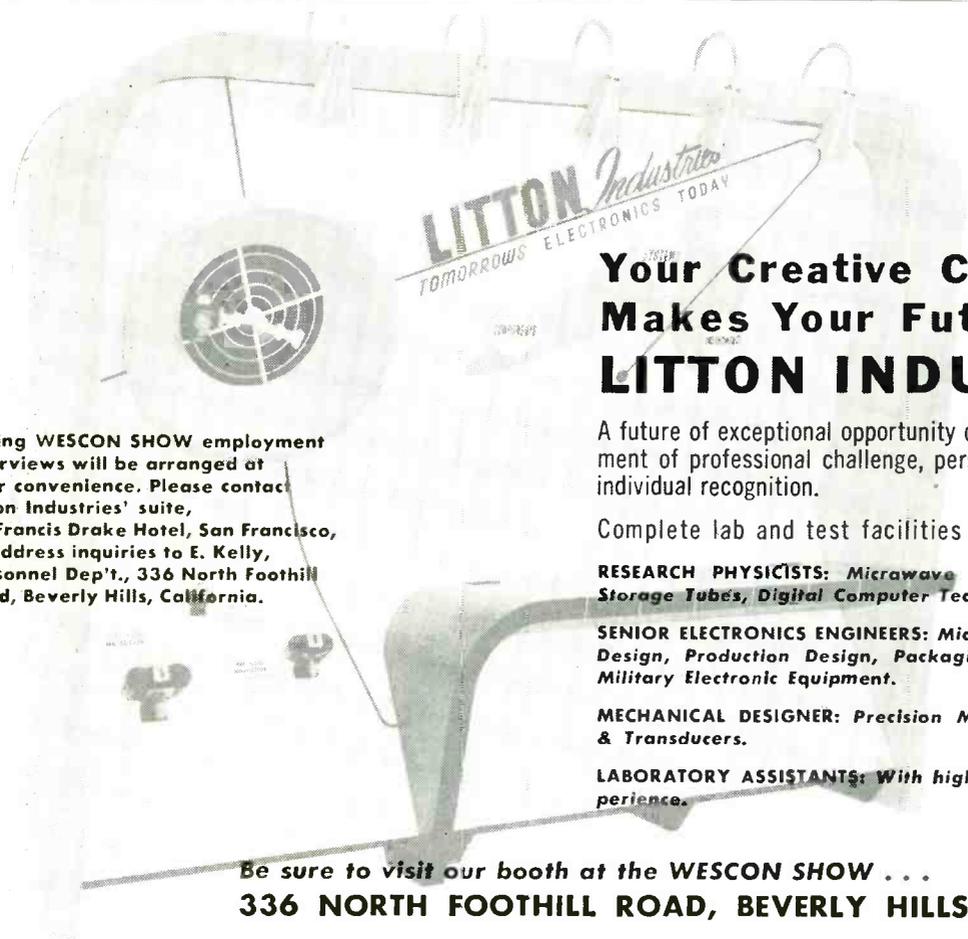
melpar, inc.

Subsidiary of Westinghouse Air Brake Co.

3000 Arlington Blvd., Dept. E-21,

Falls Church, Virginia or 11 Galen St., Watertown, Mass.

- Network Theory
- Systems Evaluation
- Automation
- Microwave Technique
- UHF, VHF or SHF Receivers
- Analog Computers
- Digital Computers
- Magnetic Tape Handling Equipment
- Radar & Countermeasures
- Packaging Electronic Equipment
- Pulse Circuitry
- Microwave Filters
- Flight Simulators
- Servomechanisms
- Subminiaturization
- Electro-Mechanical Design
- Quality Control & Test Engineers



During WESCON SHOW employment interviews will be arranged at your convenience. Please contact Litton Industries' suite, Sir Francis Drake Hotel, San Francisco, or address inquiries to E. Kelly, Personnel Dep't., 336 North Foothill Road, Beverly Hills, California.

Your Creative Contribution Makes Your Future at . . . LITTON INDUSTRIES

A future of exceptional opportunity developed in an environment of professional challenge, personal responsibility and individual recognition.

Complete lab and test facilities speed your progress.

RESEARCH PHYSICISTS: *Microwave Systems, Microwave & Storage Tubes, Digital Computer Techniques.*

SENIOR ELECTRONICS ENGINEERS: *Microwave Systems, Circuit Design, Production Design, Packaging, & Qualification of Military Electronic Equipment.*

MECHANICAL DESIGNER: *Precision Mechanisms, Instruments & Transducers.*

LABORATORY ASSISTANTS: *With high vacuum technique experience.*

Be sure to visit our booth at the WESCON SHOW . . .
336 NORTH FOOTHILL ROAD, BEVERLY HILLS, CALIFORNIA

Electronics Engineer

(MAGNETIC AMPLIFIER EXPERIENCE)

THE APPLIED PHYSICS LABORATORY OF THE JOHNS HOPKINS UNIVERSITY has open a Senior-Staff position in the theory and design of magnetic amplifiers and related devices for guided-missile controls. Applicants should have five years' electronic circuit experience, including one or more years in the magnetic-amplifier field.

THE LABORATORY OFFERS — A creative professional atmosphere, progressive wage policy, and excellent benefits with regard to vacation, pension, advanced education, etc.

Please send resume to:

Professional Staff Appointments

THE JOHNS HOPKINS UNIVERSITY
 APPLIED PHYSICS LABORATORY
 8621 Georgia Avenue
 Silver Spring, Maryland

• • • for those who qualify

Security

Understanding

Know how

Send resume to



offers

ELECTRONIC ENGINEERS

- HEAVY BACKLOGS
- SOUND FINANCING
- TOP BENEFITS
- MANAGEMENT BY ENGINEERS
- EDUCATIONAL AID
- MINIMIZED RED-TAPE
- VARIED SPECIALIZATION
- FLEXIBLE ORGANIZATION
- VERSATILE PERSONNEL

R. F. LANDER

Electronic Engineering Company
 of California



180 SOUTH ALVARADO STREET
 LOS ANGELES - 57 - CALIFORNIA

WANTED:

Electronic and Mechanical Engineers at Bendix-Pacific

This is the new Engineering Center at Bendix-Pacific now nearing completion. With 100,000 square feet of area, it represents the latest and one of the most complete engineering facilities in the nation.

You are invited to consider becoming a member of this vital engineering group—with a forward looking company in Southern California.

Unusual engineering positions in electrical and mechanical design of radar, sonar and telemetering are available. These positions, which are directly associated with our long-range projects for industry and for defense, are available at all levels.

Please fill in the coupon or write us for complete information.



W. C. Walker, Engineering Employment Mgr.
Pacific Division, Bendix Aviation Corp.
11608 Sherman Way, North Hollywood, Calif.

Please send information.

I am a graduate engineer with _____ degree.
I am not a graduate engineer but have _____ years experience.

Name _____

Address _____

City _____ Zone _____ State _____

PERMANENT ASSIGNMENTS

IN THE FIELD OF
MILITARY WEAPONS SYSTEMS

Missiles Reliability Studies
Fire Control Radar
Sonar
Underwater Ordnance

systems engineers

applied physicists

REAL CAREER OPPORTUNITIES

You'll enjoy the advantages of a small company atmosphere in the Silver Spring Laboratory . . . along with the stability of being part of the rapidly growing Vitro Corporation of America with 5 diversified operations throughout the United States

- Suburban Location in residential community adjacent to Washington, D. C.
- Plentiful housing — modern apartments, houses to rent or buy
- Advanced courses available at 4 major universities
- Cultural advantages of the nation's capital

Vitro has similar opportunities also available at West Orange, N. J. laboratory and Eglin Air Force Base, Florida.

Write to Personnel Manager

VITRO LABORATORIES

962 WAYNE AVE.

SILVER SPRING, MD.



EMPLOYMENT OPPORTUNITIES ADVERTISERS INDEX

Admiral Corporation	394	Johns Hopkins University, Applied Physics Lab	411, 413
Allen Organ Co., Inc.	404	Link Aviation, Inc.	405
AVCO Mfg. Corp.		Littleton Industries Inc.	413
Crosley Div.	398	Los Alamos Scientific Lab.	407
Avion Division of ACF Industries Inc.	410	Melpar Inc.	412
Barry Controls Inc.	406	National Cash Register Co.	409
Bell Sound Systems.	412	National Co., Inc.	396
Bendix Aviation Corp.		North Electric Co.	407
Pacific Division	414	O'Shea Employment System	392
Products Division	397, 403	Philips Laboratories	410
Radio Division	399	Radio Corp. of America	393
York Division	400	Raytheon Mfg. Co., Waltham, Mass.	402, 404
Berkshire Transformer Corp., The.	415	Remington Rand, Div. of Sperry Rand Corp., Engineering Research Associates Div.	395
Boonton Radio Corp.	392, 415	Remington Rand, Div. of Sperry Rand Corp.	400
Burroughs Research Center.	401	Republic Aviation Corp.	411
Cardwell Electronics Prod. Corp., Allen D.	402	Robertshaw-Fulton Controls Co.	406
Chance Vought Aircraft, Inc.	402	Sikorsky Aircraft	411
Convair, A Division of General Dynamics Corp.		Sorensen & Co. Inc.	404
Pomona, Calif.	407	Stavid Engineering	398
San Diego, Calif.	403	Stromberg-Carlson Co.	402
Cornell Aeronautical Laboratory Inc.	409	Sylvania Electric Products, Inc.	396
Drake Personnel Inc.	392	Technical Operations Inc.	404
Electronic Engineering Co. of Calif.	413	Tracerlab, Inc.	408
Engineering & Research, A Div. of ACF Industries Inc.	405	Transitron Electronic Sales Corp.	415
Farnsworth Electronics Co.	410	University of Michigan	396
Federal Telecommunication Labs.	409	Vitro Corp.	414
General Electric Co., Syracuse, N. Y.	394, 408, 415	Westinghouse Electric Corp.	400
General Motors Corp.		Elmira, N. Y.	400
AC Spark Plug Division	406		
Delco Radio Division	412		
General Precision Lab Inc.	408		
Hodgson Co., R. W.	392		
Hoffman Laboratories Inc.	392		
Instruments for Industry, Inc.	406		

This index is published as a convenience to the readers. Care is taken to make it accurate but CLASSIFIED assumes no responsibility for errors or omissions.

SALES ENGINEER

Well established (since 1934) small manufacturer of precision electronic instruments requires a Sales Engineer. We are located in a pleasant, active, rural community and our business is primarily commercial. Our personnel policies are modern and forward looking.

You will need a degree in EE and 3 to 5 years of engineering experience with electronic equipment or equivalent. Sales experience would be helpful but is not required.

Your work will include home office and field duties; demonstration of our instruments, customer technical assistance, and evaluation of customer needs. You will be paid a salary commensurate with your ability.

Please forward complete resume to

BOONTON RADIO CORPORATION
BOONTON, NEW JERSEY

REPRESENTATIVES WANTED

Manufacturer of electronic test equipment for military and commercial applications needs technically qualified representatives. Write giving qualifications, lines handled, territory covered.

RW-2178, Electronics
1111 Wilshire Blvd., Los Angeles 17, Calif.

SALES ENGINEERS WANTED

Excellent opportunities for several engineers with well established East Coast instrument manufacturer now expanding its line of aviation products which includes electronic and electro-mechanical components for jet engines and guided missiles.

Electrical engineering background essential. Must have established contacts with the aircraft industry. Openings in Los Angeles, Dallas, and East Coast areas.

Generous company paid benefits include hospitalization, pension, insurance, and vacation plans.

P-7255 Electronics
330 W. 42 St. New York 36, N. Y.

EMPLOYA

MENT OPPORTUNITIES

are you
a practical
electronics
engineer
interested in
travel?

Here is a division-wide opportunity for travel in the U.S. or overseas with liberal bonus and expense allowances, and specialized training in a stable and expanding field. You'll have challenging work in the installation of equipment and technical support after installation, up-to-date notice of electronic advances, and regular contact with top engineers and specialists through staff headquarters.

Aided by General Electric's educational programs and promotion-from-within policy you may progress as far as your abilities permit while enjoying the benefits for which GE is so well known.

Requires an engineering degree, radar background, U.S. citizenship.

Send resume to: Mr. S. E. McCann
Supervisor Recruiting and Training

GENERAL ELECTRIC

Electronics Park Syracuse, N. Y.

Field
Engineering

CAPACITOR SALESMAN WANTED

P-7304, Electronics
330 W. 42 St., New York 36, N. Y.

ENGINEER

for transformer design small power, audio, etc. experience preferred. Phone or write

BERKSHIRE TRANSFORMER CORP.
15 South Ave. New Milford, Conn.
Elgin 4-5566

SEMICONDUCTOR DEVELOPMENT

DEVICE ENGINEERS

PRODUCTION ENGINEERS

APPLICATION ENGINEERS

SALES ENGINEERS

Responsible positions are now available with one of the leading and fastest growing semiconductor manufacturers. These are outstanding opportunities for Physicists and Engineers in research, development, or production of advanced germanium and silicon diodes and transistors. Experience in semiconductors or other components such as tubes or capacitors is desirable. Replies held in strict confidence. Send resume or call

Transitron electronic corporation
407 MAIN STREET, MELROSE, MASS. MELrose 4-9600

SEARCHLIGHT SECTION ADVERTISING

OPPORTUNITIES EQUIPMENT - USED or RESALE

CLASSIFIED

UNDISPLAYED RATE:
3 lines. To figure advance payment count 5
lines for each insertion.
Charge one line additional in undisplayed ads.
If full payment is made in advance for four con-
secutive undisplayed ads (not including proposals).
Send NEW ADVERTISEMENTS to N. Y. Office, 330 W. 42nd St., N. Y. 36, N. Y. for October issue closing September 1

DISPLAYED RATE:
The advertising rate is \$18.50 per inch for all advertising appearing on
other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3
columns—30 inches—to a page.
EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in
Displayed Style.

Not accept advertising in the Searchlight Section, which lists the names of the manufacturers of resistors, capacitors, rheostats, and poten-
tiometers or other names designed to describe such products.

METERS:

WESTON AC AMMETER

(Pictured) In portable leather case, with Test Leads, 2 1/2", 0-15 AC and 0-3 AC Scale. . . . \$5.95

DC AMMETER HOYT:

- Portable metal case, with Test Leads, 4 1/2", Fan-
Cooled Scale—0-15 ADC. . . . \$4.95
- 3 RF AMMETER IS-128—2 1/2" Rd. Flush Mtg.
Calibrated F/Non Mag Panel. P/O BC-233 Trans-
mitter. . . . \$2.95
- 0-8 Amp RF w/Thermocouple IS-89; 2 1/2" Rd. . . . \$4.95
- 0-15 AC DC—2 1/2" Rd. IS-122. . . . \$4.95
- 0-500 Millamp DC—2 1/2" Rd. IS-22. . . . \$4.95
- 0-250 MA DC—3" Sq. Delur. . . . \$3.95
- 0-1 MA DC—Simpson; 3-1/2" Rd. . . . \$3.95
- 0-2 MA DC—Westinghouse; 3-1/2" Rd. . . . \$2.95

MOTORS:

- 24 VDC REVERSIBLE MOTOR — 3.7 RPM, 40 lb.
Torque. Motor size: 5-1/2" x 4-1/32" x 3-5/16".
Shaft size: 21/32" x 5/16". Also operates 24 VAC.
Philco No. 441-1008. . . . \$3.95
- 27.5 VDC—6000 RPM, 1.5 oz. in. Shaft size: 1 1/8" x
3/4". Motor size: 2 1/2" x 1 1/2". No. 5069-267. . . . \$4.95
- 26 VOLT 60 CYCLE—60 RPM Synchronous Cramer
Motor #1147. Shaft size: 1" x 3/8". . . . \$1.95
- 110 VDC 1/70 HP., 1550 RPM. Motor size: 4" x 2 1/2".
Shaft size: 1" x 3/16". Redmond #157. . . . \$4.95
- 6 VDC 1/20 HP., 4000 RPM. Motor size: 5" x 3".
Shaft size: 3/4" x 1/4". Redmond #E-50. . . . \$4.95
- 12 VDC 1/30 HP., 4500 RPM. Motor size: 3" x 2 1/2".
Shaft size: 1" x 3/16". Delco #5047520. . . . \$4.95
- 27 VDC 1/10 HP., 3500 RPM. Shaft size: 5/8" x 1/4".
Motor size: 4 1/2" x 3 1/2". Air Assoc. No. EP-763. \$6.95
- 80 VDC 1/50 HP., 3000 RPM. Shaft size: 3/8" x 1/4".
Motor size: 3" x 3". G. F. #5. PMSHA10. . . . \$8.95
- 28.5 VDC 1/35 HP., 2200 RPM. Motor size: 1 1/2"
x 3/4". Motor size: 4 1/2" x 3 3/4". Electrolux
#16876. . . . \$5.95
- 27 VDC GEAR HEAD MOTOR—660 RPM; 1/75 HP.;
1.75 A. Size: 5" x 3". Shaft 3/4" x 3/8". Air Assoc.
#EIE120M1. . . . \$7.95
- 27.5 VDC GEAR HEAD MOTOR—324-1 Ratio; 4050
RPM; Right Angle Drive Motor. Size: 5" x 3-1/2".
Shaft: 5/16" x 3/8". Bodine Type #V-10R.
Price. . . . \$7.95
- 24 V. GENEVA LOC ACTUATOR MOTOR ASS'Y.—
1/25 HP.; 15000 RPM. Gear Head & Limit
Switches. Motor Size: 5-1/2" x 3-1/2". Angle Drive
Shaft: 3/4" x 1/2". Bendix #LM-106524. Price: \$7.95
- 27 VDC MOTOR—1.5 A.; 1/50 HP.; 3000 RPM Shunt
Motor; Motor Size: 3" x 2-1/2". Shaft: 5/16" x 3/8"
Oster #DS-1 or WPVS-5876. . . . \$2.95
- 27.5 VDC MOTOR—1/100 HP.; 7000 RPM; Motor
Size: 3" x 1-3/4"; Shaft: 3/4" x 3/8" L. Oster #C2BP-
1A—Price. . . . \$2.95
- 27.5 PERMANENT MAGNET ALNICO FIELD MO-
TOR—.03 Amp.; 10000 RPM; Size: 1" x 1-1/8" x 2"
Shaft: 3/8" x 3/8". Delco #5068571. Price: \$2.95
- 115 Volt 60 cycle GEARED HEAD MOTOR—24 RPM.
1/100 HP. Right Angle Drive—Size: 7-1/2" x 4" x
4". Shaft Size: 3/16" x 3/8". NEW: \$9.95
- 24 VDC GEARED HEAD MOTOR—Heavy Duty, 8
Amp. 2-1/2 lb. Torque, 100/200 RPM. Shaft Size:
5/16" x 1/2". Right Angle Drive. \$2.95
- 115 VAC 60 CYCLE INDUCTION MOTOR—24 RPM.
75 Torque oz. in.; 9 Watts—with variable Multi-
Disc Coder Wheel & Micro Switch, mounted on
bracket ass'y. Holtzer Cabot Motor, Type RWC
2505. . . . \$9.95

BLOWERS:



12/24 VDC—AC CAST ALU-
MINUM BLOWER (Pictured
at left)—100 CFM; 3" intake;
2" outlet. Shunt Motor 4x3 1/2"
3000 RPM @ 24 VDC. . . \$5.95

6 VDC SINGLE—100 CFM—
No. 6100. . . \$4.95

6 VDC FLANGE—150 CFM—
No. 6150. . . \$6.95

24 VDC DUAL—20 CFM—Min—No. 2420. . . \$7.95

10 CFM BLOWER (Pictured—
right) 27.5 VDC; 1/100 HP.;
7000 RPM; Oster Motor. C2BP-
1A; L-R Mtg. Co. Bakelite
Blower #2, overall size: 3-1/2"
x 4-1/2". Price. . . \$5.95

Same as above, 12 VDC opera-
tion: Price. . . \$5.95

115 V. 400 CYCLE—10 CFM—Eastern Air Devices
Motor #31A—7500 RPM; 1/100 HP. L-R #2 Blower
Assy. Overall Size: 4-1/2" x 3-1/2". No. 3110. . . \$5.95



10 CFM BLOWER (Pictured
at left)—28 VDC—6 A.; 5000
RPM. Pioneer Motor SS-2345.
Aluminum Blower Housing.
Overall Size: 4-1/2" x 3-1/2".
Price. . . \$5.95

115 V. 60 CYCLE BLOWERS:

- 115-VAC 60 cycle SINGLE TYPE—100 CFM; 2-1/4"
intake; 2" outlet. Complete size: 5" x 6" . . . \$8.95
- No. 1C939. . . . \$13.95
- 115 VAC 60 cycle DUAL TYPE—100 CFM; 4" intake;
2" Dis. Each Side. Complete size: 8" x 6" . . . \$13.95
- No. 1C880. . . . \$14.95
- 115 VAC 60 cycle COMPACT TYPE—108 CFM; Mo-
tor built inside squirrel cage; 4-1/2" intake; 3 3/8" x 3"
Dis. Complete size: 4-1/2" W x 8-3/8" H x
8-1/8" D—No. 2C067. . . . \$14.95
- 115 VAC 60 cycle FLANGE TYPE—140 CFM; 3-1/2"
intake; 2-1/2" Dis. Complete size: 7-1/2" x
W x 7-1/2" H x 6-3/4" D—No. 1C807. . . . \$13.95
- 115 VAC 60 cycle FLANGE TWIN—275 CFM; 4-1/2"
intake; 3-3/4" x 3" Dis. Complete size: 11-3/4" W x
3-3/4" H x 8-1/16" D— . . . \$21.95
- No. 2C069. . . . \$14.95
- 115 VAC 60 Cycle BLOWER—200 CFM; 4" intake;
3" x 5" outlet. Overall size: 8" x 7" x 6". Bodine
Motor. NSI-32. Removed from New
Equipment. #BOD-200. . . . \$14.95
- 115-VAC 60 CYCLE BLOWER—100 CFM; 3-3/4" in-
take; 2" outlet; Rd. Flange with Flap Director.
Overall size with bracket: 8" L x 6-1/2" W x 7" H.
Removed from New Equipment. Dichl
Motor FB-2106-0 No. FDBL-2106. . . . \$6.95
- Same as above, but with 12" Curved Di-
rector. No. CDBL-2106. . . . \$7.95

INVERTERS & GENERATORS:

- PU-7/AP—Input 28 VDC 160 A; output 115 Volt
21.6 A, 400 cycle, 2500 VA. . . . \$89.50
- PE-218—Input 28 VDC 100 A; output 115 V, 400
cycle 1 Phase, 1500 VA. . . . USED: \$14.95
NEW: \$39.95
- PE-115 or PE-206—Input 28 VDC 36 A; output 80
Volt 800 cycle 7.2 Amps. . . . Like New: \$5.95
- TYPE 200-1-D—Input 28 Volt 62 A; output 115
Volt 7 Amp. 1 Phase 800 cycle. . . . NEW: \$24.95
- PE-109D—Input 13.5 VDC 29 A.; output 115 Volt
400 cycle, 1 Phase 1.53 Amps. . . . \$59.50
- 5D21N13A—27 VDC input; 115 Volt 400 cycle out-
put; 1 Phase 435 VA. . . . \$39.50

Specialists in TUBES

All Famous Name
Brand Radio and
TV Receiving
Tubes, Transmit-
ting tubes,
Special Purpose
Tubes

You get immediate delivery on these high
quality, low priced tubes taken from one
of the most extensive selection of tubes
available. Order now!

We handle such brands as: Hallicrafters,
National Union, Zenith, Admiral, Stewart-
Warner, Raytheon, RCA, Philco, Sylvania,
Crosley, G.E., Motorola, Testron.

SPECIALS: Transmitting Tubes

5654	\$1.00	3B28	\$2.00
5725	\$2.24	2C46	\$6.00
2D21	.81	6A56	\$1.75
6080	\$2.00	HF200	\$6.00

This is just a partial list of types avail-
able. Phone or mail your order. Send for
our complete tube listing.

B & C DISTRIBUTORS COMPANY

180 Spring Street • Paterson, N. J.
MUIberry 4-4010

TUBE TESTING LABORATORY

TEST YOUR TRANSMITTING, RECEIVING, AND
SPECIAL-PURPOSE TUBES TO
JAN, MIL-E-18 AND/OR COMMERCIAL SPECS.
LAB. CERTIFICATES SUPPLIED
BARRY ELECTRONICS CORP.
512 BROADWAY, N. Y. 12, N. Y. WALKER 5-7000

Component Bargains!

- LARGE QUANTITY
- 3BP1—RCA, Sylvania, Individ. Box . . . \$1.00
 - 6J6—6A5, Unbranded but Guaranteed. . . . 25¢
 - 3A5—RCA Jan Boxed 25¢
 - 584 Tubes 30¢
 - RESISTORS 2 WATT 5% AB, 24K, 560 ohms,
10¢ Each—Min. Order 100 of Each
 - CARBON 1/2 W \$10 per M. Min. Order
 - RESISTORS 1 W 20 per M. 100 of
 - 2 W 30 per M. Each
 - CONDENSERS—10 MFD . . . 150 V . . . 10¢ EA.
 -005 . . . 600 V . . . 15.00 M.
 - CONTROLS—1/2 & 1meg w/switch 28¢
 - CERAMIC CONDENSERS — Tubular. All Sizes
\$25 per M. Min order 100
 - 90° YOKE UNWIRED 85¢
 - #20 Shielded Wire—Solid. . . . \$7.50 per
1000 ft. 2000 ft. Spools.
 - And Many Other Items
 - We Also Purchase Your Surplus Inventory
- BELVISION, INC**
254 Greenwich St., N. Y. 7, N. Y. BA 7-6063

FAIR RADIO SALES • 132 SOUTH MAIN ST LIMA, OHIO

AN/APR-4 LABORATORY RECEIVERS



Complete with all five Tuning Units, covering the range 38 to
4,000 Mc; wideband discone and other antennas, wavetraps,
mobile accessories, 100 page technical manual, etc. Versatile,
accurate, compact—the aristocrat of lab receivers in this range.
Write for data sheet and quotations.

We have a large variety of other hard-to-get equipment,
including microwave, aircraft, communications, radar; and labora-
tory electronics of all kinds. Quality standards maintained.

NEW TS-13/AP X-BAND SIGNAL GENERATORS with manual
\$575.00; T-47A/ART-13 Transmitters, \$450.00; H-P, Boonton,
G-R, Measurements, many others in stock.

ENGINEERING ASSOCIATES

434 PATTERSON ROAD DAYTON 9, OHIO

COMMUNICATIONS EQUIPMENT CO.

AUDIO TRANSFORMERS

LVM-11, Multimatch Line Autoformer. Rated 30 watts. Will match up to 10 separate 500-ohm lines. Impedances: 500/260/167/125/100/83/71/62/50 ohms. \$3.49
 G-5603* Mike-to-Grid. 100-ohm Pri. (with 10 M.A. DC) to 125,000 W Sec. Response: $\pm 2db$. 250-4000.....69¢
 G-5604* Plate-to-Line 200 ohms ω (with 32 M.A. DC) to 600 ohms. Resp. 250/3500 cps $\pm 2db$, 15 mw. Level.....\$1.19
 W-15-21: Hybrid: Input Trans #1: 300 w/300 ohm Trans. #2: 600 ohm/250,000 ohms.....\$1.19
 W-15-41: Hybrid Output Trans. #1: 300/300 ohm Trans. #2: 300/10,000 ohm (Plate).....\$1.15
 *SPECIAL: Set of 2 Transformers: Input Trans. W-15-41 and Output Trans. W-15-21. (Above) \$1.97
 KS 9496: Output. 9000 ohms P-P. to 9 ohm V.C. 250 watts. 100 \pm to 10,000 cps $\pm 1db$\$8.95
 KS 9449: Driver Trans. P-P 6V6 (8000 ohms) to PP Grids CL "B" (805's). 10 watts 1000-10,000 cps $\pm 1db$\$2.45
 *SPECIAL: Matched Transformers KS 9449 and KS 9496 (Above).....\$9.95
 AT 071: Interstage. 10,000 ohm pp plates to 80,000 up grids. For BC 614 Speech Amplifier.....\$1.35
 AT 199: Output. 6000 ohm plate to line (200/600 ohms) Response: 200-12 kc. For CFIA and CF 3A.....\$2.45
 AT 037: Mike to grid. 75 ohms to 125,000 ohms.....\$3.65
 J-871: Output. Pri: 200/16,000 ohms P-P. Or 5,000/4,000 ohms. Sec: 500/16/7.5/3.75/1.25 ohms. Sincor, hi-fi.....\$2.75
 AT SUB Subouncer, Multimatch, 200 ohms to 15 K ohm C.T. and 100 K ohm Grids.....\$3.69
 AT501 Hi-Fi Special: PRI: 3000 ohms P-P/Sec: 4/16/12/50/200 ohms 60-10,000 CY $\pm 1db$ 50W.....\$3.49
 AT152 Hi-Fi Driver Pri: 10,000 ohms Sec: 40,000 ohms PP Grids 50-15 KC/1 db.....\$1.49
 AT602 Output to H. S. or line Pri: 14,200 ohms Sec: 8000/600 ohms.....\$1.10
 AT666 Intercom Input: Spkr (-4-8 ohms) to grid (250,000 ohms).....\$0.69
 AT415 Plate (18,000 ohms C.T.) to line (125 ohms) 175 w.-300-600 CY.....\$1.95
 AT858 Plate (10,000 ohms C.T.) to line (125 ohms) (125130 ohms) Hi-Fi-50 W.....\$6.95
 AT-694 Hi-Fi Output: 3 Watts, 8500 Ohms P-P to V.C. (15 Ohms) 15-15KC PM 1 db.....\$1.49
 AT4-1: Mike (35 ohms Carbon) to Line 600 ohm/200 ohm.....\$1.19
 AT-448: Line (600 ohms) to V.C. (6 ohms) 17 db. Level.....\$1.19
 AT-631: Mike-or-Line (200 ohms) To Single or P-P Grids (50K Ohms).....\$0.59
 *Quincer Size

3 CM. TEST SETS

TS 12/AP. For standing wave measurement of plumbing, TR/ATR boxes, crystal mixers, antennas, etc. The TS 12 consists of two basic units: Unit 1 is a high gain stable amplifier followed by a 3-inch meter which reads SWR directly. UNIT 2 consists of waveguide accessories, including a slotted line, probes, dummy load, adapters, etc. Either bolometer or crystal input may be used. Both units are portable, self contained. Operates from 115 v. 60-800 cps. New*
 TS 13/AP. Signal source 9305-9445 mc. 50 microwatts. Comes with a wavemeter, thermistor-bridge power meter, and calibrated attenuator. Oscillator is a klystron type 723/a-b which may be internally (self-synch) or externally pulsed. Controls are provided for FM operation, variable pulse delay, pulse width and phasing. Operates from 115 v. 60-800 cps. New*
 *Send for pricing and delivery schedules

MICROWAVE ANTENNAS

3cm. Horn. 1" x 1/2", with twist and 180 deg. bend. With dielectric window.....\$22.50
 AT49/APR—Broadband Conical, 300-3300 MC. Type N Feed.....\$8.95
 Discone Antenna. AS 125 APR. 1000-3200 mc. Stub supported with type "N" Connector.....\$14.50
 AS14/AP. 10 CM pick up dipole assy. complete w/ length of coax and "N" connectors.....\$4.50
 AS46A/APG-4 Yagi Antenna. 5 element array.....\$22.50
 30" Parabolic Reflector Spun Aluminum dish.....\$4.85
 AN/APA-12—Sector Scan adaptor for AFS-2 radar—Complete Kit.....\$37.50
 AT-68/UP 3 Cm Horn with type N. feed for receiver measurements, etc. New.....\$7.45
 AN-154 3 vertical dipoles working against a rectangular mesh approx. 3"x7". Freq. 140-200 mc. with lobing switch (115.00 cy and portable slatted crate. Extremely rugged.....\$27.95
 LP-24 Aerial loop, for use with glide-path transmitters (MIL-17, etc.) 100-108 mc.....\$32.50
 18" PARABOLIC DISHES, spun aluminum. Focus approx. 8 inches.....\$4.95

POWER TRANSFORMERS

COMBINATION—115V/60—INPUT
 CT-127 900V/25MA PK. 5V/2A. 2V/7.5A.....2.79
 CT-906 350-0-350V/20MA. 5VCT/3A. 2.5VCT/12.5A.....4.39
 CT-965 78V/0.6A. 6.3V/2A. 5VCT/3A. 2.5VCT/12.5A.....1.95
 CT-004 350-0-350V/90MA. 5VCT/3A. 2.5VCT/12.5A.....4.60
 CT-002 350-0350V/50MA. 5VCT/2A. 2.5VCT/7.5A.....3.65
 CT-479 7000V .018V. 2.5V/5A/17.800 V. Test!.....22.50/1
 CT-013 450-0-450V @ 200MA, 10V/1.5A, 2.5, 3.5A, 5V/3A.....4.35
 CT-403 350VCT .026A 5V/3A.....2.75
 CT-931 585VCT .086A 5V/3A, 6.3V/6A.....4.25
 CT-929 420V/0.001A, 2.5V/2A, 6.3VCT/6A.....5.35

PLATE—115V/60—INPUT

PT-07 400VCT 4.0 AMPS FOR RA43.....17.50
 PT 034 125V/45MA (For Preamp).....79
 PT 371 210-0-210V at 2.12 Amp.....9.45
 PT 381 3140/1570A, 2.26KVA.....80.00
 PT 801 22-000V/234 MA, 5.35 KVA.....115.00
 PT 521 750V/.06A. Half Wave.....59.50
 PT 913 2500V/12 MA H'SLD.....4.95
 PT 124 280VCT/1.2A.....3.95
 PT-38-2 37.5/40V AT 750 MA.....2.15

FILAMENT—115V/60—INPUT

FT-157 4V/16A, 2.5V/2.75A.....2.95
 FT-101 6V/25A.....7.95
 FT-824 5.25A/21A, 2x7.75V/6.5A.....14.95
 FT-824 2x26V/2.5A, 16V/1A, 1.2V/7A, 6.4V/10A, 6.4V/2A.....8.95
 FT-463 6.3VCT/1A, 5VCT/3A, 5VCT/3A.....5.49
 FT-552 7.2V/21.5A, 6.5V/6.85A, 5V/6A, 5V/3A.....8.95
 FT-384 6.3V/2.5A, 2x2.5V/7A 5KV Test.....2.79
 FT-650 2.5/10A-3KV TEST 1.0-CAP.....7.50
 FT-025 2.5VCT/10A, 10KV TEST.....6.95

DYNAMOTORS

TYPE	INPUT VOLTS	INPUT AMPS	OUTPUT VOLTS	OUTPUT AMPS	Price
BDAR83	14	3.8	375	.150	\$6.50
35X-059	19	3.8	405	.095	4.35
PD5X-15	14	2.8	220	.08	8.95
DM33A	28	4.8	540	.250	3.95
23350	27	1.75	285	.075	3.95
B-19	12	9.4	275	.110	6.95
			500	.050	
			300	.260	3.95
			150	.010	
DA-3A*	28	10	500	14.5	5.35
PE 73CM	28	19	1000	.350	12.50
BD 601	14	2.8	220	.08	8.95
DG-33A	18	3.2	450	.06	2.50
BDAR 93	28	3.25	375	.150	6.95
					Less filter
					*Replacement for PE 94.
PE 94—Brand New					5.95

INVERTERS

800-1B Input 24 vdc, 62 A. Output: 115 V, 800 cy. 7A. 1 phase. Used, excellent.....\$18.75
 PE-218H: Input: 25/38 vdc, 92 amp. Output 115V 300/500 cy 1500 Volt-ampere. NEW.....\$32.50
 PE205: Input: 28 vdc, 36 amps. Output: 80 V 800 cy. 500 volt-amp. Dim. Input: 13.75 x 5/2 x 10 1/2. New.....\$22.50
 EIGOR—M1 3011-S Input: 13.75 V. 18.4A. Output: 115 V/400 ω . 3db. 0.95 PF. New.....\$59
 PU 7/AP. Input: 28 vdc/160A. Output: 115 VAC. 400 ω . 1 ϕ . 500 VA., 21.6 Amp. Volt, and Freq. Req. Usel, Exc.\$75

PULSE NETWORKS

H-605: 25 KV, 1.5 usec. Type "E" Network. 400 PPS, 50 ohms Z.....\$62.50
 7-5E3-1-200-67P, 7.5 KV "E" Circuit, 1 microsec, 200 PPS, 87 ohms impedance 3 sections.....\$7.50
 7-5E4-1-6-60, 67P, 7.5 KV "E" Circuit, 4 sections 18 Microsec, 60 PPS, 67 ohms impedance.....\$15.00
 7-5E3-3200-67P, 7.5 KV "E" Circuit, 3 microsec, 200 PPS, ohms imp. 3 sections.....\$12.50
 H-616 10KV, 2.2 usec., 375 PPS, 50 ohms imp. \$27.50
 H-615 10KV, 0.85 usec., 750 PPS, 50 ohms imp. \$27.50
 KS885 CHARGING CHOKE. 1.0 ω . 2.0 microsec. Input voltage: 115 v. 400 to 2400 cps. Uses: 1-71B, 4-89-1, 3-72's, 1-73. New.....Less Cover—\$135
 G.E. 2E5E-1-350-50 PPT, "E", CKT, 1 Microsec. Pulse @ 350 PPS. 50 OHMS Impedance.....\$69.50
 KS923 CHARGING CHOKE: 1611 @ 75 MA. 380 Ohms DCR. 9000 Vac Test.....\$14.95
 G.E. 6P3-5-2000, 50 PPT; 6KV, "E" Circuit 0.5 usec /2000 PPS/50 ohms 2 sections.....\$7.50

PULSE MODULATORS

MIT MOD. 3 HARD TUBE PULSER: Output Pulse Power 144 KW (12 KV at 12 Amp.) Duty Ratio: .001 max. Pulse Duration: 5 to 1.0 μ sec. Input voltage: 115 v. 400 to 2400 cps. Uses: 1-71B, 4-89-1, 3-72's, 1-73. New.....Less Cover—\$135
 ASD Modulator-Units, mfd. by Sperry. Hard tube pulser delivers Pk. pulse of 144 kw. Similar to Mod 3 unit. Brand new, less tubes.....\$95.00
 Airborne RF head, model A1A, delivers 50 kw peak output at 9000 mc. at .001 duty. Complete with pulser unit and all tubes.....\$185.00

PULSE TRANSFORMERS

RAYTHEON WX 4298E: Primary 4KV, 1.0 USEC. SEC: 16KV-16 AMP DUTY RATIO: 001 400 CYCLE FIL TRANS. "BUILT-IN".....\$42.50
 WECO: D-163247 For Modulator of SCR 720.....\$22.50
 4P37 (West'n use). Pri: 50 ohms 750V. Sec. 15 KV/1000 ohms .001 Duty. Bifilar: 12.6V/2.5A.....\$32.50
 GE #K-2449A Primary: 9.33 KV, 50 ohms Imp. Secondary: 38 KV, 450 ohms. Pulse length: 1.05 μ usec @ 635/120 PPS. PK Power Out: 1.740 KW Bifilar: 1.5 amps (as shown).....\$62.50
 GE #K-2748-A, 0.5 usec @ 2000 Pps. Pk. Pwr. out is 32 KW impedance 40-100 ohm output. Pri. volts 2.3 KV Pk. Sec. volts 11.5 KV Pk. Bifilar rated at 1.3 Amp. Fitted with magnetron well.....\$24.50
 K-2745 Primary: 3.1/2.8 KV, 50 ohms Z. Secondary: 14/12.6 KV 1025 ohms Z. Pulse Length: 0.25 μ /0 usec @ 600/600 PPS. Pk. Power 200/150 KW. Bifilar: 1.3 Amp. Has "built-in" magnetron well.....\$32.50
 K-2461-A. Primary: 3.1/2.6 KV—50 ohms (line). Secondary 14/11.5 KV—1000 ohms Z. Pulse Length: 1 usec @ 600 PPS. Pk. Power Out: 200/130 KW. Bifilar 1.3 Amp. Fitted with magnetron well.....\$29.50
 K35-15-1 Pul Inversion: PRI: 5 KV PK. Pulse Negative. Sec. Pos. Pulse, 4 KV, 1 usec. and .001 DUTY RATIO.....\$6.50
 54J318-1-3 wdg's. Ratio: 1:1:1. 1.10 uh/wdg., 2.5 ohms DCR.....\$3.50
 UTAH X-150T-1: Dual Transformer, 2 Wdg's. per section 1:1 Ratio per sec 13 MH inductance 30 ohms DCR.....\$5.00
 UTAH X-150T-1: Two sections, 3 Wdg's. per section. 1:1:1 Ratio, 3 MH, 6 ohms DCR per Wdg.....\$5.00
 68G711: Ratio: 4:1 Pri: 200V, Sec. 53V, 1.0 usec Pulse @ 2000 PPS, 0.016 KVA.....\$4.50
 TR 099: Input: 91 Pri. 220 MH, 50 Ohms, sec. 0.75 H. DCR 100 ohms.....\$5.75
 K-904895-501: Ratio 1:1, Pri. Imp. 40 Ohm. Sec. Imp. 40 Ohms. Passes pulse 0.8 usec with 0.05 usec rise.....\$8.95
 RAYTHEON, UX-7350, UX-7307.....\$5. ea.

400 CYCLE TRANSFORMERS

(All Primaries 115V. 400 Cycles)

KS13101	6.3V/15A, 6.3V/0.9A, 6.3V/0.4A, 6.3V/0.2A	\$3.85
KS13104	1450VCT/0.283A, 1050VCT/0.217A	7.50
KS9615	6.3V/4A, 3V/1A	1.57
KS9318	6.3V/4A, P/O R-55/ARQ-9	1.35
KS9608	123V/35MA, 1140VCT/0.7A	5.79
352-7102	6.3V/2.5A	1.45
M-7472426	1450V/1.0MA, 2.5V/75A, 6.4V/3.9A, 5V/2A, 6.5V/3A, P/O ID-39/APG-13	4.95
35-7039	640VCT @ 380MA, 6.3V/9A, 6.3V/6A 5V/6A	5.49
702724	9800/8600 @ 32MA	8.95
K59584	500VCT/90MA, 5V/10A	22.50
KS9807	734VCT/177A, 1710VCT/177A	6.79
352-7273	700VCT/350MA, 6.3V/0.9A, 6.3V/25A, 6.3V/.08A, 5V/CA	6.95
352-7070	242.5V/2.5A (2KV TEST) 6.3V/2.25A/1200/150V/500V @ 005A	7.45
352-7196	115V/1.25MA, 1.5V/1.75A, 2.5V/1.75A—5KV TEST	3.95
352-7176	320VCT/50MA, 4.5V/3A, 6.3V/CT 20A, 2x6.3VCT/6A	4.75
RA6400-1	25V/1.75A, 6.3V/2A—5KV Test	2.39
901692	13V/9A	2.39
901699-501	2.77V @ 4.25A—10KV Test	3.45
901698-501	900V75MA, 100V/.04A	4.29
UX8855C	900VCT/067A, 5V/3A	3.79
352-7098	2500V/6MA, 300VCT/135MA	5.95
KS9336	110V/50MA TAPPED 625V 5V/5A	3.95
M-7474319	6.3V/2.7A, 6.3V/66A, 6.3VCT/21A, 4.25 27V/4.3A, 6.3V/9A, 1.25V/.02A	2.95
KS8984	27V/4.3A, 6.3V/9A, 1.25V/.02A	4.25
52C080	650VCT/50MA, 6.3VCT/2A, 5VCT/2A	3.75

X BAND - 1" x 1/2" WAVEGUIDE

ROTARY JOINT (APS-6) Sperry PT #658275, 180 deg. rotation, choke-to-choke. Has "Built-In" Di-Coupler. 20 DB. with "N" Takeoff.....\$9.95

 PARABOLOID DISH, 18" diam Spun Aluminum, 8" Focus. For AN/APS-6.....\$4.95
 3 CM. DIPOLE and Feed Assembly. (May be used with above dish) 8 inches long.....\$5.00
 FLEXIBLE SECTION 9" in. long. Cover-to-Cover. \$5.50
 3CM. DIPOLE FEED, 15" L. for APS-15.....\$14.50
 MITRED ELBOW, Cast aluminum, 1 1/4" x 5/8" W.G. W.P. Flanges. "E" Plane.....\$3.50
 3 CM ANTENNA ASSEMBLY: Uses 17" paraboloid dish, operating from 24 vdc motor. Beam pattern: 5 deg. in both Azimuth and elevation. Sector Scan: over 160 deg. at 35 scans per minute. Elevation Scan: over 2 deg. Tilt: Over 24 deg.....\$35.00
 Cross-Guide Directional Coupler. UG-40 output flange. Main Guide is 8" Long, with 90 Deg. "E" Plane bend at one end, and is fitted with Std. UG 39/IG 40 flanges. Coupling figure: 30 db Nominal.....\$22.50
 RG52/U Waveguide in 5' lengths, fitted with UG 39 flanges to UG40. Silver plated.....per length \$5.00
 Rotating-Joints supplied either with or without deck mountings, with UG40 flanges.....each \$17.50
 Bulkhead Feed-thru Assembly.....\$15.00
 Pressure Gauge Section with 1/2 in. gauge.....\$10.00
 Directional Coupler, UG-40/U Take off 20db.....\$15.00
 MAGNET AND STABILIZER CAVITY For 2141 Magnetron.....\$24.50
 90 degree elbows. "E" or "H" plane 2 1/2" radius.....\$8.50
 ADAPTER waveguide to type "N", UG 81-U, p/e TS 12, TS 13, Etc.....\$7.50
 ADAPTER, UG-163/U round cover to special IPTL. Flange for TS-45, etc.....\$2.50 ea.
 TS-12 SWR Measuring set slotted line accessory amplifier. 8000-10,000 M.C., New.....\$425

I. F. AMPLIFIER STRIPS

Model 15: 30 Mc Center frequency. Bandwidth 2.5 Mc. gain figure: 65 db. Uses 5 stages of 6AC7's. Has D. C. Restorer and Video Detector A.P.C. Strip included. Input impedance: 50 Ohms. Less tubes.....\$17.50
 60 MC. Miniature IF strip, using 6AK5's 60 Mc center Freq. Gain: 95 db at Bandwidth of 2.7 Mc. New. Complete with tubes.....\$15.00

JAN WAVEGUIDE FLANGES

UG 39/U.....\$1.10
 UG 40/U.....\$1.25
 UG 40A/U.....\$1.85
 UG 51/U.....\$1.85
 UG 52/U.....\$3.40
 UG 52A/U.....\$3.40

MAIL ORDERS PROMPTLY FILLED. ALL PRICES F.O.B. NEW YORK CITY. M.O. OR CHECK. ONLY SHIPPING SENT C.O.D. RATED COUNTRIES SEND P. O. PARCELS IN EXCESS OF 20 POUNDS WILL BE SHIPPED VIA CHEAPEST TRUCK OR RAILEX.

131 Liberty St., New York 7, N. Y. Dept. E-9 Chas. Rosen Phone: Dlgby 9-4124

ATTENTION

FOR
READERS
OF
ELECTRONICS
ONLY

during September 1955

FROM STOCK
*in any
standard values*

A B Buyers: RESISTORS

Any Type J-JJ-JJJ
POTENTIOMETERS

AT NEW LOW PRICES

- - - for each value separate - - -

1/2 WATT BTS + EB	10% 5%
1 WATT BTA + GB	10% 5%
2 WATT BTB + HB	10% 5%

1-99 dcs	100-900 pcs	1000 lots
.04 ea .08 ea	2.50/c 5.00/c	20.-M 40.-M
.06 ea .12 ea	4.00/c 8.00/c	32.-M 65.-M
.09 ea .20 ea	7.00/c 14.00/c	60.-M 125.-M

5000 lots

16.-M
32.-M

26.-M
52.-M

51.-M
102.-M

ONLY ON
SPECIAL
VALUES
Ask For
The List

LEGRI S COMPANY

391 Riverdale Avenue

YONKERS 5, N. Y.

Phone: Yonkers 9-6000

Announcing FORMATION OF

RUXRUR ELECTRONICS CORP.

As a new source of Surplus Military and Industrial Components
at 623 HUDSON ST (3 Blocks below 14th St)
Telephone Watkins 4-7260 NEW YORK 14, N. Y.
FOUR FLOORS OF ELECTRONIC & ELECTRICAL MATERIAL
Watch Future Issues For Specials
Have your name placed on our Mailing list for special offering Bulletins and Catalogs.
MAX EPSTEIN Pres.

HELIPOTS TEN TURNS; 50,000 OHMS

Linearity tolerance 0.05%
Resistance tolerance 1%
3/8" standard bushing mounting

New, clean, original bulk pack. Regular factory cost cut drastically because of contract termination.

\$12.95 each, postpaid in U.S.A.

QUANTITY USERS WRITE FOR QUOTATION ON these and other quality components

G. GREENE
166-04 67th Avenue Flushing 65, N. Y.

Rectifiers For Sale

Complete with cabinet and control

Output: 2800 v. DC 1.4 amps
and 6 v. AC 60 amps

Input: 220 v., one ϕ
60 cycle

Control includes breaker, plate and grid meter and interval timer

Each: \$1,000 Lots of 3, each \$850

FS-7331, Electronics
330 W. 42 St., New York 36, N. Y.

ELECTRONICS

We buy and sell all types of aircraft electronic equipment. We have the largest, most complete stock on the coast of receivers, transmitters, and radar equipment — all checked and guaranteed. We own and operate our own overhaul plant. What are your needs?

ELECTRONIC TUBES:

We have most complete stock of late-type electronic tubes for broadcasting, industrial, military and ham use. Quotations on request.



ELECTRONIC INDUSTRIES

2033 WEST VENICE BLVD.
LOS ANGELES 6, CALIFORNIA

Send for free catalogue

Phone: RRepublic 5-0215

Cable Address: VHRADLECT

FOR SALE R.F. GENERATORS

for 220 v., one ϕ , 60 cycle input
2 KW, 40.9 megacycle \$1,500
2 KW, 13.6 megacycle \$1,800

FS-7338, Electronics
330 W. 42 St., New York 36, N. Y.

SAVE ON TUBES BRAND NEW TUBES GUARANTEED TUBES

OA2 1.00	2E32 1.00	3C27 1.50	6AL5W85	QK283A.. 149.50	715B 5.00	923 1.50	5663 1.50
OA3 1.00	2J21A 3.00	3C31 2.50	6AR6 1.30	QK284A.. 149.50	715C 12.00	927 1.40	5667 150.00
OB275	2J22 3.00	3C33 9.95	6A57G 2.00	287A 3.50	717A75	SN930 4.50	5670 2.00
OB2WA 3.00	2J26 5.00	3C45 7.00	6D21 200.00	304TH 8.95	719A 10.00	931A 2.75	5672 1.25
OC3/VR105 .75	2J27 5.00	3DP11A 7.50	6F4 3.25	304TL... 8.95	720AY-EY. 25.00	935 4.00	5675 7.00
OD3/VR105 .75							CK5678 1.00
1B23 3.50							5686 2.00
1B24 6.00							5687 3.00
1B26 2.00							5691 5.00
1B27 10.00							5692 5.00
1B29 3.00							5693 4.75
1B35 4.50							5696 1.10
1B36 4.00							5702 2.00
1B40 3.00							5703 1.25
1B44 22.50							5718 3.00
1B51 7.25							5719 2.50
1C21 2.00	2J31 15.00	3D21A 5.00	6J4 3.50	305A 3.50	721A 1.00	SN944 4.50	CK5721 189.50
1N2175	2J32 15.00	3E29 9.50	6K4 2.50	307A/RK75 1.00	721B 7.50	SN949C 4.50	5725 2.00
1N21B 1.50	2J33 15.00	3GP1 1.95	6L6WGB... 3.50	312A 2.95	722A75	SN953D 4.50	5726 1.00
1N2375	2J34 15.00	3J30 35.00	6SL7WGT... 2.00	313C 3.00	723A/B 8.50	95435	5727 2.25
1N23B 1.75	2J36 20.00	3J31 45.00	6SN7W 2.00	316A50	724A 1.00	95540	5744 1.00
1N23BM 5.00	2J42 60.00	3K30 125.00	7C22 50.00	323B 5.00	724B75	95640	5750 3.10
1N25 4.00	2J48 40.00	4B23 10.00	7C23 69.50	327A 2.50	725A 3.50	95740	5751 2.20
1N26 4.95	2J49 40.00	4B24 7.50	7C24 100.00	336A 5.00	726A 7.00	958A50	5780 199.50
1N34A60	2J50 35.00	4B26 3.50	15E 1.00	338A 5.00	726B 25.00	959 1.50	CK5787 4.95
1N35 1.50	2J51 150.00	4B27 4.00	NE1635	349A 7.50	726C 25.00	SN977CX 4.50	5814 1.60
1N42 8.00	2J55 35.00	4-125A 17.50	RK21 1.00	350A 3.00	730A 10.00	99135	5842 13.50
1N47 4.50	2J56 50.00	4C27 3.50	HK24 3.00	350B 2.75	750TL 45.00	CK100535	5844 1.75
1N63, K63. 1.75	2J61 15.00	4C28 25.00	23D790	354A 15.00	801A50	CK1006 2.75	5851 4.00
	2J62 5.00	4C35 15.00	T40 2.50	354C 5.00	802 2.75	1500T 85.00	
		4E27 9.00	D42 40.00	368AS 3.00	803 1.50	1603 3.50	
		4J22 45.00	HK 54 2.00	388A 1.20	804 9.75		
		4J23 45.00	CK59 30.00	393A 4.50	805 4.75		
		4J24 45.00	CK60 25.00	394A 3.00	806 9.50		
		4J26 75.00	RK60/1641 1.95	396A 3.25	807 1.25		
		4J27 40.00	CK61 30.00	403B/5591 2.75	807W 4.50		
		4J28 40.00	CK62 29.50	WE417A... 13.50	808 1.50		
		4J29 50.00	HY65 2.00	WL417A4.00	808 2.75		
		4J31 65.00	RK65/5D23.10.00	WE418A... 15.00	811A 3.50		
		4J34 50.00	FG67/5728 10.00	WE421A... 15.00	812 2.50		
		4J42 25.00	RKR7250	WE422A... 11.00	813 11.00		
		4J50 85.00	RKR7350	RT434 25.00	814 2.00		
		4J51 150.00	FG104 29.50	434A 3.00	815 1.50		
		4J52 50.00	FG105 12.50	446A50	816 1.50		
		4J57 149.00	F123A 4.00	446B 2.00	828 8.50		
		4X150A 25.00	F128A 20.00	450TH 35.00	829 6.00		
		4X500A 60.00	H100 7.50	450TL 35.00	829B 8.50		
		5BP2A 6.50	FG154 17.50	WL456 59.50	830B95		
		5BP4 2.00	VT158 10.00	464A 2.50	832 4.00		
		5CP1 1.75	FG166 17.50	CK512AX... 1.10	832A 6.00		
		5CP1A 10.00	FG172 17.50	527 15.00	833A 27.50		
		5C22 29.50	WL200 75.00	ML531 4.00	836 2.00		
		5C30/C5B 1.50	203A 5.00	55950	837 1.00		
		5CP7 7.50	204A 35.00	KU610 5.00	845 6.00		
		5D21 7.00	207 50.00	HY61550	846 75.00		
		5D23 7.50	211/VT4C... .50	WL616 99.50	849 24.50		
		5FP7 1.50	212E 17.50	KU627 10.00	851 12.50		
		5FP14 5.00	217A 2.00	631P1 7.00	852 5.00		
		5JP2 7.50	217C 2.00	648P1 7.50	860 3.50		
		5JP4 7.50	WL218 25.00	WL651 39.50	861 15.00		
		5JP5 7.50	QK221 125.00	WL652 25.00	86550		
		5JP11A 17.50	FG235A 35.00	WL681/68627.50	866A 1.15		
		5J23 20.00	QK249 150.00	701A 1.95	872A 1.50		
		5J29 7.00	249B 3.00	703A 1.50	87460		
		5J30 7.00	249C 3.00	704A 1.00	87860		
		5J33 5.00	250R 5.00	705A 1.00	884 1.25		
		5MP1 3.95	250TL 15.00	706AY-GY 15.00	5634 7.50		
		5NP1 5.00	251A 50.00	707A 3.50	GL889 60.00		
		5R4GY 1.00	252A 10.00	707B 5.00	GL889A... 74.50		
		5R4WGY... 2.40	QK253 149.50	708A 1.00	889RA 150.00		
		C6J 6.50	254A 6.50	713A50	902A 3.50		
		C6L/5528... 4.00	FG258A 130.00	714A 12.50	902P1 3.50		
		6AC7A90	271A 10.00	714AY 20.00	919 2.50		
		6AC7W 1.25	274B 1.00	715A 2.00	922 1.25		
		6AJ5-JAN. 1.25	282B 5.00				

This is only a partial inventory. — We stock one of the largest tube inventories in the U. S. Complete inventories purchased. — Quantities large or small — we buy them all!

SPECIAL!



Vacuum Capacitors

6 mmfd. 30 KV... 10.00
50 mmfd. 32 KV... 9.00
50 mmfd. 40 KV... 14.50
75 mmfd. 20 KV... 12.50
150 mmfd. 20 KV... 14.00

SPECIAL!

5" DUAL GUN TUBE

Long persistency face. Value at \$200.00. This tube has been rejected for military use.

Tested Before Shipped & Fully Guaranteed. Only

\$17.95

1N6949	2J62A 50.00	161675	5894 20.00
1P21 30.00	2J85150	1620 3.50	5896 6.50
1P22 6.50	2K22 15.00	1623 2.50	5899 7.00
1P29 2.00	2K25 12.50	1624 1.00	5901 6.50
1P36 2.50	2K26 45.00	162530	5902 8.00
1P39 1.20	2K28 37.00	162635	5905 8.95
1W5 1.25	2K33 100.00	163050	5907 7.90
1Z2 2.00	2K33A 65.00	1631 1.75	5908 7.95
2AP1 5.00	2K34 99.50	1636 1.25	5910 2.25
2C2150	2K39 125.00	1641 1.50	5932 4.00
2C26A50	2K41 100.00	164250	5933/807W 4.00
2C3435	2K43 125.00	2050 1.00	6005 2.00
2C35 2.50	2K44 150.00	205170	6021 4.00
2C39 7.50	2K45 50.00	ZB3200 75.00	CK6050 2.00
2C39A 8.50	2K48 90.00	5550 30.00	6072 3.95
GL2C40 10.00	2K54 15.00	5551 25.00	6080 3.50
2C42 15.00	2K56 50.00	5553/655 135.00	6080WA 4.25
2C43 9.00	2V3G 1.50	5557/FG17. 3.50	6111 6.50
2C4450	2X2A 1.00	5559/FG57.12.50	6147 4.00
2C46 9.00	3B22 1.50	5560 20.00	6177 49.50
2C51 3.25	3B24 1.50	5561 29.50	8002R 20.00
2C52 3.50	3B26 3.50	5586 150.00	8005 4.95
2C53 10.00	3B28 6.00	5591/403B 2.30	8012 1.00
2D21 1.00	3B29 6.95	5611 99.50	8013 4.95
2D21W 1.50	C3JA 7.50	5634 7.50	8025A 2.50
2E22 2.00	3C22 60.00	5636 5.00	900190
2E26 3.25	3C23 3.75	5637 8.50	900270
	3C24 1.50	5651 1.40	9003 1.00
		5654 1.50	9004 1.25
		5656 7.50	9005 1.10
		5657 125.00	9203 20.00

THIS IS ONLY A PARTIAL INVENTORY. CHECK WITH US FOR YOUR REQUIREMENTS

Thousands of other types in stock. Send us your requirements. RECEIVING TUBES! We Carry a complete line in stock. Standard brands only.



ELECTRONICS
Dept. ET
1108 Venice Blvd.
Los Angeles 15
California

All Prices F.O.B. Los Angeles, subject to change without notice. Minimum order \$5.00. Check with us for items not listed.

TYPE CK5 INERTIA SERVO MOTOR

2 phase; 26 volts; stalled torque .5" oz.; speed 3460 rpm; reversing time 0.4 seconds; weight 6 oz.; length 1 3/4"; Pioneer Instrument.



Stock No. 119
\$22.50 ea.

TYPE R-210-1-A SYNCHRO TRANSMITTER

Rotor 1 phase; 26 volts; stator 3 phase, 11.8 volts; 400 cycle; motor length 1 3/4"; OD 1.062; weight 3.5 oz.; Kearfoot Company Inc.



Stock No. 121
\$15.00 ea.

DC TIMING MOTOR

with chronometric governor adjustable from 1 to 25 min. mfgd. by Haydon 20-30 VDC



Stock No. 134
\$22.50 ea.

INFRA-RED RECEIVER (SNOOPERSCOPE) TYPE A1

Contains elaborate optical system with many-coated lenses. Unit is very lightweight complete with carrying case. Receiver is 8 1/2" long with 2 1/2" schmidt Ultra high speed approximately +0.5 object lens



\$19.95 ea.

TIMING MOTORS: HAYDON

B-5796 20/30 Volts DC—30 RPM with Chronometric Governor—

Stock No. 130
\$9.95 ea.



INVERTERS

MG 149F HOLTZER CABOT
OUTPUT: 26 VAC @ 250 VA; 115 V. @ 500 VA; single phase; 400 cycle; INPUT: 24 VDC @ 36 amps...\$49.50
PIONEER 12123-1-A
OUTPUT: 115 V.; 3-phase; 400 cycle; Amps .5; INPUT: 24 VDC; 12 amp. \$69.50
PIONEER 12126-2-A
Output: 26 volts; 3 phase; 400 cycle; 10 VA; .6 PF Input: 27.5 volts DC; 1.25 amps\$24.50
DNF2506M

CONTINENTAL ELECTRIC
24-30 volts input; 5.5-45 amps; cont. duty. Output: 115 volts; 44 amps; 400 cyc; 1 phase; PF 1.0; 50 watts \$39.50
10563 LELAND ELECTRIC
Output: 115 VAC; 400 cycle; 3-phase, 115 VA; 75 PF. Input: 28.5 VDC; 12 amps.\$39.50
PIONEER 12117
Output: 26 volts; 400 cycles, 6 volt ampres, 1 phase. Input: 24 VDC; 1 amp\$19.95
PE 218 LELAND ELECTRIC
Output: 115 VAC; Single Phase PF 90; 380/500 cycle; 1500 VA. Input: 25-28 VDC; 92 amps; 8000 rpm; Exc. Volts 27.5 BRAND NEW\$39.95
PE 109 LELAND ELECTRIC
Output: 115 VAC; 400 cyc; single phase; 1.5 amp; 8000 rpm. Input: 13.5 VDC; 29 amp\$65.00
MG153 HOLTZER-CABOT
Input: 24 VDC; 52 amps. Output: 115 volts—400 cycles, 3-phase, 750 VA and 26 volt—400 cycle, 250 VA. Voltage and frequency regulated\$95.00
PIONEER 12130-3B
Output: 125.5 VAC; 1.5 amps, 400 cycles single phase, 141 VA. Input: 20-30 VDC, 18-12 amps. Voltage and frequency regulated\$69.50
12116-2-A PIONEER
Output: 115 VAC; 400 cyc; single phase; 45 amp. Input: 24 VDC, 5 amps.\$39.95
10285 LELAND ELECTRIC
Output: 115 volts AC, 750 VA, 3 phase, 400 cycle, .90 PF and 26 volts, 50 VA, single phase, 400 cycle, .40 PF. Input: 27.5 VDC, 60 amps, cont. duty, 6000 rpm. Voltage and frequency regulated\$59.50
10486 LELAND ELECTRIC
Output: 115 VAC; 400 cycles; 3-phase; 175 VA; .80 PF. Input: 27.5 DC; 12.5 amps; cont. duty\$90.00
PIONEER 10042-1-A
DC Input 14 volts; output: 115 volts; 400 cycles, 1-phase; 50 watt\$39.50
10339 LELAND ELECTRIC
Output: 115 volts; 150 VA; single phase; 400 cycle; .90 PF and 26 volts; 60 VA; 400 cycle, .40 PF. Input: 27.5 volts DC 18 amps cont. duty, voltage and freq. regulated\$49.50



SYNCHRONOUS SELSYNS

110 volt, 60 cycle, brass cased, approximately 4" dia. x 6" long. Mfd. by Diehl and Bendix.

QUANTITIES AVAILABLE
REPEATERS\$20.00 ea.
TRANSMITTERS\$20.00 ea.

SYNCHROS

GENERAL ELECTRIC MOD. 2J15M1; 115-57.5 volts, 400 cycle\$22.50
KOLLSMAN AUTOSYN MTR. TYPE-403; 32 VAC; 60 cycl; single phase,\$9.95
BENDIX AUTOSYN MTR. TYPE-851; 32 VAC; 60 cycle, single phase,\$9.95
MICROSYN UNIT TYPE IC-006A,\$15.00
IF SPECIAL REPEATER; 115 volt-400 cycle\$15.00
2J1F3 GENERATOR; 115 Volt-400 cycle\$10.00
5CT CONTROL TRANSFORMER; 90-50 volt; 60 cycle\$45.00
5F MOTOR; 115-90 volt; 60 cycle\$45.00
5SDG DIFFERENTIAL GENERATOR; 90-94 volts; 400 cycle\$30.00
BENDIX TRANSMITTER TYPE C-78248; 115 volt; 60 cycle\$22.50
DIFFERENTIAL TYPE C-78249; 115 volt; 60 cycle\$5.00
BENDIX REPEATER TYPE C-78110; 115 volt; 60 cycle\$37.50
REPEATER, Type C-78663, AC Synchronous 115 volt, 60 cycle\$9.50
DIEHL REPEATER TYPE FJE 22-2; 115 volt; 400 cycle; secondary 90 volt\$27.50
5G GENERATOR; 115/90 volt; 60 cycle\$45.00
7G SYNCHRO GENERATOR; 115/0 volt; 60 cycle\$75.00
6G SYNCHRO GENERATOR; 115/90 volt; 60 cycle\$60.00
60G SYNCHRO DIFFERENTIAL GENERATOR; 90/90 volt; 60 cycle,\$50.00
2J5F1 SELSYN CONTROL TRANSFORMER; 105/55 volts; 60 cycle\$22.50
2JDSH1 SELSYN GENERATOR; 115/105 volts; 60 cycle\$50.00
2J1F1 GENERATOR; 115/57.5 volts; 400 cycle\$12.50
2J1H1 DIFFERENTIAL GENERATOR; 57.5/57.5 volt; 400 cycle\$12.50
2J1G1 CONTROL TRANSFORMER; 57.5/57.5 volts; 400 cycle\$7.50
2J5H1 SELSYN GENERATOR; Mfr. G.E.; 115/105 volts, 60 cycle\$27.50

SIMPLE DIFFERENTIAL

Size: 2-5/32" long x 1 1/4" dia.; bearing one end 1/2" O.D.; Shaft Size: 1" long, threads 8-32-3/4" long, with bearing shaft 1/8" dia. x 1/4" long. Gear on shaft end 1-7/16" dia., gear on bearing end 1 1/4" dia. Drive gear 25/32" dia.

Stock No. 101

\$3.95 ea

400 CYCLE SYNCHRONOUS TIMING MOTOR

Hysteresis type mfgd. by Haydon 115 V single phase. Can be connected for either right or left rotation or reversing duty. Output shaft is .125 diameter x .258 long with end slotted .031 wide x .125 deep. Output speeds 1 r.p.m., 1/6 r.p.m. and 1/66 r.p.m.

Stock No. 135
\$9.95 ea.



SENSITIVE INTEGRATING GYROS

This is the famous HIG gyro which is being used in missile guidance systems, radar stabilization and fine control systems. Gov't cost approx. \$1500.00. Limited quantity available not meeting Gov't Specs.

Stock No. 133



\$25 ea.

SIMPLE DIFFERENTIAL

1:1 reverse ratio. Size: 6 3/4" long x 2 3/4" dia. Shaft size: 1 1/32".



Stock No. 111
\$7.50 ea.

SIMPLE DIFFERENTIAL

Size: 5 1/2" long x 2 1/4" dia. Shaft size: 3/8" on one end and 1 1/32" on other end. Hub is 1-3/32" dia. on each end.



Stock No. 112
\$7.50 ea.

PRECISION PLANETARY DIFFERENTIAL

1:1 reverse ratio, ring gear 3" dia., 120 teeth. Overall length 5 1/4". shaft dia. 1 1/32", 1/8" key on one end.



Stock No. 114
\$7.50 ea.

WRITE OR WIRE FOR INFORMATION ON OUR COMPLETE LINE OF SURPLUS ELECTRONIC COMPONENTS. ALL PRICES NET F.O.B. PASADENA, CALIFORNIA.

C&H

SALES CO.

2176-E East Colorado St.
Pasadena 8, California
RYan 1-7393

WANTED
BC-788, T-47A/ART-13,
BC-348R, R-5/ARN-7,
RT-18/ARC-1

RADALAB
 87-17 124th STREET
 Richmond Hill 18, New York
 Phone Virginia 9-8181-2-3

*Prices FOB NYC. Rated firms
 open account. Prices subject
 to change without notice.*
CABLE: Radalab, NY
TELETYPE: NY-4-4361

AN/ASQ-1 and 1A MAGNETOMETERS
 This is an airborne magnetometer used to measure the magnetic flux of the earth and to locate submarines and other metallic objects by their distortion of the magnetic field. Sensitivity 2-3 gamma or better. POR.

AN/GSQ1-A SPEECH SCRAMBLERS
 Speech scrambler for use on any comm. channel to insure privacy. We can supply complete installations of this equipment 28v DC input. Also 110v 60 cye.

SCR-291A DIRECTION FINDER
 Automatic ground direction finder covering 1.5mc-30mc. Provides instant bearings on a C.R. indicator of any signal in its range. This equipment is transportable and can be set up quickly. 110v 60 cye. POR.

P.P.I. REMOTE RADAR REPEATERS

We can supply the following types of remote Radar P.P.I. Repeaters. The main radar provides the Synchronizing, Syncro. and Video. Pulses to operate the Repeaters. These repeaters may be used with any marine ground or airborne.

VC 7" P.P.I. Upright deck mount Repeater. 4 Ranges are provided from 4-200 miles. Input 110 Volt 60 Cye.

VD 7" P.P.I. Deck mount Repeater. This unit is very similar to the VC but is completely Waterproof and may be used on deck. The ranges are the same as the VC. Input 110 Volt 60 Cye.

VE 7" P.P.I. Table mount Repeater. This is a very compact set. 4 ranges are provided from 4-200 miles. Input 110 Volt 60 Cye.

VF 9" P.P.I. Deck mount Repeater. This is a very late model Repeater enabling 20 radars to be fed into it. 4 Ranges from 4-200 miles are provided. Input 110 Volt 60 Cye.

VG 12" P.P.I. Plotting Table Projection Repeater. This is a very elaborate Remote Indicator. For use in a plotting center. Up to 20 Radars may be fed into it. This set utilizes a Skiatron tube to provide data that can be retained on the screen and can be erased at will. Input 110 volt 60 Cye.

Accessories are available such as repeater adaptors enabling the set to be used at a greater distance than normal. Input switches to select the radar to be viewed etc.

SCR-682-A RADAR
 10CM high power long range harbor surveillance and early warning RADAR. This equipment is a 3000 mc mobile search radar that can be transported in a truck. The equipment incorporates a 7" PPI for operation up to 240,000 yards. Azimuth accuracy is ± 1%. Range accuracy is 100 yards at 10,000 yard range and 5000 yards at 240,000 yard range. Trans. output is approx. 225 KW. pulse width is one microsecond. Antenna beam width is 6°. Input is 110v 60 cye. Can be supplied with or without operating shelter or antenna tower. POR.

We can supply many types of radars, test sets, communications equipments, manufactured after 1947. Write us if you cannot find it.

AN/APR-4 38-4000 MC RECEIVER
 This is a precision receiver covering 38-1000 mc. The set utilizes 5 tuning units with direct reading dials in megalcycles. The receiver has a wide and narrow band-width 30mc. I.F. strip which may be selected at will. An output meter is provided to measure signal strength. Outputs are provided for a pulse analyzer and an adaptor. Each tuning unit has an automatic sweeping mechanism which enables any portion of the tuning range to be scanned automatically. Input 110v 60 cye. POR.

500-1300 MC SIGNAL GENERATOR
 This is a high precision signal generator covering 500-1300 mc. A precision attenuator is built in providing accurate determination of output from 0-100,000 microvolts. Either CW or pulsed carrier output with the following characteristics are provided. Pulse rate 60-2500 CPS. Pulse length 2-30 microseconds. Output line 50 Ohm impedance. Accuracy better than one percent. Input 110 v 60 Cye. With calibration charts. Price \$249.50

90-600 MC SIGNAL GENERATOR
 This set covers 90-600 mc. with an accuracy of one percent or better. C.W. or pulse output with the following characteristics are provided. Output from 0-100,000 microvolts 2-30 microseconds long. Pulse rate 60-2500 cps. Pulse delay 3-300 microseconds. Output 50 ohm line. Input 110v 60 cye. Price.....\$249.50

CF-3A CARRIER REPEATER
 This is a transportable 4 wire carrier telephone repeater. This set amplifies all signals when used in an intermediate position on a carrier system to extend the range. DC signaling and telegraph communications can be performed to the terminal equipments or to other repeaters. Monitoring and transmission circuits are built in. Power Input 110 or 220v or 12v DC. This set can be used with all CF terminals and commerial equipments. Brand New in original cases. POR.

AN/APA-17 DIRECTION FINDER
 This is an automatic direction finder covering 300-1,000 mc to be used with the APR-1 and APR-4 radar search receivers. The bearing is presented on a cathode ray screen in a cardoid pattern. The set can be used in aircraft or on the ground. Input 110v 400 cye and 28v DC. POR.

RADAR BEACONS
X and S Band High and Low Power Racons

We can supply the following Beacons in Portable and Stationary Models. The X-BAND models will operate with the new Weather Radars AN/CNP-6 X-Band high power Radar Beacon. This is a 40 KW set for use at an Airport. This set will interrogate X-BAND Radars up to 200 miles. Variable Coding is provided as well as monitoring facilities. Input is 110 V 60 CYC.

AN/CNP-8 S-BAND HIGH POWER Airport Beacon. This is a very compact set. This set will interrogate S-BAND Radars up to 200 Miles. Variable Coding and monitoring facilities are provided. Input 110 Volt 60 Cye.

AN/CNP-17 S-BAND High power version of the CPN-6 with all the latest improvements. Input 110 Volt 60 Cye.

AN/UPN-1 X-BAND Very lightweight Portable Beacons. This set will interrogate X-BAND Radars up to 60 miles. Variable Coding is provided. Input 12 Volts D.C. and 110 Volts 60 Cye. Weight Approx 40 Lbs.

AN/UPN-1 and 2 S-BAND Portable Beacons. This set will interrogate a S-BAND Radar up to 60 Miles. Variable Coding is provided. Input is 12 Volts D.C. and 110 Volts 60 Cye. Weight Approx 50 Lbs.

PHOTOCON SALES

417 N. Foothill Blvd. SYcamore 2-4131
 Pasadena 8, Calif. RY an 1-6751

CABLE: Photocon, Pasadena

BC-906 Frequency Meter 150-235 mc. Battery operated.....Exc. 12.95
 TS13/AP X-Band Signal Generator, wavemeter, watt meter.....Exc. PUR
 BC-1206 Beacon Receiver 200kc.-400kc., I.F. Frequency 142.5 kc. Input 28 vdc.....NEW 14.50
 MG149F Inverter.....Exc. 49.50

PHOTOFLASH SPECIALS

FT-524 General Electric 3200 watt-second Photoflash tube.....New \$20.00
 80 mfd., 4000 v., 610 watt-second Photoflash capacitor.....New 50.00

Weston Mod. 686 True Mutual Conductance Vacuum Tube Analyzer.....New 450.00
 TS184/AP Signal Generator Freq. Range 400-430 mc. complete.....New 69.50
 Esterline-Angus Model AV Recording Voltmeter 0-10 vac. 400 ohms.....Exc. 150.00

LORAN EQUIPMENT

AN/APN4B Loran with 1D6B Indicator, RRB Receiver, crystal, mounts, plugs, and manual New \$129.95
 PE-206 Inverter.....14.95

BC-221 Freq. Meter 125kc.-20mc. with cal. book and xtal.....Exc. 99.50
 BC-683 FM Receiver with tubes 27-38.9 mc. Exc. 49.50
 BC-684 FM Transmitter 27-38.9 mc. 35w. output.....Exc. 17.50
 1-1300 Signal Generator P. O. IE-19C for SCR-522 Freq. Range 100-156mc. crystal controlled, battery operated.....Like New 99.50
 BC-659 Transmitter-Receiver 27-38.9mc. Exc. 24.95
 General Electric S79A Dual Regulated Power Supply.....NEW PUR
 GP-11 Transmitter with coils 3000-3675kc. Exc. 14.50
 BC-223AX Transmitter with tubes, TU17, TU18, TUQ5, 2000-5250 kc.....Exc. 32.50

We have one of the largest and most complete electronic stocks in the country. Thousands of tubes, capacitors, plugs, accessories, transmitters, receivers, test equipment, etc.

WRITE FOR OUR 1955 CATALOG!

R. F. HEATING UNIT:

RCA Radio Frequency Generator for dielectric heating applications. Type 15 B. Input 40 KVA; 3 phase, 220 V.; 50/60 cycle. Output approximately 10 KW. Frequency range 2-10 M. C.

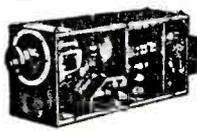
Included with apparatus—Westinghouse 3 phase Type S, Rectifier Transformer, 220 V.; 50/60 cycle; 8500 V. at 3.2 amp. D.C. or 3800 V. at 2.1 amp. D.C. output.

Also included is oil-immersed motor driven 3 phase, 220 V. Variac to control primary of transformer above. Spare set of tubes. Apparatus can be inspected by appointment. Willing to sell at fraction of original cost of \$11,000.

AMERICAN CYANAMID COMPANY
 Affn: Mr. W. M. Bowes
 1937 West Main Street Stamford, Conn.
 Telephone—Flreside 8-7331—Ext. 418

RCA TV CAMERA

NEW Surplus
 for Labs! Export!
 Industrials!
 Medicine!
 Closed Circuit
 TV!



Ideal for labs, industry, prisons, TV, technicians, swim pools, movies—"mechanical eye" for closed circuit TV. 1846 Iconoscope, 6-stage video amplifier and clipper. THE REAL THING! Send for new free, complete technical data. SOLD AT FRACTION OF REAL VALUE!
 Write today! Note our new address!

Harjo Sales Co.
 Mailing Address: Box 1187-ED, MAGNOLIA PARK STATION, BURBANK, CALIF.
 Office-Warehouse: Dent. E. 9, 503 N. Victory Blvd., BURBANK, CALIF.

ART-13 APR-4 BC-610-E

BC-348, BC-312, BC-342, RAK, RAX.
 BC-221, TS-174, #241 Scope, LM
 ARC-1, APA-10, DY-17, DY-11

Alltronics, Box 19, Boston 1, Mass
 Telephone: Richmond 2-0048, 2-0916

Western Electric Carrier Frequency
CF-1-A THRU CF-7

Varistors, Resistors, Filters, Capacitors, Relays, Switches, Terminal Boards, Equalizers, Attenuators, etc. Send for listing.

POTS—TYPE J JJ JJJ

Most sizes priced from.....\$.65 to \$1.50
 TOP BRAND Rectangular 10mfd/600v., 10 for 13.50 (1.50 ea.)
 W.E. .1mfd/Marked a Conservative 400V—WHI Handle 600V. 100 for \$50.....60c ea.
 7 mfd/600V. 10 for \$7.50.....95c ea.
 Bath Tube—.5mfd/600V. T. T. 100 for \$25.00.29c ea.
 Large Stock of W.E. PRECISION Oil & Silver Mica Capacitors.

Specialists in Procuring Hard To Get Items For Gov't Contracts & The Industry. Send For Catalog "R"

RADIONIC PRODUCTS CO.
 325 Canal St., N. Y. 13, N. Y. WO 6-1290

TIME DELAY RELAY

Raydon 115v 60 cy. adj. in 5 sec. steps to 40 sec. spdt mu sw. \$5.95. With 2 arms & 2 sw.\$9.95
 PULSE xfmr Utah 1059-AA.3-50T windings.\$3.95

Hundreds of other items, see ad in Buyers Guide Issue, write for listings.

EMPIRE ELECTRONICS COMPANY
 109Q Ave. L Brooklyn 30, N. Y. Cloverdale 2-4000

CAPACITORS
 gov't termination purchase
 Oil filled-impreg., micas.
 Write for current listings

RESISTORS
 inst. quality 1/2-1 & 2 watts
 Wirewound—3-5-10-20-50 watts

GOULD GREEN, 252 Greenwich St., NYC 7

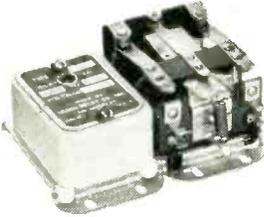
SPECIAL PURPOSE TUBES

0A2	.75	3BP1	2.50	605G	2.00	WE-121A	3.50	WE-347A	3.50	806	7.50	1626	.95
0A3	.90	EL-3C	5.50	65C7GY	2.00	WE-122A	1.50	WE-348A	5.00	807	1.20	1629	.95
0A5	4.00	EL-3CJ	7.00	65K7Y	.40	F-123A	5.00	WE-349A	7.50	807W	4.00	1630	.40
0B2	.75	3C92	60.00	65N7WGT	2.00	WE-123A	5.00	WE-350A	2.85	808	1.40	1631	1.40
0B3	.75	3C93	5.00	65U7GTY	2.25	WE-124A	3.75	WE-350B	2.85	809	2.70	1632	.50
0C3	.70	3C94	1.40	7BP7	5.00	VT-127A	1.50	WE-351A	6.00	810	10.00	1633	.75
0D3	.70	3C31	9.25	7CP1	15.00	F-128A	19.00	WE-352A	10.00	811	3.00	1634	1.35
EL-C1B	9.25	3C33	9.50	7EP4	10.00	HF-130	.90	F-353A	2.00	811A	3.50	1635	1.50
EL-1C	1.50	3C37	25.00	9GP7	5.00	VR-150	.70	WE-353A	3.50	812	2.25	1636	1.20
1B22	1.50	3C45	6.50	9LP7	3.50	FG-154	15.00	WE-354A	14.00	813	11.00	1641	1.50
1B23	3.00	3D21A	3.75	9MP7	7.50	HK-154	5.00	WE-355A	15.00	814	1.75	1642	.50
1B24	5.50	3D22	9.75	10Y	.35	VT-158	9.75	WE-359A	3.00	815	1.50	1644	1.00
1B27	10.00	3DP1	3.75	CE-11V	2.50	FG-166	16.50	WE-368A	2.00	816	1.50	1649	1.00
1B32	1.00	3DP1A	7.50	12A6	.50	FG-172	16.50	371A	1.50	822	10.00	1654	3.50
1B35	4.50	3EP9	9.00	12DP7A	35.00	OK-181	20.00	371B	1.50	826	1.00	1655	2.00
1B38	30.00	3E21	2.00	12GP7	15.00	FG-190	7.50	F-375A	15.00	828	7.50	1656	6.50
1B40	3.00	3FP7	2.00	12J5WGT	1.50	HF-200	12.50	WE-388A	1.50	829	7.50	1661	6.00
1B42	4.50	3FP7A	5.00	12K8Y	.50	CE-201	3.50	WE-393A	5.00	829B	9.00	1846	50.00
1B59	10.00	3GP1	2.50	12L8GT	1.00	CE-203	5.00	394A	2.50	830B	.85	1851	1.75
1C21	2.00	3HP7	3.00	LM-15	100.00	203A	4.75	WE-394A	3.50	832	3.75	1904	10.00
1P21	30.00	3J21	75.00	NE-16	.30	203Z	5.00	WE-396A	3.00	832A	5.00	1960	.50
1P23	2.00	3J31	35.00	FK-20A	8.00	204A	25.00	WE-404A	10.00	833A	30.00	1984	10.00
1P25	75.00	3K27	150.00	RK-19	.85	WE-205B	.75	410R	100.00	834	5.75	2000T	150.00
1P30	2.00	3K1	7.25	RK-20A	8.00	207	50.00	WE-417A	12.00	835	5.00	2050	1.00
1P32	1.00	3R1	7.25	TZ-20	1.75	211	.50	WL-417A	3.85	836	2.00	2051	.65
1P34	1.75	4.400A	40.00	CE-21C	3.00	WE-211C	10.00	WE-418A	12.50	837	.90	2172	12.50
1P36	2.50	KC-4	75.00	RK-21	.85	WE-211D	8.00	WE-421A	14.00	838	.90	2183	5.00
1Z2	2.00	4AP10	3.75	RK-22	3.50	WE-212E	25.00	GL-434A	10.00	842	2.50	ZB-3200	75.00
VG-2	10.00	4B22	6.50	CE-23C	1.40	217A	1.50	446A	.50	843	.50	R-4100	7.50
2AP1	4.75	4B23	9.00	PJ-23	2.00	217C	3.00	446B	1.85	845	5.00	R-4330	10.00
2AP1A	4.75	4B24	5.50	RK-23	2.50	WL-218	20.00	450TH	35.00	845W	8.50	5528	3.75
2AS15	5.00	4B25	8.00	HK-24	2.85	CE-220	.50	450TL	35.00	846	75.00	5550	25.00
2B21	1.00	4B26	3.00	HK-24G	1.40	220C	100.00	451	5.00	849	22.50	5551	25.00
2B25	1.50	4B27	3.50	CE-25A/B	2.00	CE-221	8.00	WL-460	10.00	850	25.00	5553	100.00
2C21	5.00	4B28	3.00	RK-25	2.75	CE-222	1.50	464A	2.25	851	10.00	5556	6.75
2C22	.35	4B30	.75	25T	2.85	CE-224	5.50	WL-468	15.00	852	7.00	5557	3.25
2C24	.75	4B32	10.00	25TG	1.40	CE-225	3.00	SS-501	7.25	860	3.00	5560	20.00
2C25	.35	4C22	7.50	FG-27A	12.00	CE-226	3.00	RH-507	35.00	861	15.00	5610	1.25
2C26A	.50	4C25	3.00	CE-28D	2.50	WE-231D	2.00	CK-510AX	.50	864	.35	5625	75.00
2C33	.75	4C27	3.50	RK-28	2.50	RX-233A	.75	WL-525	10.00	865	.50	5632	7.50
2C34	.35	4C30	1.50	28D7	.75	CE-235A	5.00	527	25.00	866A	1.10	5645	6.50
2C39A	10.00	4C35	15.00	28D7W	1.50	235R	50.00	WL-530	25.00	866 JR	1.50	5651	1.35
2C40	7.50	4E27	8.75	CE-29	1.25	WE-242A	5.00	WL-531	7.50	868	2.00	5656	7.00
2C42	13.50	4J52	35.00	CE-30C	1.25	WE-242C	8.00	WL-532A	1.00	869B	24.50	5670	1.85
2C43	10.00	4X100A	20.00	Twin 30	7.50	WE-249B	2.85	WL-535	10.00	GL-872A	2.50	5687	2.50
2C44	.50	EL-5BHD	9.00	HY-30Z	2.65	WE-249C	2.85	WL-538	.50	872A	1.35	5691	4.75
WE-2C51	3.00	EL-5B2.5	6.50	CE-31V	2.40	250R	4.75	GL-553	2.00	874	.50	5696	1.00
2C53	10.00	5AP1	2.00	FG-32	6.00	250TH	20.00	559	5.00	876	.75	5703	1.15
2D21	.75	5B21	2.00	FG-33	15.00	250TL	15.00	GL-564	1.50	878	.50	5720	11.50
2D21W	1.40	5BP1	2.00	RK-33	.50	WE-251A	47.50	575A	15.00	879	.35	5725	1.90
2E22	2.00	5BP1A	10.00	RK-34	.35	WF-252A	9.50	WL-579B	10.00	884	1.00	5726	.75
2E24	2.50	5BP2A	6.00	35TG	3.00	WE-253A	5.00	KU-610	4.75	885	1.00	5728	9.00
2E25	2.25	5BP4	2.00	RK-38	6.50	WE-254A	6.00	HY-615	.50	902P1	3.25	5740	44.00
2E26	3.25	5C21	6.00	RK-39	1.50	HK-257B	9.00	WL-629	1.25	905	2.00	5763	1.00
2J21A	2.75	5C22	28.00	T-40	2.35	WE-257A	3.50	WL-630	1.00	913	15.00	5801	2.50
2J26	4.75	5C30	1.00	TZ-40	3.50	FG-258A	100.00	631-P1	6.75	917	2.50	5820	350.00
2J27	4.75	5CP1	3.00	CE-42C	1.50	WE-259A	12.50	WL-632A	17.50	918	2.00	5826	375.00
2J29	15.00	5CP1A	10.00	RK-44	1.00	WE-261A	10.00	WL-655 658	100.00	919	2.40	5827	2.50
2J30	15.00	5CP7	7.00	OK-47	50.00	WE-262B	7.00	WL-670A	8.00	920	3.00	5829	1.00
2J31	14.50	5D21	6.50	RK-47	1.75	WE-264C	3.00	WL-681 686	25.00	921	1.00	5842	12.00
2J32	14.50	5D23	7.00	CE-48	1.75	WF-267B	10.00	WE-701A	1.85	922	1.20	5847	10.00
2J33	14.50	5FP7	1.35	RK-49	2.85	WE-271A	10.00	702A	.50	923	1.40	5932	4.00
2J34	14.50	5FP1.4	5.00	HY-51B	.85	WE-272A	5.00	702B	1.00	924	1.35	5933	4.00
2J36	15.00	5GP1	5.00	FP-54	44.00	WE-274A	4.75	703A	1.50	925	2.00	5948	250.00
2J37	5.00	5J26	100.00	HK-54	2.00	WE-274B	2.00	WE-704A	.85	926	2.50	5963	.90
2J38	10.00	5J29	6.75	T-55	3.50	274B	.75	705A	.75	927	1.00	5981 5650	75.00
2J39	10.00	5J30	6.75	RK-57	4.50	WE-275A	5.00	707A	3.50	928	2.50	5998	15.00
2J40	15.00	5J32	20.00	RK-58	.90	276A	3.00	707B	4.50	929	1.25	6011	4.75
2J50	35.00	5J1	15.00	OK-59	25.00	WF-282A	7.50	WE-708A	.75	930	1.25	6013	10.00
2J51	150.00	5J2	7.00	OK-60	25.00	WE-283A	4.00	WE-709A	1.00	931A	2.70	6031	4.75
2J53	25.00	5J4	7.00	RK-60	1.50	WE-285A	5.00	710A	.50	954	.30	R-6160	2.00
2J55	50.00	5JP5A	7.00	HY-61	1.25	WE-286A	6.00	713A	.35	955	.35	R-6175B	1.00
2J56	75.00	5JP11	15.00	OK-61	25.00	WE-287A	3.50	714AY	25.00	956	.35	R-6200	.75
2J61	15.00	5LP1	7.50	RK-61	3.00	WF-295A	5.00	715A	2.00	957	.35	R-6210	15.00
2J62	4.75	5LP1A	25.00	OK-62	25.00	WE-296A	25.00	715B	4.85	958A	.35	UX-6653	.75
2J62A	50.00	5NP1	3.00	RK-62	1.75	HF-300	17.50	WE-715C	12.00	959	1.50	8001	8.75
2J851	.35	5R4GY	1.00	RK-63	20.00	WE-300B	5.00	717A	.50	991	.30	8002R	18.50
2K25	14.75	5R4WGY	2.50	HY-65	2.25	CE-302	1.00	WF-719A	9.50	CK-1005	.25	8005	4.25
2K28	35.00	5X3	3.00	RK-65	7.00	EL-302.5	5.00	721A	.90	CK-1006	2.00	8008	6.00
2K30	100.00	5Z2P7	75.00	FG-67	9.00	CE-303	2.25	721B	7.25	CK-1007	.75	8011	.50
2K33A	65.00	5Z4P11	150.00	RK-69	2.00	WF-304B	7.50	722A	3.50	CK-1009	5.00	8012	1.00
2K39	135.00	EL-C6A	6.00	RK-72	.50	304TH	10.00	723A B	9.00	CK-1026	3.00	8012A	2.50
2K41	75.00	EL-C6J	6.00	RK-73	.50	304TL	10.00	WE-724A	.85	R-1100	5.00	8013	2.75
2K54	10.00	EL-C6L	3.75	HY-75	3.00	WF-305A	3.00	WF-724B	.85	R-1130B	10.00	8013A	3.75
2K55	.75	EL-C6	8.00	RK-75	.85	307A	.85	WF-725A	3.25	1500T	85.00	8014A	50.00
2P21 (Image orthicon)	50.00	6AC7W	1.00	VR-75	1.00	CF-319	3.25	WF-726A	7.00	1602	2.25	8016	2.50
2V3G	1.50	6AJ5	1.15	75TL	4.75	WF-310A	4.00	WE-726B	30.00	1603	3.40	8021	1.25
2X2	.35	6AJ6	2.00	VR-78	.50	WF-310S	5.00	WE-726C	24.00	1608	3.75	8021	.75
2X2A	.90	WE-6AK5	1.35	FG-81A	5.00	WE-311A	5.00	WE-730A	7.50	1609	9.25	8022	.75
3A4	.50	6AK5W	1.50	VR-90	.75	WE-313C	2.85	731A	1.50	1610	2.25	8023	1.50
3A5	.50	6AL5W	.75	CV-92	3.50	316A	.50	WE-732A	2.00	1611	1.50	8025	1.50
3AP1	4.85	6AN5	3.00	FG-95	20.00	WF-323A	10.00	WL-735	2.00	1612	1.25	8025A	2.25
3B21</													

world's largest stock

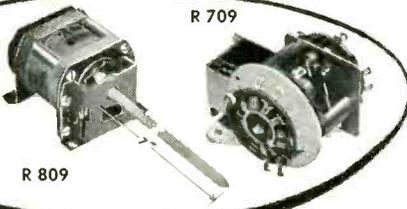
RELAYS

immediate delivery!



ADJUSTABLE THERMAL TYPE TIME DELAY RELAY

Operates on 115 V.A.C. Continuously adjustable delay from 5 to 20 seconds. 1/4 Inch D.P.D.T. 12 1/2 amp. contacts. Primarily designed for use with radio transmitters but has wide variety of other applications. Catalog No. R 686 Price \$6.10 each



STEPPING UNIT

Operates on 22 to 30 V.D.C. 12 Position driving mechanism operates through 360° in progressive steps. Indexes one position for each momentary current impulse. Attached wafer switch may be used for self interruption. 7 inch flatted shaft will drive pulley, gear or one or more wafer switches.

Catalog No. R 809 Price \$2.45 each

SOLENOID OPERATED RATCHET STEPPER

Operates on 6 V.D.C. Operates three 12 position wafer switches. Most standard wafers are interchangeable with those supplied. Rotates 30° with each impulse.

Catalog No. R 709 Price \$3.90 each

HUNDREDS OF RELAY TYPES IN STOCK

- | | |
|----------------------------------|-----------------------------------|
| Standard Telephone Relays | Differential and Polarized Relays |
| Short Telephone Relays | Special Relays BK-Series |
| Midjet Relays | Antenna and Ceramic Relays |
| Timers | Motor and Control Relays |
| Aircraft Contactors | Relay Assemblies |
| Rotary Relays | Latching and Interlocking Relays |
| Western Electric Type "E" Relays | Mechanical Action Relays |
| Keying Relays | Ratchet and Stepping Relays |
| Hermetically Sealed Relays | |
| Voltage Regulators and Cutouts | |

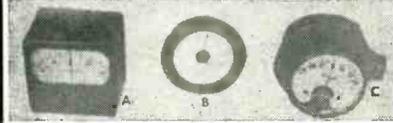
All relays are new, individually inspected and unconditionally guaranteed. They are first line products of leading manufacturers. Special attention given to orders of one or more relays. 24 Hour delivery.

Write for new catalog. Phone, write or wire your requirements.



AUstin 7-0709
4717 W. Madison St.
Chicago 44, Ill.

WESTERN ELECTRIC METERS—NEW!



- A. 80-0-80 amperes. Diam. 5 1/2 in. Individually boxed. With shunt \$15.00
- B. 100-0-100 Voltmeter. Diam. 3 1/4 in. Basic movement 1 milliamp. Model D-165573 Individually boxed. SPECIAL \$8.75
- C. 150-0-150 amperes. Diam. 4 1/4 in. Individually boxed. With shunt \$12.75
- 10-0-10 amperes. Diam. 4 1/4 in. Individually boxed. With shunt. Only \$10.75
- 20-0-20 amperes. Diam. 4 1/4 in. Individually boxed. With shunt. Only \$11.50
- 40-0-40 amperes. Diam. 4 1/4 in. Individually boxed. With shunt. Only \$11.50

MINIATURIZATION SPECIALS

902 TWO-INCH CATHODE RAY TUBE

First time in surplus! Overall length only 7 1/4 inches! Octal base. Electrostatic deflection. Operates on normal B+ voltages. A natural for modulation monitor, TV-converter indicator, phase-angle indicator, etc. New in original carton. Guaranteed. \$2.95

ONE-INCH PANEL METER

0-1 MA. Mounts through 1 1/2 inch hole in panel, flush, or with 1/8" square black bakelite face outside of panel. Depth of case: 1 3/8". New. Only \$3.95

46 ACJ UHF RECEIVER

13 tube double conversion receivers, frequency range 450-600 MC. This unit employs 446A lightweight tubes in the RF section, mixer and oscillator circuits. First IF frequency of 55 MC has two stage of amplification, second IF frequency of 16 MC has 4 stages of amplification. Two video stages follow the second detector. With schematic and tubes 8-GAC7, 8-44E, 16AG7, 1-6116. New Condition \$9.95

ISOLATION TRANSFORMER

For isolating line noise. AC-DC sets, etc. Electrostatic shielding. 2,000 V. breakdown test. 6 ft. cord. female receptacle. Primary 110-120 V. 50/60 cycles. Secondary 110-120 V. Mfg. by UTC. Model No. R-76. 1200 W. New condition \$9.95

CAA GLIDE-PATH TEST OSCILLATOR

TS-170/ARN-5. Xtal-controlled to .02%. 332.6, 333.8, 335.0 MC modulated 90 or 150 cy. Output 50 ohms. Calibrated attenuator. 10 to 1,000 Tr. Checks sensitivity. AVC and AF channels in Glide Path Receivers. New with tubes and cord. ONLY \$97.50

FM WOBULATOR CAPACITOR

Freq. modulator. Voice-coil-driven capacitor plate in permanent-magnet field. W/reprint complete instr. for sweep gen. See also "Audar" radar for small craft in July '55 Radio & TV News. Wt. 3 lbs. Special \$2.75
2 for \$4.95

TS-182/UP

SIGNAL GEN. & SYNCHROSCOPE

Complete. For checking power output, receiver sensitivity, pulse shapes and recovery time. Equipment consists of a pulsed R-F oscillator with calibrated attenuator built-in power supply which operates from 110 V. 60 to 1200 cps. Unit has a 2AP1 Scope Tube and 10 other tubes. Pre. range: 150-240 MC. Like new. Weight 50 lbs. \$42.50

TS-10C/APN

Latest model for testing FM radio altimeters. Complete with cables and indicator. New condition P. U. R.

NEW CATALOG NO. 114

1955 ISSUE
LISTS LATEST INVENTORY OF AIRCRAFT, INDUSTRIAL AND MILITARY ELECTRONICS EQUIPMENT. SEND FOR YOUR COPY.

ARROW SALES INC.

Western Division
Mailing Address: P.O. Box 3878E, N. Hollywood, Cal.
Office-Warehouse: 7460 Varna Ave., N. Hollywood, Cal.
Phones: STanley 7-0406 • POplar 5-1810
Sales Showrooms:
2005 EMPIRE AVENUE, BURBANK, CAL.
1632 VENICE BLVD., LOS ANGELES, CAL.
Cable Address: ARROWSALES, North Hollywood
Telegraph Address: WUX, North Hollywood
Central Division
Mailing Address & Sales-Showroom:
2441 S. MICHIGAN AVE., Chicago 16, Illinois
Phone: CALumet 5-4750

GLASS TUBING

PYREX - NONEX - URANIUM
BULB & CYLINDERS
WRITE FOR FREE MONTHLY LIST
HOUE SUPPLY COMPANY
PHONE KEYPORT 7-1286
M. R. #1 Box 86X Keyport, N. J.

FOR SALE

Wholesale to Institutions
Industrials & Dealers Only

- RELAYS ● METERS
- MOTORS ● BLOWERS
- SWITCHES ● MAGNETS
- SYNCHROS ● RECEIVERS
- I.F. STRIPS ● NETWORKS
- ANTENNAS ● RESISTORS
- DUPLEXERS ● CAPACITORS
- CONNECTORS ● CONTACTORS
- INSTRUMENTS ● WAVE GUIDES
- MODULATORS ● DYNAMOTORS
- TRANSMITTERS ● TRANSFORMERS
- TORQUE UNITS ● SYNCHRONIZERS
- TEST EQUIPMENT ● CONTROL BOXES
- POTENTIOMETERS ● KLYSTRON MOUNTS
- JUNCTION BOXES ● MICROWAVE PARTS

ALL TYPES OF TUBES

WRITE TO

AMBER INDUSTRIAL CORP.
METALS AND SALVAGE DIVISION
732 E. Monument Ave. Dayton, Ohio

FOR SALE

One RCA TG1A Sync. Generator
Complete. Excellent Condition \$750.00

FS-7470, Electronics
330 W. 42 St., New York 36, N. Y.

These "Searchlight" advertisements

are live opportunities in the Electronic field.

Each announcement represents a current Want or Offering of an organization or individual in the field. Some have money-saving possibilities, others are opportunities for more business; many offer equipment—used or surplus new.

"Searchlight" advertisements are constantly changing. New opportunities are constantly finding their way into this great Want medium, each issue. Regular reading of the "Searchlight" pages can be as important to you as reading the editorial sections; Editorial matter is news of the industry; Advertising is NEWS OF OPPORTUNITIES offered in the Industry.

for EVERY business WANT
"Think SEARCHLIGHT first"

CONDENSERS

10 mfd. 600 V. . . . \$.89
 Three term. bot. mntg. channel type. Dims. 3 3/4"x3 1/2"x2". Two 5 mfd. sections rated 400 V at 72 deg. "C". 1800 V test. Meets commercial specs. for 600 V operation up to 40 degs. "C". Ideal for filter or power factor application where ruggedness and quality are paramount. Carton or 24 weight 42 lbs. **\$.79**

16 mfd.—600 V. . . . \$1.89
 Dual 8 mfd oil filled cond. hermetically sealed and packed. Tube type PT-SC-11 measuring 3 3/4"x2 9/16"x2 9/16". Stud mntg. centers 2". Plugs into standard four prong socket.

4 mfd.—600 V. . . . \$.98
 Type TLA Inverted cylindrical cap. sing. term. Mounts through 3/4" hole in chassis. Hardware included. Factory cartons.

- OTHER ITEMS AVAILABLE -

MICA CONDS.
 BATHTUB CONDS.
 CHANNEL CONDS.
 RHEOSTATS
 POTENTIOMETERS

Mfd.	Volts	Price	Mfd.	Volts	Price
.001	60KV	24.95	2	2500	3.45
.0025	16KV	6.95	2	3000	4.25
.01	500V	4.95	2	4000	7.50
.01	10KV	4.95	2	5000	12.50
.012	25KV	12.95			
.02	800V	4.75	2	7500	21.9
.02	10KV	5.25			
.02	20KV	10.95	2	10KV	35.95
.025	50KV	22.95	2	12.5KV	59.50
2X .025	20KV	14.50	2	20KV	89.75
.03	7500	4.50	2x2	600	.85
.035	10KV	5.95	3	2000	2.50
.05	7500	2.95	3	2000	2.50
.08	12.5KV	8.95	3	4000	8.99
.1	1500	1.39			
.1	2000	.89	2x3	150	.29
.1	2000	.89	3x3	400	.68
.1	2500	.98			
.1	3000	.69	4	500	-.59
.1	3000	1.19	4	600	-.79
1	7500	.85	4	600 TLA	.98
.1	7500	4.25	4	1500	2.65
.1	10KV	6.35	4	2000	2.95
.1	12KV	6.35	4	2500	4.95
2X .1	2000	.89	4	3000	6.99
2X .1	7500	3.50	4	4000	11.95
2X .1	6000	2.25	4	5000	24.95
2	10KV	8.50	4	7500	39.95
2	15KV	13.95	4	10KV	59.95
2	50KV	39.50	4	200AC	1.19
3X .2	4000	2.85	5	330AC	1.39
.25	1500	.88	5	600	1.19
.25	2000	.98	5	1000	1.89
.25	3000	1.45	5	1500	1.98
.25	4000	1.98	5	400	.89
.25	6000	.85	5	600	1.19
.25	20KV	18.95	5	800	1.29
.25	25KV	40.00	6	600	1.69
.25	32KV	49.50	6	330AC	1.69
.25	50KV	62.95	6	1000	2.30
.25	3000	1.98	6	1500	2.95
2X .25	2000	1.10	7	110AC	1.98
4	10KV	10.90	7	600	.98
2x4	7500	5.25	7	800	1.35
.5	1500	-.59	7	800	1.75
.5	2000	1.19	7	5000	29.95
.5	2500	1.49	8	600	1.49
.5	3000	2.20	8	600AC	4.25
.5	5000	3.09	8	800	1.89
.5	7500	6.25	8	1000	2.78
5-1	2000	-.39	8	1400	3.05
2x.5	600	.69	8	1600	3.85
2x.5	8000	12.95	8	2000	5.95
.66	25KV	45.95	8	2500	6.50
	12.5KV	13.95	2x8	600	1.19
	500	-.55	10	50AC	.65
	1500	-.99	10	600	1.19
	2000	1.85	10	1000	3.75
	2500	2.20	10	1500	4.25
	3000	2.95	10	2000	5.95
	5000	6.25	12	6000	59.50
	6000	5.95	12	600AC	3.75
	6000	6.50	14	50	.99
	7500	8.95	15	330AC	3.50
	10KV	14.90	15	400	1.29
	15KV	26.95	15	400AC	3.25
	20KV	45.95	15	1070	3.95
	25KV	49.50	15	1500	5.40
	25KV	55.00	20	5000	63.50
	25KV	75.00	20	330AC	3.35
	330AC	.69	20	600	1.69
1.75	600	-.55	20	800	1.99
	600	.65	28	1000	5.95
	1000	.79	30	330AC	5.25
	1000 TLA	1.29	30	5000	12.95
	1500	1.15	30	330AC	6.50
	2000	2.80	30	220AC	6.50
			180	4000	45.50

WANTED

Oil & Mica Condensers in any quantity. Also other Standard Components. Write: Art Hankins

MONMOUTH RADIO LABS.

BOX 159 OAKHURST, N. J. Capital 2-2776



FULL-WAVE BRIDGE TYPE

DIRECTRON SELENIUM RECTIFIERS

Max. Amps.	18VAC 14VDC	36VAC 28VDC	54VAC 42VDC	72VAC 56VDC	130VAC 100VDC
1	\$1.35	\$2.35	\$3.75	\$4.50	\$7.45
2	2.00	2.75	5.35	5.90	9.15
3	2.95	4.15	5.85	7.85	12.75
4	3.50	6.45	11.35	14.35	21.75
6	4.00	7.75	12.85	17.30	29.75
10	5.90	11.45	19.50	24.80	41.35
12	7.25	14.35	22.10	29.75	44.25
20	13.05	25.05	37.25	48.75	78.50
24	14.25	28.75	44.50	57.55	81.00
30	17.95	34.35	56.50	71.00	109.00
36	22.45	42.35	65.00	86.95	134.00
100	29.50	54.35	105.45	115.75	174.00
100	59.50	119.00			

We build other Selenium Rectifiers, Transformers, and Chokes to your specifications. Buy from the Direct Source for Quick Delivery.

NEW RECTIFIER TRANSFORMERS

Continuous Ratings 1 Amp. \$5.75
 Pri: 115V, 60 cycles input 2 Amps. 6.75
 SEC: 3, 12, 18, 24, and 36 12 Amps. 16.65
 volts. 24 Amps. 35.65
 50 Amps. 59.00
 100 Amps. 108.00

NEW RECTIFIER CHOKES

Continuous Ratings 1.5 ohm \$4.95
 1 Amp. .1 Hy. .9 ohm 5.95
 2 Amps. .04 Hy. .5 ohm 7.95
 4 Amps. .07 Hy. .5 ohm 14.95
 12 Amps. .01 Hy. .025 ohm 29.95
 24 Amps. .04 Hy. .01 ohm 54.00
 50 Amps. .005 Hy. .01 ohm 54.00

FILTER CAPACITORS

Capacity	W. Voltage	Each
500 MFD	200 V.	\$1.95
500 MFD	50 V.	.85
1000 MFD	15 V.	.35
2000 MFD	50 V.	2.25

NOW AVAILABLE! SUPER GLOSS RED & BLACK TUBE CARTONS

SIZE EACH	SIZE EACH
Miniature .5-1.6	LARGE GT. -1 1/2"
1"x1 1/2"	1 1/2"x1 1/2"x4 1/2"
6A6, 6AL5, etc.	1B3, 6B6GT, etc.
GT	LARGE G -2"
1 1/2"x1 1/2"x3 1/2"	2"x2"x6"
6SN7GT, 6W4GT, etc.	5U4G, 6BG6G, etc.

Also in White Coated
 Both types with new safety partitions—they meet U. S. Government specifications! Attractive discounts for quantity users. Minimum order 100 of a size. Be sure to specify white or color when ordering.

TRANSMITTING TUBE CARTONS

Small Jumbo Large Jumbo
 White Only
 3"x3"x7 1/2" FOR 809, 866A, etc. 4"x4"x10" FOR 813, 872A, etc.
 \$7.50 PER 100 \$10.00 PER 100
 \$50 TO THE CASE \$30 TO THE CASE

KILOWATT POWER SUPPLY

Matched, compact, hermetically-sealed components for KW power supply. Ideal for new Collins KWS-1K, etc.
 • Power xfmr. Pri: 115 v. 60 cy. with taps for 1/2, 1/3, and full power. Sec: 3400 v. @ 400 ma. 39 lbs.—8"x5 1/2"x7 1/2"
 • Choke to match above—12 henries @ 400 ma. 34 lbs. 8"x5 1/2"x7 1/2"
 • Filament xfmr for 4—866A's in bridge circuit. Pri: 115 v. 60 cy. Sec: 2.5 v. @ 5.0 A, 2.5 v. @ 5 A., and 2.5 v. @ 10 A.
 Complete set of above 3 items only \$45.00

QUALITY ELECTRONIC TUBES

Guaranteed • Unused • Boxed

• SPECIALISTS IN JAN, WESTERN-ELECTRIC, SUBMINIATURE, 5000/6000 SERIES AND RECEIVING TYPES

NEW, FREE RECEIVING TUBE CATALOG JUST OFF PRESS!

• Critical Types Lab Tested for Your Protection

OA4G	\$1.00	QK61	25.00	872A	1.50
OB3/VR90	.85	QK62	25.00	872A(G.E.)	2.75
OC3/VR105	.85	FG67	12.00	874(RCA)	.60
OC3W	3.00	QK69	25.00	876(RCA)	.85
OD3/VR150	.85	QK72	25.00	891	125.00
1B24A	15.00	RKR-72	.50	902/902P1	6.00
1B26	1.50	RKR-73	.50	931A	3.00
1B32	2.00	90-NB		932	1.25
1B35	6.50	Amperex	7.00	958A	.50
1B63A	22.50	FG98A	20.00	1619	.30
1B85	9.95	100R Surplus	5.00	5516	6.50
1B86	7.75	100TH	6.75	5517	2.15
1N21	.06	100TL Surplus	8.50	5633	8.00
1N21A	.50	FG105	15.00	5634/SD828E	7.00
1N21B	1.50	VT127A	2.50	5637	5.00
1N22	.50	VXR130	.75	5638	8.00
1N23B	1.50	FG172	45.00	5641	6.00
1N26	4.50	QK181	35.00	5642	1.00
1N27	.75	203A	2.50	5654	1.65
1N34A	.65	204A	00.00	5656	6.50
1N35	1.50	207	45.00	5670	1.75
1N38A	.85	211/VT4C	.50	5672	1.25
1N48	.40	212E	15.00	5676	1.00
1N56	.85	227A	2.00	5678	1.15
1N64	.70	249A	3.00	5686	2.00
1N65	.75	251A(WE)	45.00	5687	3.00
1N69	.60	HK253	7.50	5691	5.50
1N70	1.20	266B	45.00	5692	5.25
1N81	.90	272A	9.00	5693	4.75
1N82	.70	274B	1.00	5696	1.15
1P30	2.00	275A	3.50	5702	2.00
2E30	1.60	276G	8.50	5703	.95
2E35	1.95	287A	3.00	5704	1.90
2J36	35.00	GL299	3.50	5718	4.25
2J32	15.00	300B	6.00	5726/6AL5W	1.15
2J37	10.00	304TH		5732	3.00
2J54	35.00	Surplus	8.75	5744	1.00
2K25	22.50	304TL		5751	2.50
2K28	28.50	Surplus	10.75	5763	1.10
2K45	65.00	311A	5.50	5780	250.00
2K55	17.50	311C	2.50	5787/WA	5.75
3B24	1.50	337A	6.50	5794	7.75
3B24/W	5.00	350A(WE)	3.00	5795	250.00
3B27	3.50	WE355A	17.50	5812	2.75
3B28	6.00	359A	2.00	5814	1.50
3B29	6.00	391A	3.50	5814A	2.00
3C23	7.50	417A Klystron	3.50	5819	49.95
3C31/C1B	2.25	429A	8.75	5820	Write
3C45	7.95	464A	2.55	5829	2.00
3D21A	4.50	CK503AX	1.00	5840	5.00
3J30	45.00	GL599	5.00	5841	7.50
3J31	45.00	GL562	50.00	5844	4.00
3BP1	2.95	WL651/6552	50.00	5879	1.40
3BP11	7.00	WL-653B	110.00	5881	2.65
3DP1	3.00	GL673	13.00	5886	.275
3FP7	2.50	703A	1.25	5890	35.00
4B24	5.00	705A	.85	5963	1.20
4B28 6 Amp	5.00	707A	4.00	5963	10.00
Rectigon	3.00	707B	5.00	6003	5.00
4C35	13.50	708A	2.00	6073	1.65
4E27	9.50	709A	1.75	6095	1.25
4J21	77.50	715B	3.95	6096	1.50
4J36	75.00	717A	5.00	6097	1.50
4J37	75.00	721A	.75	6098	1.90
4I63	7.00	722B	1.00	6099	1.50
4PR60A	723A/B		9.50	6100	5.50
Surplus	75.00	726A	4.50	6101	1.00
4-125A	726B		25.00	6112	9.00
Surplus	19.00	726C	35.00	6186	4.00
4X150A	750TL		write	6189	4.50
Surplus	24.00	800	2.00	8000	9.50
4X1506	35.00	803	2.00	8020 Surplus	1.25
4X500F	807		1.25	8008/	
Surplus	65.00	808	1.50	RCA872A	4.00



COMPASS ELECTRONICS SUPPLY

A Division of Compass Communications Corporation

WE MAINTAIN OUR OWN FULLY EQUIPPED TESTING LABORATORY TO TEST AND GUARANTEE ANYTHING WE SELL
Wholesale, Industrial and Institutional Sales Only

Special Announcement

In keeping with our plans for expansion and increased service, we take great pleasure in announcing the removal of our offices and laboratory to a new location. Effective immediately, our new address is:

75 VARICK ST. NEW YORK 13, N. Y.

TEST SETS

- TS-3A/AP
- TS-4A/AP
- TS-10A and B
- TS-12/AP
- TS-13/AP
- TS-14
- TS-16/AP
- TS-35A/AP
- TS-36/AP
- TS-61/AP
- TS-62/AP
- TS-74/UPM
- TS-89/AP
- TS-98
- TS-101/AP
- TS-104
- TS-110
- TS-125/AP
- TS-131
- TS-173/UR
- TS-184
- TS-278
- TS-323
- TS-UPM-1

RECEIVERS

- ARB
- ARC-1
- ARC-3
- ARC-4
- ARC-5
- AR-88
- ART-13
- CR-21
- SLR
- RAK
- RAL
- RAO
- RBB
- RBO
- RBG
- RBL
- RBA
- RBM
- RCM
- BC-224
- BC-312
- BC-314
- BC-344
- BC-48

AND OTHERS

FIELD EQUIPMENT

- SCR-274
- 284
- 300
- 309
- 353
- 356
- 358
- 828
- BC-191
- 375
- 603
- 604
- 610E
- 682
- 684
- 923
- 923
- 924
- 1000
- 1306

AND OTHERS

TEST SETS

- TS-13/AP-X BAND RADAR TEST SET—Measures power, freq. signal-to-noise ratio, I.F. Bandpass, etc. Input—115/1/60—800. WRITE
- TS-35A/AP-X-BAND—Measures transmitted power & frequency of Radar Transmitters, also used for receiver adjustments. NEW. WRITE
- TS-100/AP—TEST SCOPE, type A, R, J & X indications, gated & un-gated sweep. Int. or Ext. trigger. WRITE

SPECIAL PURPOSE TUBES

Write for Latest Listing at Great Savings, of New Tubes, Standard Brands Only—Guaranteed!

MICROWAVE ACCESSORIES

- 15 LB. ALNICO-V MAGNET—approx 4800 gauss. \$16.00
- WAVEGUIDE, FLEX, with flanges, 3 cm., 12" \$12.50 ea.
- 3 CM., 2 1/2" \$14.00 ea. 10 CM., 60" \$22.50 ea.
- BENDS, E. & H. plane, 3 & 10 CM. WRITE
- DUPLXER, Mixer & Preamp Ass'y., 3 CM. WRITE
- etc. etc. klystron mounts, rotating joints, circular waveguide stubs, etc. WRITE

WESTERN ELECTRIC VARISTORS, THERMISTORS, Res. Networks Relay Ass'y, Precision Potentiometer, #60 A Key Selectors, etc. WRITE

RADAR BEACONS

- YJ and YG for shipboard use AN/CPN-8 10 cm.
- AN/CPN-6 3 cm. AN/APS-2, APS-3, APS-4, APS-6, APS-15
- Also SA, SF, SG, SD, SK, SN, SQ—both equipment and spare parts

SA-2 RADAR

Used for air traffic control, tracking and search, both land-based and ship-borne, 5 microsec. pulse, PPI indication, operates at 200 mcs, peak power of 150 K.W. Input 110/120 volts a.c. 4 complete installations in stock—Write for price.

Write for More Details on Any Particular Item in Which You are Interested These are partial listings only of our stock. Please write for other types.

75 Varick St.
CANAL 6-7455

New York 13, N. Y.
Cable: COMPRADIO, N. Y.

MOTOR GENERATORS AND CONVERTERS

50, 60, 400 and 800 cycle and DC Power Supplies

- 28dc to 110/1/800 @ 1kva. \$49.50
- (Overall length: 12 inches)
- 110dc to 110/1/800 @ 350va. 150.00
- 110ac to 110/1/800 @ 350va. 235.00
- 110dc to 110/1/400 @ 2kva. 395.00
- 110/1/60 to 110/1/400 @ 2kva. 435.00
- 220/1/60 to 110/1/400 @ 2kva. 435.00
- 440/3/60 to 110/1/400 @ 2kva. 435.00
- 32dc to 110/1/60 @ 350va. 100.00
- 110dc to 110/1/60 @ 350va. 100.00
- 110dc to 28dc @ 250va. 95.00
- 110/1/60 to 28dc @ 250va. 115.00
- 220/1, 3/60 to 28dc @ 250va. 115.00
- 110dc to 110/1/60 @ 1.25kva. 135.00
- 220 to 110/1/60 @ 1.25kva. 145.00

Partial listings write for others

SYNCHROS & SELSYNS

- 5F. \$40.00 7G. \$70.00
- 5G. 45.00 21F1. 10.00
- 5CT. 45.00 21G1. 10.00
- 5SDG. 27.50 21H1. 10.00

TORQUE UNIT PIONEER 12602-1-A with CK-5 Motor and AY-43 Autosyn. \$34.50

115 V AC BLOWER

w/motor, 1/150 hp. p. 300 RPM \$10.00

HEAVY DUTY TRANSFORMERS



Cat. #5459.—1.8 to 3.6 KVA. Input 115/230 volts 50-60 Cycle. Output 36 volts at 50 amps. Continuous and up to 100 amps. intermittent duty. Size 6 1/2 x 6 1/2 x 10". Wt. 42 lbs. Price BRAND NEW \$34.50
Cat. #5453.—0.9 to 1.8 KVA. Input 115 V, 50-60 Cycle. Output 36 V at 25 amps continuous—up to 50 amps. intermittent duty. Price BRAND NEW \$24.50
Cat. #5451. 0.9 to 1.8 KVA. Input 115 V, 60 Cy. Output 18 V at 50 amps. continuous—up to 100 amps intermittent duty. Price NEW \$24.50

HEAVY DUTY LAB TEST CABLES



STK. #907.—For making connections between batteries, generators, motors, etc. Rated 100 amps.—insulated for 600 V. Each set has four heavy 6 1/2" spring-action clamps (illustrated) with powerful jaw pressure, one connected to each end of two 8-foot extra flexible #4 rubber cables. Thick clamp insulators are red on one cable—black on other. Over 900 sets sold this year. List \$12.95. Price NEW PER SET \$8.75

GLASS INFRA-RED FILTERS

Special designed filter when placed in front of any light source blocks and filters out visible light but freely passes invisible infra-red rays. Army Snoposcope Part #A-1529. 5-5/8" Dia. by 1/8" thick. BRAND NEW. Ten for \$10.00 or \$1.50 ea.

BATTERY CHARGERS

ASSOCIATED-HARTMAN CORP.—Made for them by MALLORY. Feature heavy duty construction and parts, oversize transformers, and full-wave MALLORY Selenium Rectifiers, U.L. Approved. Fresh '55 Stock. SEE OUR MARCH AD FOR COMPLETE LISTING AND PRICES.

ALL MERCHANDISE FULLY GUARANTEED PROMPT SHIPMENT ON ALL ORDERS
Terms: Prices FOB St. Louis. Cash with orders. Well Rated Concerns (D&B) Net 10 Days Cash.

McNEAL ELECTRIC & EQUIPMENT CO.
4736 Olive St. St. Louis 8, Mo.

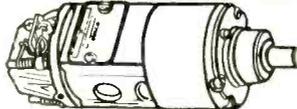


3 Con Coiled Kord

22 inches long stretches to 9 feet
List price \$3.00 Net \$1.26

REVERSIBLE GEARED-MOTOR

Delco-PM-Permanent Magnet Alnico Field Motor



#5071895 1/4 SHAFT or 11/16 GEAR. \$17.50
#5069500 \$18.50
Clamps to hold motor: \$1.50 ea.

GRAIN OF CORN LAMPS

10 for \$3.00—100 for \$25.00

- #328, 6 Volts
- #326, 2 1/2 Volts
- #321, 28 Volts

- ### TELECHRON Motors
- 4 RPM on 50 cy. or 4 3/4 RPM 3.6 RPM. 3.15
 - on 60 cy. \$2.85 1 RPM. 3.95
 - 2 RPM. \$2.90 3 R.P. Hr 2.85
 - 4 RPM. 3.90 1 R.P. 2 Hr 2.80
 - 4 RPM. 2.90 60 RPM. 4.85
- Laboratory Special 1 of Each Motor \$25.

please include postage

BLAN

EST. 1923

64M Dey Street
New York 7, N. Y.

BLOWERS 115 Volts A. C. 60 cy.

- REDMOND 5" 18 watts. \$8.95
- DELCO 60 cfm, 40 watts. \$14.50
- #5062369 used in 584 RADAR EASTERN AIR DEVICES 70 watts, 3400 RPM. labeled 80 cfm, but blows like blazes! \$17.50

HAND WOUND 10 Sec. to 24 Min. TIMER SWITCH. \$1.25

6 Watt Most POWERFUL TELECHRON 1 RPM

110 v. 60 cy. \$6.50
10 for \$50.00

3" Round Elapsed Time Meter Square Case \$13.75 \$14.50



MARKTIME 5 HOUR SWITCH

A 10 amp. timing device. Pointer moves back to zero after time elapses. Ideal for shutting off radios and TV sets when you go to bed. Limited supply at this special PRICE. \$4.90
Also available in 15 min., or 30 min. or 1 hr. at \$6.50

HAYDON TIMING MOTORS

- 110v 60 cycle 30 RPM. \$2.60
- 110v 60 cycle 1 RPM. 2.60
- 230V 1 RPM. 1.00
- 60C 1/2 RPM. 1.00

SPECIAL PURPOSE TUBES

PURCHASING AGENTS—EXPORTERS—GOVERNMENT AGENCIES

If you ever have requirements to buy—KLYSTRON—MAGNETRON—TRANSMITTING—RELIABLE—SUB-MINIATURE—INDUSTRIAL—tubes and CRYSTAL DIODES it will pay you to send for our new *GUIDE TO SPECIAL PURPOSE TUBES*. A copy will be rushed to you by air-mail when requested on your letter-head.

Here are a few of the SPECIALS you will find listed:

1B36-SYLVANIA-3.75	1Q26-GE-58.00	807W-SYLVANIA-2.95
2K42-SPERRY-125.00	5A6-RAYTHEON-.49	2C39-A MACHLETT-9.95
5963-RCA-.90	2K35-SPERRY-350.00	QK185 RAYTHEON-75.00

These tubes are new, available in quantity and are FULLY GUARANTEED!

WANTED

TURN YOUR SURPLUS STOCKS OF SPECIAL PURPOSE TUBES INTO CASH BEFORE THEY GO OUT OF DATE OR BECOME OBSOLETE. We will pay highest cash prices for any quantities from one to a thousand.

Send us a post-card mentioning type, quantity and condition for a top quotation by return air-mail. Or for future reference, send for a quantity of our convenient forms for listing your material. Don't delay—do it today!

255 East 78th Street
New York 21, N. Y.

MICROWAVE
EQUIPMENT SUPPLY COMPANY

Phone No.
TRafalgar 9-3776

A BARGAIN FOR YOU in a . . .

SOLA *Constant Voltage* TRANSFORMER

End
Fluctuating
Line
Voltage

OVER 60% OFF . . .

the factory price of a 1-input 2,000 VA unit! And here's another bonus! This Air Forces 2,000 VA overstock, Sola Cat. No. 30768, has 4 inputs! 90-125 V., 190-250 V., 60 cy. or 50 cy. Isolated secondary is constant 115.0 V. + 1% from no-load to full-load of 17.4 amp. So, if you choose, use it as a 220:115 V. step-down. And slash \$147.50 off the factory 1-input price!



Brand new in original wood box. 4 cu. ft. Ship. wt. 254 lbs. F.O.B. Pasco, Wash. Only **\$97.50**

(EXPORTERS: Note choice of 50 cycles.)

THE M. R. COMPANY

P. O. Box 1220-B Beverly Hills, Calif.

A DEPARTMENT STORE FOR YOUR ELECTRONIC SUPPLIES

WE'RE SELLING YOU RELAYS — WHAT ARE YOUR OTHER NEEDS? Our normal Inventory Includes Over 80,000 Different Items in the Electronic, Radar and Radio Fields

RELAYS



ALLIED • LEACH • TELEPHONE TYPE
MINIATURE AIRCRAFT • GUARDIAN
SIGMA • HERMETICALLY SEALED
and many others

SPECIAL PURCHASE CAPACITORS

For Labs., Universities and Manufacturers. Specifically designed for atomic reactor work where High Voltage and High Capacity is needed.

SPECIFICATIONS

VOLTAGE : 12,500 VOLTS
CAPACITY : 7.5 MFD
CASE SIZE : 16" x 12" x 4"
WEIGHT : 60 lbs.
VALUE : 300.00

YOUR PRICE \$80.00
(subject to prior sale)

SCHWEBER ELECTRONICS

122 Herricks Road, Mineola, L. I., New York
Pioneer 6-6520

WILL BUY ALL

Art-13 T47A Transmitters	BC-348 Rec'r modified	\$225.00	\$25.00
Art-13 T-47 Transmitters	BC-348 Rec'r unmodified	\$150.00	\$50.00
BC-788C Altimeters	ARC-1 Radio complete	\$150.00	\$200.00
RS/ARN7 Radio Compass	BC-312 Receiver	\$160.00	\$40.00
ARC-3 Complete	BC-342 Receiver	\$185.00	\$50.00

Ship via Express C.O.D. Subject to inspection to:
H. FINNEGAN
49 Washington Ave. Little Ferry, N. J.

WANTED

ART-13 transmitters, parts, and components. DY-12 and DY-17 dynamotors. CU-25 etc. Also ARC-1 and ARN-7 material. Advise price, condition first letter.

Florida Aircraft Radio & Marine, Inc.
P. O. Box 205—International Airport
Branch Miami 48, Florida.

WANTED

BC-1016 TAPE RECORDERS

COMMUNICATION DEVICES CO.

2331 Twelfth Ave. NYC 27, N. Y.
Cable: Communidev Tel: Ad 4-6174

WANTED

ELECTRONIC TUBES, all types. Also want all types airborne electronic equipment: ART-13; BC-788; I-152; ARC-1; ARN/7, etc. Top dollar paid!

BOB SANETT, W6REX
1524 S. Edris Dr.
Los Angeles 35, California



SENSITROLS

STEPPING SWITCHES



SEND FOR OUR LATEST BULLETINS

AND ADD YOUR NAME
TO OUR MAILING LIST

cable address: UNIGENCOR, N. Y.

324 CANAL ST. (Near B'way) N. Y. — WA 5-9642
Universal general corp.

TELEPHONE RELAYS

See our May Ad for a more complete listing

Chase

ELECTRONIC SUPPLY CO.
105-07 225 St., Queens Village, N. Y. Hollis 4-5033



Best quantity prices on large stocks of RELAYS CONDENSERS TRANSFORMERS CHOKES TUBES COMPONENTS

Write for list.

5 HP 220-440V 3 PH. MOTORS \$70
2 KW power plants 110V 800~+24V DC \$90
2 KW Gen. Vee belt 110V 800~+24V DC \$20

NORTH ELECTRONIC SUPPLY
3704 Brandini St. San Diego 1, Calif.

SAVE 1/2 ON WEBER ENVIRONMENTAL TEST CHAMBERS!

Demonstrators . . . Excellent Condition!

Carry New Equipment Guarantee

1 cu. ft. Bench Type, front opening, —100F

2 cu. ft. Chest Type, top opening, —100F

4 cu. ft. Chest Type, top opening, —120F

Write for details.

WEBBER MANUFACTURING CO., INC.
2740 Madison Ave., Indianapolis, Indiana

TEST EQUIPMENT

FLUXMETER. Measures magnetron magnets from 500 to 4000 gauss. New \$14.95
FREQ. METER. TS-127-U. Range 375-725 Mcs. New with manual. \$34.50
PANADAPTER. AN/APA-10. For 115v., 60 cycle operation. New with manual. \$145.00
TEST OSC. TS-47/APR. 40-500 Mc. on fundamentals and 2000 Mcs. and above on harmonics. Pulse and sine wave mod. New with manual. \$149.50
FREQ. STANDARD. Telrad 18A. Puts out 1000/100/10 crystal check points. New \$23.95
RECEIVER. MX-24/APT-1. For use with tuning units TN-1, 2, 3. Nice condition. \$97.50
RECEIVER. BC-1068A. Tunes 158 to 210 Mcs. Includes 14 tubes. For 115/1/60. \$29.50
PULSE TIMER. Navy Type CUZ-50AGD. For 115/60/110 including tubes \$65.00
OSCILLATOR. AN/APT-2. Radar Jammer. Tunes 450-710 Mcs. New, inc. tubes \$29.75
OSCILLATOR. AN/APT-5. Radar Jammer. Tunes 300-1600 Mcs. Brand new, with PP-104/APT-5 Power Supply Tubes, etc. \$169.50
TEST SET. S Band. Navy Type LZ. Complete set-up including Sig. Gen. Scope, Power Meter, Ant. Cables, Etc. Brand New \$250.00
MODULATOR. Type BC-1203. For 115v., 60 cycle operation. With tubes. \$125.00
MODULATOR. Type BC-423B. Radiates 205 Mc. signal pulsed at 4.098 cps. New \$19.50

HI-VOLT OIL CAPACITORS

ALL TOP BRANDS

Mfd.	KV	Price	Mfd.	KV	Price
.001	50	22.50	.135	7.5	6.95
.01	5	2.50	.2	50	29.50
.02	8	4.50	.25	15	9.95
.02	20	6.75	.25	20	15.95
.025	50	17.95	.25	50	44.50
.025/.025	50	34.50	1	7.5	6.95
.1	3	1.75	1	15	29.50
.1	4.5	3.50	2	5.5	9.50

TRANSFORMERS

STEPDOWN. G.E. 6kva. Pri: 230/460. Sec: 115/125. 60 cy. 1ph. New. \$49.50
HI-POT. Westhse. Pri: 115/60/1. 15,000 v.c.t. @ 60 ma. Oil filled. Sec. c.t. ungrounded. New \$29.50
PLATE POWER. Raytheon. Pri: 440/220/60/3. Sec: 1510v. @ 0.67 Amps. \$39.50
RESONANT CHARGING. G.E. Type Y-3502-A. Output peak 22,800v. Kva. 2.18. Linear within 3% from .0195 to .195 Amps. New \$79.50
PLATE POWER. Kenyon #S-10716. Pri: 220/60/3. 3 sec. coils. 1420-0-1420, 1420-0-1420, 1300-0-1300. Each 350 ma. New \$35.00
FILAMENT. Raytheon U-5819. Pri: 440/220/60/1. Sec: 5 v.c.t. @ 30 amps. New \$9.75
CHOK. Oil-filled. 16 H @ 450 ma., 125 ohms. Insulation 6,000 v. New \$9.75
SCOPE. Pri: 115/60/1. Sec. #1: 4400v. rms. @ 4.5 ma., Sec. #2: 5 v.c.t. @ 3A. Insu. 15 KV. \$6.75
MODULATION. For RCA type 250K transmitter, which uses a pair of 828 tubes to modulate a pair of 810's. Weight 143 lbs. \$49.50

RADAR ANTENNAS

SO-1 (1CM) assembly with reflector, waveguide nozzle and drive motor. \$279.50
SO-3 (3CM) Surface Search type with reflector and drive motor, but less plumbing. \$99.50
SO-13 (10CM) Complete assembly with 24" dish, dipole, drive motor and gearing. \$49.50

RA38 RECTIFIER

Variable output 0-15000 V DC @ 500 MA. Input 115V 60 cy. 1 ph. Size 63 x 53 x 56 in. Write for detailed information.

NEW SCR-522A EQUIPMENT

Complete BC-624C receivers and BC-625AM Transmitters including mounting racks, plugs, connectors, dynamotor. Brand new equipment with instruction manuals. Write for full details.

G.E. SERVO AMPLIFIER

Used in P29 planes for Central Station Fire Control Systems B2, B3 and B4. Used to drive Amplidyne 5AM31N9A and Control Motor 5BA501J2A listed below. New less tubes. \$29.50

AMPLIDYNE

G.E. 5AM31N9A. 530 Watts. 7500 RPM. Input: 27 VDC. Output: 60 VDC. Weight 34 1/2 lbs. \$23.50

CONTROL MOTOR

G.E. 5BA501J2A. Armature 27VDC at 8.3 Amps. Field 60VDC at 2.3A RPM 4000. H.P. 0.5 New \$27.50

The equipment advertised above represents but a few of the hundreds of items carried in stock in our two large warehouses. This material includes antennas, capacitors, dynamotors, generators, radars, synchros, test equipment, and a wide variety of components. Your requests for quotations will receive our prompt attention.

Phone: DEerfield 7-0044

ELECTRONICRAFT
 27 MILBURN ST. BRONXVILLE 8, N. Y.

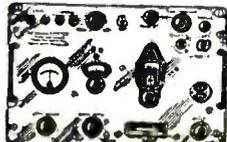
NEW YORK'S RADIO TUBE EXCHANGE

NEW TUBES

Standard brands. First grade only. No pull outs. No rejects. No rebrands. At lowest prices. Wholesale and export only.

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
0A2	51.00	2J36	90.00	3CP1	5.00	1M15	200.00	388A	1.80	802	3.95	1500T	135.00
0A3	1.10	2J38	8.95	3J21	75.00	15E	1.75	393A	7.50	802	3.95	HK1554	75.00
0B2	.99	2J39	8.59	4B39	5.40	15H	.75	394A	3.95	805	4.95	1803	5.00
0B3	1.10	2J40	8.59	4C27	10.00	NE16	.59	MX408T	1.50	807	1.25	1612	1.50
0C3	.96	2J42	135.00	4C28	35.00	20.4	.75	417A	15.00	808	1.35	1613	1.25
0D3	.89	2J49	60.00	4E27	16.00	KY21A	8.25	434A	15.00	809	2.95	1616	1.25
C1B	2.95	2J50	95.00	4J25	50.00	RR21	2.50	446A	1.95	810	10.50	1619	.45
1B22	1.50	2J55	150.00	4J26	30.00	RX21	8.00	446B	3.95	811A	1.75	1620	.25
1B23	5.95	2J56	110.00	4J27	50.00	RX24G	1.50	450TL	45.00	812A	3.95	1624	1.75
1B24	12.00	2J61	20.00	4J28	50.00	25T	2.95	450TH	52.50	813	13.75	1625	.35
1B26	1.75	2J61A	25.00	4J29	50.00	2K39	2.75	464A	7.50	814	1.75	1626	.25
1B27	12.50	2J62	15.00	4J30	30.00	HF50	1.75	471A	1.25	815	3.25	1851	1.80
1B38	35.00	2K22	29.00	4J31	150.00	HK54	4.50	52T	18.00	816	1.45	2000T	150.00
1B50	23.00	2K23	15.00	4J32	150.00	100TH	7.95	W1530	33.00	827	1.90	2050	1.50
1B51	7.50	2K25	19.50	4J33	150.00	RR73	1.00	WL531	22.50	829A	12.00	2051	1.00
1B56	35.00	2K26	58.00	4J34	100.00	FG95	19.95	WL533	15.00	829B	12.50		
1B60	35.00	2K28	35.00	4J35	150.00	100TH	7.95	WL584	35.00	830B	2.00		
1N21	.55	2K29	35.00	4J36	150.00	FG105	20.00	700A/D	10.00	832A	9.95		
1N21A	.95	2K33A	75.00	4J37	150.00	122A	1.75	701A	4.50	833A	45.00		
1N21B	1.80	2K39	140.00	4J38	150.00	203A	7.50	703A	3.95	834	7.50		
1N21C	12.50	2K41	135.00	4J39	150.00	211	.95	703A	1.95	836	3.95		
1N22	.66	2K42	180.00	4J40	150.00	217C	12.00	705A	2.75	837	7.50		
1N22C	7.50	2K43	199.00	4J41	150.00	242C	10.90	706A/V	8.95	838	5.95		
1N23A	.90	2K44	195.00	4J42	190.00	244C	9.50	706A/V	8.95	839	35.00		
1N23B	1.50	2K45	80.00	4J51	190.00	249C	4.25	707A	25.00	857B	125.00		
1N27	1.50	2K55	25.00	4J52	150.00	2501H	19.95	707B	15.00	860	3.50		
1N34	.79	2K56	72.00	4J53	225.00	2501H	19.95	714A/Y	36.00	861	25.00		
1N43	2.25	3AP1A	10.00	5BP1	3.95	252A	3.00	715A	4.50	866A	1.50		
1N43	2.25	3AP1A	10.00	5BP2A	12.00	274B	1.00	716B	9.00	869B	67.50		
1N43	2.25	3AP1A	10.00	5BP4	3.95	304TH	10.00	716C	22.50	800H/X	50.00		
9C39A	13.50	3B24	5.50	5CP7	9.95	307A	3.50	719A	22.50	874	2.25		
2C40	12.00	3B25	5.50	5CP12	15.00	310B	4.95	GY	50.00	879	5.00		
2C41	14.50	3B26	8.00	5D21	19.00	311A	6.50	721A	1.50	884	1.50		
2C44	.60	3B28	8.00	5JF1	27.50	312A	3.50	721B	7.50	885	1.50		
2C46	7.50	3C22	5.50	5JF2	19.50	323A	15.00	723A/B	18.00	902P1	6.75		
2C47	12.00	3C24	75.00	5JF4	27.50	327A	3.75	724A	1.95	931A	5.00		
2J22	5.00	3C24	75.00	5JF5	25.00	326A	6.75	724B	2.25	954	5.00		
2J26	15.00	3C21	2.95	5L11A	25.00	350A	4.50	726A	18.00	955	.50		
2J27	15.00	3C21	2.95	6A	11.00	350B	5.95	726A	18.00	956	.75		
2J31	24.00	3D1A	10.00	6B7A	24.00	374C	4.50	726B	15.00	957	2.75		
2J32	29.00	3D1A	10.00	7B7	5.00	357A	15.00	726C	45.00	958A	.60		
2J33	32.00	3E1P	10.00	7D14	9.00	368AS	4.50	730A	22.50	959	2.25		
2T34	36.00	3E2P	15.50	12DP7A	59.00	385A	4.50	801A	.90	1280	.95		

Various 5000 and 8000 series of new production tubes
 5820 - 475.00
 5826 - 450.00
 8012 - 2.00
 8012A - 2.50
 8013 - 3.00
 8013A - 3.50
 8019 - 1.75
 8025 - 1.80
 8025A - 1.50
 PDB365 - 96.00
 9001 - 1.52
 9002 - 1.50
 9003 - 1.25
 9004 - .35
 9005 - 2.75
 9006 - .25
 Thousands of other tubes



NEW TS-147 B AND C/UP TEST SET SIGNAL GENERATOR

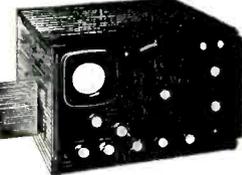
Hard-to-get X-Band Now Available

Test Set TS 147 UP is a portable Microwave Signal Generator designed for testing and adjusting beacon equipment and radar systems which operate within the frequency range of 8500 MC to 9600 MC.

NEW UNUSED SURPLUS TS 259 K BAND 23400-24500 MEGACYCLES SIGNAL GENERATOR

NEW MICROWAVE TEST EQUIPMENT TS148/UP SPECTRUM ANALYZER

Field type X Band Spectrum Analyzer. Band 8430-9580 Megacycles.



Will Check Frequency and Operation of various X Band equipment such as Radar Magnetrons, Klystrons, TR Boxes. It will also measure pulse width, c-w spectrum width and Q or resonant cavities. Will also check frequency of signal generators in the X band. Can also be used as frequency modulated Signal Generator etc. Available new complete with all accessories, in carrying case.

SPECIAL! 5,000 V. POWER SUPPLY For IP25 Infrared Image Converter from 3 V. Battery Source. \$9.90

OTHER TEST EQUIPMENT USED CHECKED OUT, SURPLUS

TSKI/SE	T35/AP	TS108	TS226	Surplus Equip.
TS3A/AP	TS36/AP	TS110/AP	TS239A-TS239C	APA10
RF4/AP	1-96A	TS125/AP	TS251	APA38
TS12/AP	TS-45	TS126/AP	TS258	AP5 3 APS 4
TS13/AP	TS47/APR	TS147	TS270	APR4
TS14/AP	TS69/AP	TS174/AP	TF890/1	APR5A
TS33/AP	TS100	TS175/AP	834	APT2-APTS
TS34/AP	TS102A/AP	TS182		

You Can Reach Us on TWXNY1-3235
 Large quantities of quartz crystals mounted and unmounted.
 Crystal Holders: FT243, FT171B others.
 Quartz Crystal Comparators.
 North American Philips Fluoroscopes Type 80.
 Large quantity of Polystyrene beaded coaxial cable.
Minimum Order 25 Dollars

Phone: WOrth 4-8262
LIBERTY ELECTRONICS, INC.
 135 LIBERTY STREET, NEW YORK 6, N. Y.
 Cables: TELSERUP

FOR SALE
UNUSED SURPLUS COMPONENTS
 Power Rheostats - Power Resistors - "J" - "JJ"
 Pots - Wire Wound Pots - Glass Ferrule Resistors - Precision Resistors
 Send us your requirements and let us quote
 J. C. DIXON: Troy, Ind.

400-800 CYCLE MOTOR-GENERATOR SETS & ALTERNATORS
 FOR SALE OR FOR RENT
 1 to 5 KVA-I PHASE & 3 PHASE
IMMEDIATE DELIVERY
 ALL INQUIRIES INVITED
 SEND FOR OUR LIST
EDWARD WOLF COMPANY
 P. O. BOX 82 MATTAPAN, 26, MASS.
 Bluehills 8-1254

"TAB" TUBES

TUBES

"TAB" TESTED
INSPECTED
GUARANTEED!!!

NEW!! HI SENSITIVITY
6KV DC & AC
27 Range
MULTITESTER
(Not a Kit)

VACUUM CAPACITORS
25mmf/7.5kV @ \$4.98, 3 for \$10
50mmf/7.5kV @ \$6.98, 4 for \$20
100mmf/7.5kV @ \$7.49, 4 for \$20
50mmf/20kV @ \$9.34, 3 for \$20
50mmf/30kV @ \$11.34, 3 for \$20
100mmf/20kV @ \$21.34, 3 for \$24
@ \$11.27, 2 for \$26
Buy \$100 & Deduct 20% Discount

MICRO-POSITIONER Barber-Colman
AYL3522-S polarized DC relay Diode
coil, differential current sense, 50V max
for remote control positioning \$5.50;
2/5/10

CIRCUIT BREAKERS
Heinmann Magn. Bkrs. Amps: 3,
5, 7, 9, 10, 12, 30, 40, 50, \$1.98 ea.
12/250/50/575
Sq. D & CH Toggle Sw. Bkrs.
Amps: 5, 10, 15, 20, 25, ea. .98
Millett Push Buttons
Bkrs. Amps: 3, 10, 15, 30, 35 @ \$9.34
10/57.98
Ass't'd One Each Twelve Types @ \$5

CIRCUIT BREAKER FUSES
Push to Reset
Amps 3-5-7-10-15-20 Ea 27c; 4 for 51; 25 for
\$8; 100 for \$18
Circuit Breaker Fuse w/2 Mounting Clips 39c;
3 for \$1; 20 for \$6; 100 for \$25; 1000 for \$200
Fuses in 3 1/2" size 1/2" diameter Amps (Current)
desired. Kit of Six \$1.50

DELAY LINE, Millen I Micro sec/d @
\$2.95;
DELAY LINE, ESC #2200/0.1 Micro
sec/d @ \$2; 6/\$10

PRICE SLASHED \$ \$
*30¢ "J" POTS

Ohms	Shaft	*As Priced Below	Shaft	R	L
50	7/16	1/4 30K	1/8S	1/2L	
100	3/8	1/2 50K	1/8S	1/2L	
150	1/2	3/8 75K	1/2	3/4L	
200	5/8	1/2 100K	1/2	3/4L	
250	1 1/4	3/8 150K	1/2	3/4L	
300	1 1/2	1/2 200K	3/8S	1/4L	
350	1 3/8	1/2 250K	3/8S	1/4L	
400	1 1/2	3/8 300K	3/8S	1/4L	
450	1 3/8	1/2 350K	3/8S	1/4L	
500	1 1/2	3/8 400K	3/8S	1/4L	
550	1 3/8	1/2 450K	3/8S	1/4L	
600	1 1/2	3/8 500K	3/8S	1/4L	
650	1 3/8	1/2 550K	3/8S	1/4L	
700	1 1/2	3/8 600K	3/8S	1/4L	
750	1 3/8	1/2 650K	3/8S	1/4L	
800	1 1/2	3/8 700K	3/8S	1/4L	
850	1 3/8	1/2 750K	3/8S	1/4L	
900	1 1/2	3/8 800K	3/8S	1/4L	
950	1 3/8	1/2 850K	3/8S	1/4L	
1000	1 1/2	3/8 900K	3/8S	1/4L	
1050	1 3/8	1/2 950K	3/8S	1/4L	
1100	1 1/2	3/8 1.1M	3/8S	1/4L	
1150	1 3/8	1/2 1.15M	3/8S	1/4L	
1200	1 1/2	3/8 1.2M	3/8S	1/4L	
1250	1 3/8	1/2 1.25M	3/8S	1/4L	
1300	1 1/2	3/8 1.3M	3/8S	1/4L	
1350	1 3/8	1/2 1.35M	3/8S	1/4L	
1400	1 1/2	3/8 1.4M	3/8S	1/4L	
1450	1 3/8	1/2 1.45M	3/8S	1/4L	
1500	1 1/2	3/8 1.5M	3/8S	1/4L	
1550	1 3/8	1/2 1.55M	3/8S	1/4L	
1600	1 1/2	3/8 1.6M	3/8S	1/4L	
1650	1 3/8	1/2 1.65M	3/8S	1/4L	
1700	1 1/2	3/8 1.7M	3/8S	1/4L	
1750	1 3/8	1/2 1.75M	3/8S	1/4L	
1800	1 1/2	3/8 1.8M	3/8S	1/4L	
1850	1 3/8	1/2 1.85M	3/8S	1/4L	
1900	1 1/2	3/8 1.9M	3/8S	1/4L	
1950	1 3/8	1/2 1.95M	3/8S	1/4L	
2000	1 1/2	3/8 2.0M	3/8S	1/4L	

PHOTOFLASH & STROBE LAMPS
No. Replaces Max Each
TWL FA 104/ET118 150 \$5.98
THL 100 100 9.98
23ST GE FT 210 200 9.98
THVA SYLV. 4330 300 9.98
V4XK 1500 200 14.98
TK DX & PA100 150 9.00
TDX DXC/250-350 150 10.00
250VOLT 250 9.98
TRIGGER COIL LO VOLT FLASH \$1.47
525MFD/450VDC/53 Waxed COND new low
excess lamping mfg. \$9; 2/515

0A2	5.74	4J30	99.55	HY615	4.46	5663	1.06	5950	6.45
0A3	.98	4J47	485.00	703A	1.48	5670	2.24	5959	37.25
0B1	.64	4J55	649.95	703B	.98	5672	1.85	5963	1.75
0B3/VR30	64	4K150	250.00	705A	.98	5676	1.55	6027	179.95
0C3/V105	82	5C22	29.50	710A	1.68	5686	2.99	6072	3.99
0D3/V150	78	5D27	9.48	715B	11.90	5692	6.48	6089	1.55
1A0A	3.95	5L1C	4.46	717A	1.48	5692	6.48	6099	1.55
1A1A	1.35	6AN5	3.60	721A	.98	5693	5.49	6101	1.55
1A2	1.25	6AS5	1.60	723AB	9.98	CK5694	3.70	6110	6.55
1B5	.66	6A57G	2.98	724A	2.94	CK6111	3.70	6111	8.95
1B24	4.98	6J6	.48	724B	.96	CK5702	2.50	6119	6.45
1B46	1.88	6SN7	.56	725A	4.49	5704	2.25	6121	9.00
1B63A	42.50	6V6GT	.56	807	1.19	5713	173.50	6121	9.00
1Q21	3.45	6X4	.42	807W	4.98	5718	5.98	6146	4.87
1Q23	150.00	7C25	125.00	814	4.48	5719	5.99	6164	64.95
1X2A	.62	8D21	99.00	815	3.98	5721	189.55	6199	49.99
2C39A	16.90	12AU7	.54	829B	8.49	5722	6.35	6201	3.99
2C51	2.50	12X7	.58	832A	5.49	615727	1.77	6270	199.95
2T21	.75	FG17	3.01	864	.34	5732	3.94	6271	159.95
2E22	1.89	19B6G	1.38	927	1.36	5736	159.95	6273	199.95
2E24	2.48	24C	1.96	954	.18	5744	2.39	8005	4.97
2E26	3.78	MK24	4.90	955	.65	5749	1.72	8012	1.09
2E27	2.07	35Z5	.46	956	.32	5750	6.00	8013	4.91
2E43	1.49	TZ40	4.49	957	.51	5751	3.09	8014A	50.15
2J30	50.50	50L6	.60	CK1005	.56	5764	55.99	8020	2.95
2J42	99.50	71A	.74	1612	1.91	5820	69.00	8025A	2.99
2K25	23.88	HY69	5.49	1613	1.27	5769	298.00	9001	.98
2K28	29.50	QM155	699.99	1616	.79	CK5783	5.55	9002	.98
2K29	6.00	2K202	99.99	1617	.34	CK5787	8.95	9003	.98
2K30	130.00	203A	7.38	1620	5.01	5794	8.99	9006	.15
2K33	219.48	215	10.35	1625	.44	5812	2.99	9006	.15
2K39	0	233A	2.92	1626	.16	5814	1.28	9006	.15
2K41	175.00	250R	10.95	1629	.22	5819	49.99	9006	.15
2K42	149.55	MK254	18.00	1632	.68	5820	69.00	9006	.15
2K43	130.00	250TH	35.00	1633	.98	5823	1.29	9006	.15
2K44	0	304TH	15.00	1642	.62	5825	11.99	9006	.15
2K48	110.00	304L	15.00	1644	.99	5826	11.99	9006	.15
2K50	110.00	316A	1.89	1649	99.00	5840	5.05	9006	.15
2P23	298.00	388A	1.99	2050	.98	5841	7.98	9006	.15
3B24W	8.48	394A	1.96	2050W	2.48	5842	11.00	9006	.15
3C22	72.50	434A	3.94	2051	.68	5844	1.00	9006	.15
3C24	3.98	402B	75.49	5514	4.69	5847	7.57	9006	.15
3C25	325.00	408X	2.05	5517	2.22	5853	59.50	9006	.15
3X2500A	125.00	512XA	1.35	5586	150.22	CK5875	2.05	9006	.15
4-65A	19.49	536XA	1.55	5634	7.50	5879	1.59	9006	.15
4-125A	19.09	538DX	9.98	5640	13.57	5883	2.00	9006	.15
4B27	4.98	516A	2.50	5641	6.39	5884	7.50	9006	.15
4C35	16.95	571XA	4.45	5642	.99	5910	1.72	9006	.15
4J26	79.55	605CX	.97	5654	1.72	5927	89.45	9006	.15
				5656	9.98	5932	5.00	9006	.15

5663	1.06	5950	6.45	6119	6.45
5670	2.24	5959	37.25	6121	9.00
5672	1.85	5963	1.75	6121	9.00
5676	1.55	6027	179.95	6146	4.87
5686	2.99	6072	3.99	6164	64.95
5692	6.48	6089	1.55	6199	49.99
5693	5.49	6099	1.55	6201	3.99
CK5694	3.70	6101	1.55	6270	199.95
CK5702	2.50	6110	6.55	6271	159.95
5704	2.25	6111	8.95	6273	199.95
5713	173.50	6119	6.45	8005	4.97
5718	5.98	6121	9.00	8012	1.09
5719	5.99	6121	9.00	8013	4.91
5721	189.55	6146	4.87	8014A	50.15
5722	6.35	6164	64.95	8020	2.95
615727	1.77	6199	49.99	8025A	2.99
5732	3.94	6201	3.99	9001	.98
5736	159.95	6270	199.95	9002	.98
		6271	159.95	9003	.98
		6273	199.95	9006	.15
		8005	4.97		
		8012	1.09		
		8013	4.91		
		8014A	50.15		
		8020	2.95		
		8025A	2.99		
		9001	.98		
		9002	.98		
		9003	.98		
		9006	.15		
		C/Ray Tubes			
		3BP1A	6.55		
		3CP1A	9.98		
		3DP1	4.81		
		3DPA	6.80		
		51P1	4.71		
		51P2	7.94		
		51P3	9.91		
		51P4	10.00		
		7BP7	6.50		
		5BP1	1.98		
		5CP5	3.55		
		5HP1	3.91		
		51P1	4.71		
		51P2	7.94		
		51P3	9.91		
		51P4	10.00		
		7BP7	6.50		

"TAB" \$21.95 ea
IN LOTS OF 3

A complete precision test instrument... \$22.95 ea
HV PROBE, 30,000 Volts @ \$5.95 ea

POCKET AC-DC Multitester
"TAB" 27C \$9.45 ea

INDEX TO ADVERTISERS

Ace Electronic Associates.....	342	Bendix Aviation Corporation	
Ace Engineering & Machine Co., Inc.....	280	Pacific Div.....	289
Aeme Electric Corp.....	344	Red Bank Div.....	278
Admiral Corporation.....	106	Scintilla Div.....	209
Advance Electric & Relay Co.....	368	Bentley Harris Mfg. Co.....	32
Advance Electronics Co., Inc.....	431	Berg Mfg. Corp.....	433
Aeronautical Communications Equip- ment, Inc.....	36	Berkeley Div. Beckman Instruments, Inc.....	331
Aerovox Corporation.....	261	Bird & Co., Inc. R. H.....	366
Ainslie Corp.....	319	Bird Electronic Corp.....	336
Airborne Instruments Laboratory, Inc.....	62	Biwax Corp.....	385
Aircraft-Marine Products, Inc.....	40, 41	Boesch Mfg. Co., Inc.....	386
Airpax Products Co.....	58	Bomac Laboratories, Inc.....	63
Allegheny Ludlum Steel Corp.....	68	Bosworth & Co., S.....	391
Allen-Bradley Co.....	64	Bourns Laboratories.....	200
Allen Manufacturing Co.....	346	Brubaker Electronics, Inc.....	335
Allied Control Co., Inc.....	72, 73	Bruno-New York Industries Corp.....	234, 235
Allied Radio Corp.....	204	Brush Electronics Company.....	64A, 64B, 302
Almo Radio Co.....	375	Burgess Battery Company.....	378
Alpha Metals Inc.....	383	Burroughs Corp., Electronic Instruments Div.....	212
American Airlines, Inc.....	56	Burlington Instruments Co.....	308
American Electrical Heater Co.....	202	Bussmann Mfg. Co.....	98
American Electronic Mfg. Inc.....	360	Byron Jackson Co.....	185
American Lava Corporation.....	55		
American Machine & Foundry Company.....	387	Caledonia Electronics & Transformer Corp.....	385
American Phenolic Corp.....	180	Cambridge Thermionic Corp.....	42
American Television & Radio Co.....	364	Cannon Electric Co.....	33
Amperex Electronic Corp.....	114	Carborundum Company.....	38
Ampex Corporation.....	57	Centralab, a Division of Globe-Union Inc.....	80
Arnold Engineering Co.....	13	Chamber of Commerce, Daytona Beach, Florida Traffic & Industrial Dept.....	434
Assembly Products, Inc.....	376	Chase Brass & Copper Co.....	219
Astron Corporation.....	35	Chemical Products Corp.....	242
Atlas Precision Products Co.....	46	Chicago Standard Transformer Corp.....	198
Audio Fair, The.....	381	Chicago Telephone Supply Corp.....	66
Augat Bros., Inc.....	373	Cinch Mfg. Corp.....	171
Automatic Electric Manufacturing Co.....	214	Clarostat Mfg. Co., Inc.....	100
Automatic Manufacturing Corp.....	65	Cleveland Container Co.....	245
Automatic Production Research.....	382	Clifton Precision Products Co., Inc.....	87
Avion Instrument Corp.....	359	Cohn Corp., Sigmund.....	336
		Collectron Corp.....	374
		Collins Radio Company.....	311
Bakelite Company, a Div. of Union Car- bide & Carbon Corporation.....	301	Color Television, Inc.....	327
Baker & Adamson Products, General Chemical Div., Allied Chemical and Dye Corporation.....	229	Communication Products Co., Inc.....	328
Ballantine Laboratories, Inc.....	208	Condenser Products Company Div. of New Haven Clock & Watch Co.....	362
Baltic Metal Products Co.....	362	Consolidated Engineering Laboratories Co.....	366
Barrett Division, Allied Chemical & Dye Corp.....	116, 117	Constantin Engineering Laboratories Co.....	250
Barry Controls, Incorporated.....	21	Continental-Diamond Fibre Co.....	249, 285
Bausch & Lomb Optical Co.....	184	Continental Wire Corp.....	194
Bead Chain Mfg. Co.....	329	Cornell-Dubilier Electric Corp.....	95
Beaver Gear Works, Inc.....	324	Corning Glass Works.....	337
Bell Aircraft Corp.....	306	Cornish Wire Company.....	365
Bell Telephone Laboratories.....	265	Crane Packing Company.....	319

NEW = PRECISION PHASE METER =



TYPE 405

- 0.3-120 V, 8 CPS—100 KC
- NO AMBIGUITY AT ZERO DEGREE
- 0.25° RELATIVE ACCURACY
- PHASE READING INDEPENDENT OF SIGNAL AMPLITUDES

Type 405 Phase Meter has a frequency range of 8 cps to 100 kc, phase range 0-36, 0-90, and 0-180 degrees; a switch is provided for 180-216, 180-270, and 180-360 degrees. The accuracy is 1/4 degree relative and 1 degree absolute in any range. The input impedance is 2.7 megohms shunted with 20 uuf on both channels. The meter scale is 6 1/2" long, thus a fraction of 1/4 degree can be read easily. For 0.0001 cps to 1000 cps, use our U-L Phase Counter.

PRICE: \$485.00

HIGH Z MINIATURE DELAY LINES FOR COLOR TV



- 2200 OHMS IMPEDANCE
- PHASE RESPONSE—LINEAR OVER 10 MC
- RISE TIME—7% OF TIME DELAY
- BANDWIDTH OVER 10 MC

SPECIFICATIONS

TIME DELAY: 0.5 us for 6C2a, 0.7 us for 6C2b, and 0.9 us for 6C2c. Different values of time delay can be furnished upon request.

PHYSICAL SIZE: 1/4" in diameter for all models, 3.5" long for Type 6C2a, 4.5" long for Type 6C2b and 6" long for Type 6C2c.

PRICE: \$7.50 each for 6C2a, \$8.50 each for 6C2b, and \$9.50 for 6C2c. Reduced prices on large quantities.

WRITE
FOR
DATA!



**ADVANCE
ELECTRONICS CO., INC.**

451 Highland Avenue • Passaic, N. J.

the ONLY instrument in the field that offers ALL these features at



**NO
EXTRA
COST!**

the new
DS-6100-T
FREQUENCY-PERIOD
electronic counter

A compact frequency-period counter designed for direct measurement of any mechanical, electrical or optical phenomena which can be converted to a varying voltage. Read-out in direct digital form. Ideal for use by skilled or unskilled personnel. Price \$700.00.

Write for complete catalog data **TODAY!**

- **FREQUENCY Measurement**
- **1 and 10 SECOND Time Base**
- **PERIOD Measurement**
- **1 and 10 CYCLE Gate Time**
- **PRECISION ACCURACY Over 1-100,000 cps range**
- **EASILY PORTABLE Only 28 Pounds**
- **SMALL SIZE 14 1/4" W x 7 1/2" H x 13 1/2" D**

FOR OUR COMPLETE
PRODUCT LINE... SEE
electronics '55 BUYERS' GUIDE



Representatives in all major areas.

COMPUTER-MEASUREMENT CORP.

5457 Cleon Avenue, Dept. 78-J
North Hollywood, California

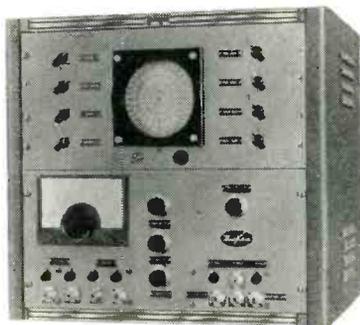
Q-116



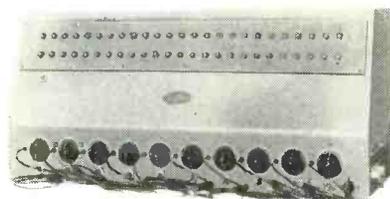
LABORATORY INSTRUMENTS

PHASE DISPLAY EQUIPMENT

The PDE-1 displays the transfer function of any network, amplifier, or complete system as a simultaneous polar plot of phase and amplitude. Phase and amplitude distortion can be measured over the range of 100 kc to 10 mc. The self-contained sweep is adjustable to 10 mc, at a recurrence rate of 30 c.p.s. A built-in marker generator provides markers at 100-kc and 500-kc intervals, for Z-axis modulation of the display oscilloscope. The PDE-1 is ideal for transistor studies and measurements, and can be used in the design and evaluation of feedback amplifiers and servo systems.



NETWORK SYNTHESIZER AND UNIVERSAL FILTER



The NS-1 permits rapid synthesis of any filter characteristic over the entire video range, eliminating cut-and-try design procedures. The unit will synthesize 10 terms of a Fourier series or 10 steps of any transient response function. Voltages are selected from a 50-section delay line (.034 μ sec per section) and combined by means of 10 cathode followers, each having an attenuator and polarity (algebraic sign) selector switch. Controls can be reset to repeat a desired network. Built-in regulated power supply.

Write for complete literature on these items.

Wickes ENGINEERING AND CONSTRUCTION COMPANY

12TH STREET AND FERRY AVENUE

ESTABLISHED 1920

CAMDEN 4, NEW JERSEY

Cro-Plate Company, Inc.	384
Cross Co., H.	376
Curtiss-Wright Corp.	350

Dano Electric Co.	328
Daven Company	3rd Cover
DeJur-Amsco Corporation	266
Dectron Corp., Computer-Measurements Div.	432
Dialight Corporation	317
Dumont Laboratories, Inc., Allen B.	193
duPont de Nemours & Co. (Inc.) E. I. Film Dept.	205
Polychemical Dept.	43

Eagle Signal Corp.	317
Eastern Air Devices, Inc.	264
Edison Incorporated, Thomas A.	246
Eitel-McCullough, Inc.	67
Eleo Corporation	344
Electric Regulator Corp.	258
Electrical Industries Div. of Amperex Electronic Corp.	275
Electro Data Corp.	371
Electro Impulse Laboratory	381
Electro Motive Mfg. Co., Inc.	103
Electro Product Laboratories	359
Electro-Snap Switch & Mfg. Co.	183
Electro Tec Corporation	271
Electronic Associates, Inc.	190
Electronic Instrument Co., Inc. (EICO)	379
Electronic Research Associates, Inc.	378
Engineering Co., The	363
Erie Resistor Corp.	232

F-R Machine Works, Inc.	287
Fairchild Controls Corp. A sub. of Fairchild Camera & Instrument Corp.	109
Falstrom Co.	53
Fansteel Metallurgical Corp.	320, 321
Farnsworth Electronics Company	303
Federal Telephone & Radio Co.	217
Filtors, Inc.	434
Filtron Company Inc.	101
Five Star Co.	386
Ford Instrument Co.	380, 384
Freed Transformer Co., Inc.	293
Frenchtown Porcelain Co.	191

G M Laboratories, Inc.	369
G-V Controls, Inc.	228
Gabriel Electronics, Div. of Gabriel Co.	271
Ganewell Co.	218

Garrepy Platers, Inc.	391
General Ceramics Corp.	81
General Electric Co. Apparatus Dept.	23, 263
Tube Dept.	70, 71
General Mills, Inc. Mechanical Div.	297
General Precision Equipment Corp.	48, 49
General Radio Co.	17
General Research & Supply Company ...	308
Georgia Dept. of Commerce.	259
Giannini & Co., Inc., G. M.	367
Good-all Electric Mfg. Co.	107
Goodyear Aircraft Corp.	201
Grant Pulley & Hardware Corp.	349
Green Instrument Co.	312
Greenleaf Mfg. Co.	211
Gries Reproducer Corp.	377
Guardian Electric Mfg. Co.	69
Hammarlund Mfg. Co., Inc.	25
Hayden Assoc., Paul.	391
Haydon Company, A. W.	276
Haydon Manufacturing Co., Inc.	260
Haydu Brothers of New Jersey.	207
Heath Company	345
Heiland, A Div. of Minneapolis-Honey- well	333
Helco Products Corp.	373
Helipot Corp., Div. of Beckman Instru- ments, Inc.	177
Hermetic Seal Products Co.	51
Hertner Electric Company.	365
Hewlett-Packard Company	83, 257
Heyman Manufacturing Co.	370
Hitemp Wires, Inc.	301
Hoffman Laboratories, Inc.	277
Houghton Laboratories Co.	252
Hudson Tool & Die Company, Inc.	315
Hughes Aircraft Co.	77
Hughes Research & Development Labora- tories	339
Hycor Eastern, Inc.	216
Hycor Company, Inc.	367
Intra Corporation	364
Indiana Steel Products Company.	30, 31
Industrial Test Equipment Co.	382
Infra Electronic Corp.	224
Instrument Resistors Co.	332
International Crystal Mfg. Co. Inc.	82
International Nickel Co., Inc.	86
International Rectifier Corp.	110
Ippolito & Co., Inc., James.	338
Irvington Div., Minnesota Mining & Mfg. Company	189
Jennings Radio Mfg. Corp.	195
Johnson Company, E. F.	334, 358

TERMINALS IN STRIP FORM and MACHINERY to ASSEMBLE THEM..THIS IS OUR SPECIALTY

BERG MFG. CORP.

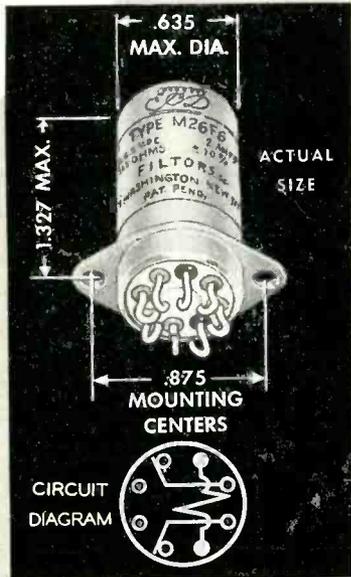
142 Reno Ave.

New Cumberland, Penna.

Phone CEdar 8-9394

NEW DPDT SUB-MINIATURE RELAY

by
FILTORS, INC.



ENGINEERED FOR CRITICAL AIRBORNE AND GUIDED MISSILE APPLICATIONS

*This relay meets the
requirements of
MIL-R-5757B and
MIL-R-25018 (USAF).*

Two Form C contacts are rated at 2 amps, resistive, at 29 V.D.C. or 115 V.A.C.

Withstands operational shock of 50 G's and operational vibration of 5 to 2000 CPS at 10 G.

Ambient temperature range: -65°C to +125°C

Weight: 1.3 ounces

Operate time: 10 milliseconds or less.

Release time: 5 milliseconds or less.

Send for NEW CATALOG

FILTORS, Inc. E

30 Sagamore Hill Dr.,
Port Washington, L. I., N. Y.

PLEASE SEND RELAY CATALOG

NAME

COMPANY TITLE

CITY STATE

Want more information? Use post card on last page.

434

Jones Div., Howard B., Cinch Mfg. Co. . . . 388
Joy Manufacturing Co. 223

Kable Engineering Co. 15
Kartron 391
Kay Electric Co. 27
Kearfott Co., Inc. 282, 314
Kennedy & Co., D. S. 210
Kepeco Laboratories 175
Kester Solder Co. 221
Keystone Bolt & Nut Corp. 361
Kinney Mfg. Division, New York Air
Brake Company 239
Knights Company, James 101, 105
Koch Fiberglass 215
Kollsman Instrument Corp. 89
Kwikheat Manufacturing Co. 434

Laboratory for Electronics, Inc. 115
Lambda Electronics Corp. 111
Lampkin Laboratories, Inc. 328
Lapp Insulator Co., Inc. 328
Lavoie Laboratories, Inc. 203
Lewis Spring & Mfg. Co. 256
Librascope, Inc. 199
Litton Engineering Laboratories 375
Lockheed Missile Systems Div. 272, 273
Loral Electronics Corp. 93

M B Manufacturing Co., Inc. 59
MacDonald Inc., Samuel K. 391
Magnatran, Inc. 348
Magnetics, Inc. 181
Malco Tool & Manufacturing Co. 324
Mallory and Co., Inc., P. R. 120, 173
Marconi Instruments, Ltd. 267
Marion Electrical Instrument Co. 296, 328
Markem Machine Co. 371
Martin Company, Glenn L. 316
McColpin-Christie Corp. 372
McGraw-Hill Book Co. 346
McMillan Industrial Corp. 295
Measurements Corporation 386
Metals & Controls Corp., General Plate
Div. 299
Meyercord Co. 262
Micro-Wire Stranding Company 374
Mid-Century Instrument Corp. 52
Midwestern Instruments 307
Miles Reproducer Co., Inc. 391
Millen Mfg. Co., Inc., James 334
Minneapolis-Honeywell Regulator Co., In-
dustrial Div. 29
Minnesota Mining & Mfg. Co. 102
Monsanto Chemical Co. 97

on the LINE

in the FIELD

KWIKHEAT

Controlled Heat Soldering Irons

**are better ... faster
for Printed Circuits!**

Light weight, perfectly balanced, small size, controlled-heat Kwikheat Type 200 soldering irons are designed for close soldering. Sealed, high temperature, built-in thermostat maintains pre-set heat (800° for production, 700° for stand-by). Kwikheat irons, weighing only 7½ oz., are economical — maintaining heat on only one-third of heater capacity. Three versatile plunger-type tips are easily changed in the field.

**For better, faster work —
at lower cost — switch to
KWIKHEAT soldering irons.**

KWIKHEAT Manufacturing Co.
3732 San Fernando Rd., Glendale 4, Calif.

**THIS SITE
WILL ATTRACT
TOP-FLIGHT
PERSONNEL**



*NOW available to Electronic
and related industries!*

- ✓ 4000 acres for planned industrial development . . . adjacent to double track main line railroad and spur-track, U. S. 1 Highway and airport.
- ✓ 5 miles to the "world's most famous beach" and recreational area.
- ✓ More than a location . . . a way of life!

WRITE FOR 58 PAGE FACTUAL ECONOMIC SURVEY.
TRAFFIC AND INDUSTRIAL DEPT.
CHAMBER OF COMMERCE, DAYTONA BEACH, FLORIDA

**DAYTONA BEACH
RECREATIONAL AREA**

HOLLY HILL ORMOND BEACH SOUTH DAYTONA
Want more information? Use post card on last page.

September, 1955 — ELECTRONICS

Muirhead & Co., Ltd.	5
Mullard Overseas Ltd.	79
Mycalex Electronics Corp.	294

N J E Corporation	119
Narda Corporation	310
Naresco Equipment Corporation, Sub. of National Research Corp.	281
National Moldite Co.	213
Natvar Corporation	283
New Hermes Engineering Machine Corp.	361
Ney Company, J. M.	351
Norden-Ketay Corp.	237
Northeastern Engineering, Inc.	99

Ofner Electronics, Inc.	340
Ohmite Manufacturing Co.	32A, 32B
Opad Electric Co.	357
Orber Manufacturing Co.	391
Ortho Filter Corp.	75
Oster Manufacturing Co., John	227

Panoramic Radio Products, Inc.	388
Parameters, Inc.	358
Perkin Engineering Corp.	182
Phermag Corp.	382
Phalo Plastics Corp.	230
Phelps Dodge Copper Products Corp., Inca Mfg. Div.	44, 45
Phillips Process Co., Inc.	350
Pix Manufacturing Co., Inc.	380
Plasteck, Inc.	568
Polarad Electronics Corporation	39, 279
Popper & Sons, Inc.	377
Potter Instrument Company, Inc.	186
Precision Apparatus Co., Inc.	436
Precision Paper Tube Co.	326
Pye, Ltd.	91

Quaker City Gear Works, Inc.	240
------------------------------	-----

Radial Cutter Manufacturing Corp.	351
Radio Condenser Co.	225
Radio Corporation of America	4th Cover
Radio Engineering Products	345
Radio Materials Corp.	84
Radio Receptor Co., Inc.	74
Railway Express Agency, Air Express Div.	231
Raybestos-Manhattan, Inc.	118
Raytheon Mfg. Company	18, 19, 91, 108



everything in Fluorocarbons... the most complete service in parts and stock

■ United States Gasket Company offers precision parts fabricated from duPont TEFLON, Kellogg KEL-F, BAKELITE Fluorothene and other plastics. U.S.G. facilities provide cold molding and sintering techniques, compression molding, extruding and injection molding—quality controlled “from powder to part,” to assure uniform electrical, chemical and physical characteristics of the highest quality.

U.S.G. also maintains a machine shop specially equipped for the precision machining of parts from fluorocarbon stock.

Come to U.S.G. for all your requirements—sheets, rods, tubing, tape, cylinders, bars, beading, electrical spaghetti—as well as custom-molded and machined parts.

Write for Catalog No. 300.

United States Gasket Company
CAMDEN 1, NEW JERSEY



**FABRICATORS OF FLUOROCARBONS
AND OTHER PLASTICS**

Representatives in principal cities throughout the world

PRECISION announces THE MODEL 98



A New Lab-Type VTVM and Electronic Ohmmeter with 7 INCH METER

Peak-to-Peak Voltage Ranges to 3200 Volts
Zero-Center and
Left-Hand Zero-Center VTVM Ranges

The Model 98 is a wide-range, high impedance, electronic test set. Special P-to-P voltage ranges afford accurate response to pulsed waveforms as encountered in Color and Monochrome TV.

9 DISTINCTLY SEPARATE FUNCTIONS
with 55 SELECTED WIDE-SPREAD RANGES

- ★ 6 True-Zero-Center DC Voltage Ranges:
Constant 26 $\frac{2}{3}$ Megohms input resistance.
0 \pm 1.2 \pm 6 \pm 12 \pm 60 \pm 300 \pm 1200 volts.
- ★ 6 Electronic Ohmmeter Ranges:
0-1K-100K ohms.
0-1-10-100-1000 Megohms.
- ★ 6 Minus and 6 Plus DB Voltage Ranges:
(Left-Hand-Zero) 13 $\frac{1}{2}$ Megohms input.
0-1.2-6-12-60-300-1200 volts.
- ★ 6 Hi-Impedance RMS AC Voltage Ranges:
0-1.2-6-12-60-300-1200 volts.
- ★ 6 High Impedance P-P AC Voltage Ranges:
0-3.2-16-32-160-800-3200 volts.
- ★ 5 Special High Frequency Probe Ranges:
0-1.2-6-12-60-300 volts RMS to 300 Mc.
(Requires optional PRECISION RF-10A Probe.)
- ★ 8 DC Current Ranges: 0-300 microamperes.
0-1.2-6-30-120-600 MA. 0-1.2-12 Amps.
- ★ 6 Decibel-Output-Meter Ranges: -20 to +63 DB.
- ★ Universal, 3-Way, Coaxial AC-DC VTVM Probe.
- ★ Extra Large 7" Rugged PACE Meter,
200 microamperes, \pm 2% accuracy.
- ★ 1% Multipliers and Shunts: wire and film types.

Model 98-MCP Deluxe: (illustrated) in blue-grey, custom-styled, hooded cabinet and two-color satin-brushed aluminum panel with contrasting dark blue control knobs. Case dimensions 11 $\frac{1}{2}$ x 13 x 6 $\frac{1}{2}$ inches. Complete with 3-way, coaxial, VTVM probe and manual.

Net Price: \$109.50

Model 98-MCP Standard: Complete as above except with standard black anodized panel in black ripple finished cabinet, 10 $\frac{1}{2}$ x 12 x 6"

Net Price: \$104.50

Accessories Available for the Model 98
RF-10A HF vacuum tube probe..... \$14.40 net
TV-8 60 Kilovolt safety probe..... 14.75 net

PRECISION Test Equipment is available and on display at leading electronic parts distributors. Write directly to factory for new 1955 catalog.

PRECISION Apparatus Company, Inc.
70-31 84th Street, Glendale 27, L. I., N. Y.
Export: 458 Broadway, New York 13, U. S. A.
Canada: Atlas Radio Corp., Ltd., 50 Wingold Ave., Toronto 10

Want more information? Use post card on last page.

Reeves Instrument Corp.....	85	Transitron Electronic Corp.....	187
Relliance Mica Co., Inc.....	369	Trans-Sonics, Inc.....	286
Resin Industries, Inc.....	363	Tung-Sol Electric, Inc.....	54
Resinite Corp., Div. of Precision Paper Tube Co.....	192		
Resistance Products Co.....	284		
Revere Copper & Brass Inc.....	75	U. S. Components.....	347
Revere Corporation of America.....	330	Union Carbide & Carbon Corp., Bakelite Company.....	301
Rex Rheostat Co.....	391	United Air Lines.....	309
Richardson Company, The.....	76	United Electronics.....	37
Rome Cable Corp.....	241	United Shoe Manufacturing Corp.....	28
Rutherford Electronics Co.....	348	United States Gasket Co.....	435
		United States Rubber Company.....	60
		United Transformer Co.....	2nd Cover
		Universal Winding Co.....	233
Sargeant & Wilbur Heat Treating Corp.....	375		
Sauerisen Cements Co.....	391	Vacuum Metals Corp.....	112
Scientific Electronic Labs.....	370	Vartflex Sales Co., Inc.....	255
Scintilla Div., Bendix Aviation Corp.....	209	Varian Associates.....	78
Seovill Manufacturing Company.....	325	Veeder-Root, Inc.....	305
Shalleross Manufacturing Co.....	196	Victoreen Instrument Corp.....	206
Sierra Electronic Corporation.....	226	Volkert Stampings, Inc.....	90
Sigma Instruments, Inc.....	288		
Signal Engineering & Mfg. Co.....	388	Waldes Kohinor, Inc.....	47
Simmons Fastener Corp.....	50	Waterman Products Co., Inc.....	254
Skydyne Inc.....	388	Waters Manufacturing, Inc.....	376
Sola Electric Co.....	92	Wenco Manufacturing Co.....	372
Solartron Electronic Group Ltd.....	13	Western Gear Works.....	243
Sorensen & Co., Inc.....	4	Westinghouse Electric Corp.....	298
Southeo Div., South Chester Corp.....	311	Weston Electrical Instrument Corp.....	34
Southern Electronics Co.....	290	White Dental Mfg. Co., S.S.....	360
Sperry Gyroscope Company.....	253	Whitney Blake Company.....	236
Sprague Electric Co.....	11, 179, 273	Wickes Engineering and Construction Co.....	432
Stackpole Carbon Co.....	61	Wincharger Corp.....	96
Standard Cabinet Company.....	379	Winkler Laboratories.....	296
Standard Electric Time Company.....	197		
Star Porcelain Co.....	372	MANUFACTURER'S REPRESENTA- TIVES.....	391
Sterling Transformer Corp.....	340		
Stevens Arnold Inc.....	356	PROFESSIONAL SERVICES.....	389
Stoddart Aircraft Radio Co., Inc.....	312, 343		
Stupakoff Ceramic & Mfg. Co., Div. of the Carborundum Company.....	322, 323	CLASSIFIED ADVERTISING F. J. Eberle, Asst. Mgr. SEARCHLIGHT ADVERTISING.....	416-430
Sturtevant Co., P. A.....	296	ADVERTISERS INDEX.....	426
Sun Tube Corp.....	238	EMPLOYMENT OPPORTUNITIES.....	392-415
Superior Electric Company.....	313	ADVERTISERS INDEX.....	414
Superior Tube Co.....	247		
Sylvania Electric Products, Inc.....	9, 269, 355		
Tare Electronics, Inc.....	262		
Taylor Fibre Co.....	291		
Technicraft Laboratories, Inc.....	216		
Technology Instrument Corp.....	300		
Tektronix, Inc.....	88		
Tete Coil Co., Inc.....	381		
Tell Products Corp.....	391		
Terpening Company, L. II.....	318		
Texas Instruments, Inc.....	188, 353		
Textile Banking Co., Inc.....	251		
Thompson Products, Inc.....	292		
Transradio, Ltd.....	332		

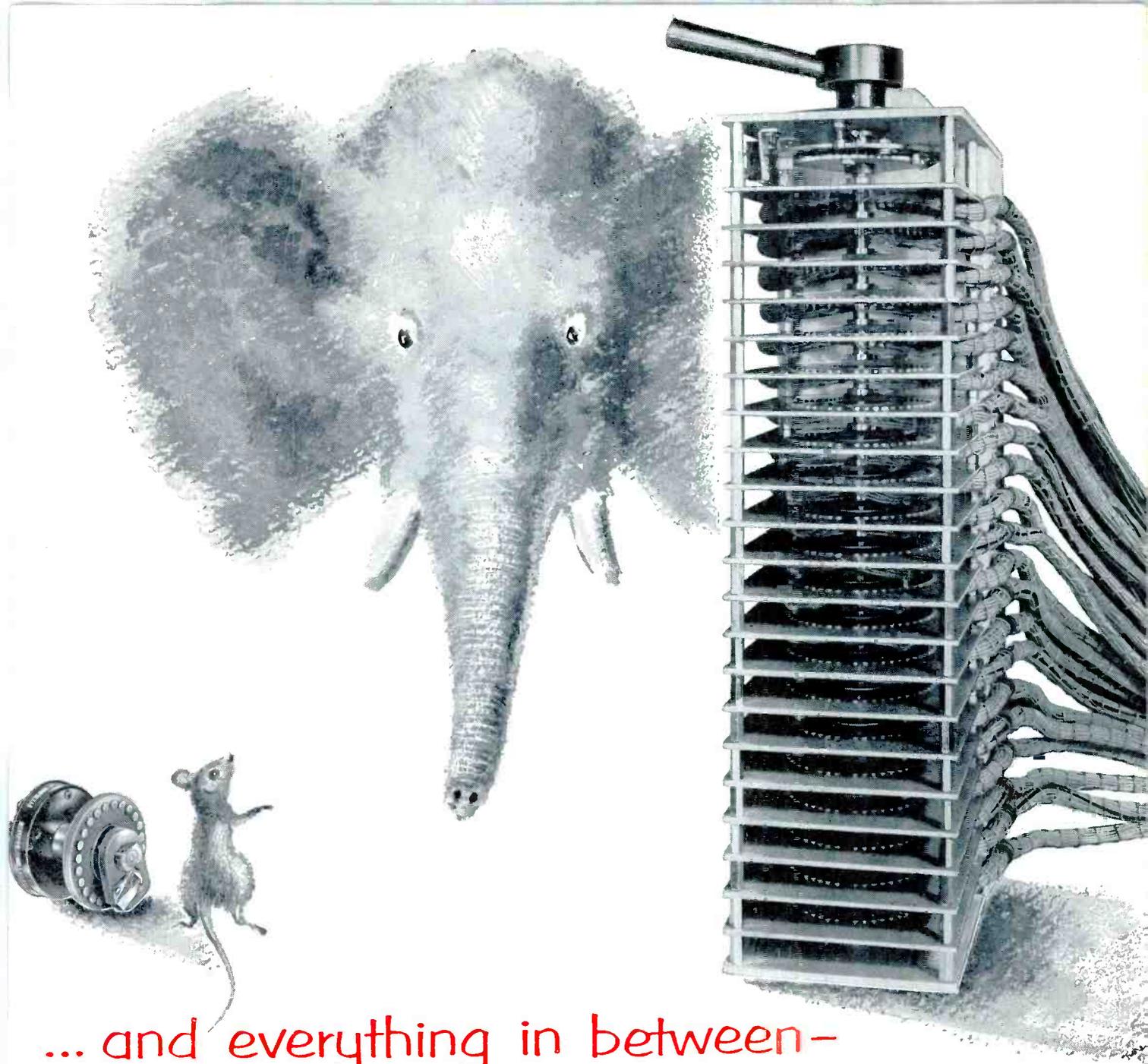
MANUFACTURER'S REPRESENTA-
TIVES..... 391

PROFESSIONAL SERVICES..... 389

CLASSIFIED ADVERTISING
F. J. Eberle, Asst. Mgr.

SEARCHLIGHT ADVERTISING..... 416-430
ADVERTISERS INDEX..... 426
EMPLOYMENT OPPORTUNITIES..... 392-415
ADVERTISERS INDEX..... 414

This index is published as a convenience to the readers. Every care is taken to make it accurate, but ELECTRONICS assumes no responsibility for errors or omissions.



... and everything in between—

With Over 3500 Standard Switches In The Daven Line From Which To Choose—and which in turn can be modified to provide countless additional switch combinations—it's easy to see why *Daven* is equipped to meet your most exacting switch requirements on short notice.

Knee-Action Rotor Lowers Contact Resistance . . . Gives Longer, Trouble-Free Switch Life! Every *Daven* switch features the exclusive, patented *Knee-Action* rotor arm with two separate wiper blades, each individually spring-loaded—to insure extremely low and uniform contact resistance throughout the life of the switch.

Daven's special design renders these blades tamper-proof . . . they withstand rugged treatment in the field. Because of their self-wiping action, little or no servicing is required.

Compact Design for Smaller-Size Components—With *Daven's* space-saving design, up to 8 poles per deck can be supplied . . . a significant factor for maximum performance where depth and mounting space are at a premium. *Daven* switch sizes start at 1-3/8" diameter x 1-11/16" in depth. Solid silver alloy rotors, slip rings, and contacts are used exclusively. These switches meet all applicable military specifications.

Write today
for **FREE**
catalog.



THE DAVEN co.

191 Central Avenue
Newark 4, New Jersey

WORLD'S LARGEST MANUFACTURERS OF ATTENUATORS

RCA WT-100A Electron-Tube MICROMHOMETER

NEW VERSATILE TUBE TESTER!



RCA-WT-100A

Electron-Tube MICROMHOMETER
Suggested User Price: \$785.00

Practical for:

- Radio, Phonograph, and TV Set Manufacturers
- Electronic Equipment Manufacturers
- Electronic Research and Development Groups
- Electronic Maintenance and Service Groups
- Communication and Broadcast Stations
- Tube Manufacturers

... has accuracy approaching that of tube-factory equipment for measuring true gm

The new RCA-WT-100A Electron-Tube MICROMHOMETER is especially suited for laboratory and production-line testing, and circuit design engineering. Unique design makes possible the testing of receiving tubes, receiving-type tubes for industry and communications, and small transmitting tubes under actual operating voltage and current conditions. This feature permits *direct correlation* of test results *with tube manufacturers' published data*—and, in design work, permits the determination of a tube's performance under a given set of current and voltage conditions. The MICROMHOMETER is manufactured in accordance with the same rigid standards of high quality that account for the outstanding reputation of RCA tubes. The WT-100A weighs only 50 pounds; measures 23½" x 8" x 18½".

Plug-in, multiple-socket attachments — new socket types easily added!

Separate voltage controls for each element!

Burn-out protector — electrically protects

AC-heater-current measurements — including 600-ma types at rated voltages!

Built-in calibration circuit!

Tube-pin selector switches — up to 14 pins!

Voltage-drop measurements across tubes, dry-disc rectifiers, and crystal diodes!

Control-grid-plate and suppressor-grid-to-plate transconductance measurements to 100,000 micromhos!

Measures currents up to 300-ma in 11 ranges — as low as 3 μ amp full scale!

Storage compartment for plug-in multiple-socket attachments!

No inconvenient patchcords — no external null indicators required! Highly accurate, repeatable measurements! Built-in voltage-regulated power supply provides voltages to 300 volts; provides currents to 300 ma!



RADIO CORPORATION of AMERICA
TUBE DIVISION

HARRISON, N. J.

For descriptive information, call or write your RCA Representative or write Commercial Engineering, RCA, Section 1190, Harrison, N. J.